

# Learning visual similarity for product design with convolutional neural networks

## Supplemental Material

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### 1 Additional training details

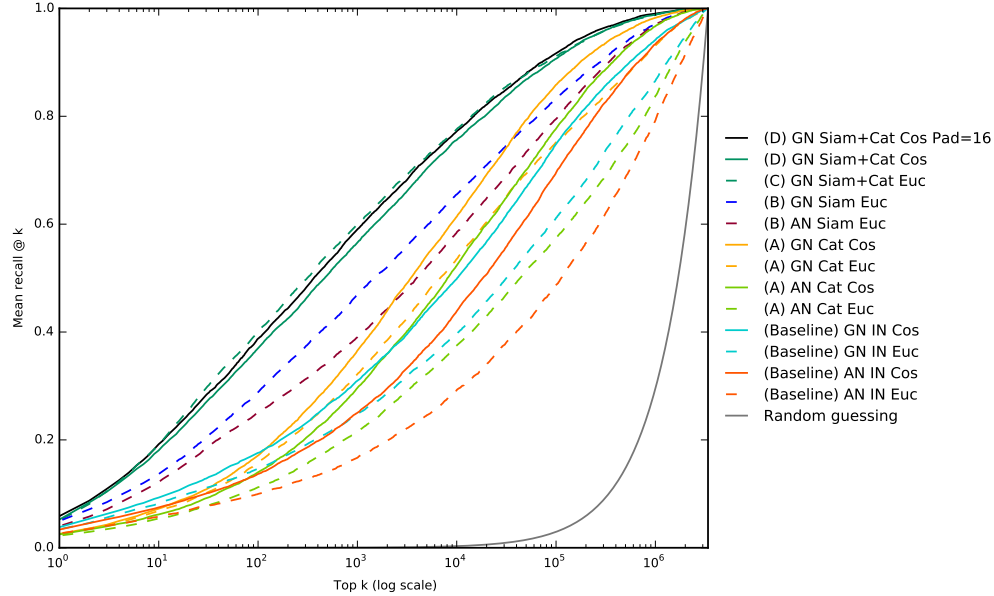
Training parameters are listed in Table 1. Note that the “Pad=16” version of **D** is not a different model; it is only tested differently by providing padded bounding boxes at test time.

	Architecture					
	A AN	A GN	B AN	B GN	C GN	D GN
Base learning rate ( $\alpha_0$ )	2e-3	1e-3	5e-6	1e-5	2e-4	1e-3
Number of batches ( $t_{\max}$ )	150,000	150,000	200,000	200,000	200,000	200,000
Weight decay	5e-4	2e-4	5e-4	2e-4	2e-4	2e-4
Margin $m$	N/A	N/A	$\sqrt{1000}$	$\sqrt{100}$	$\sqrt{0.2}$	$\sqrt{0.2}$
Dropout	0.5	0.4	0.5	0.4	0.4	0.4
Momentum	0.9	0.9	0.9	0.9	0.9	0.4
Embedding Loss Weight	N/A	N/A	1	1	1	100
Category Loss Weight	1	1	1	1	1	1
Learning rate schedule ( $\alpha_t$ )	$\alpha_t = \alpha_0 \sqrt{1 - t/t_{\max}}$					

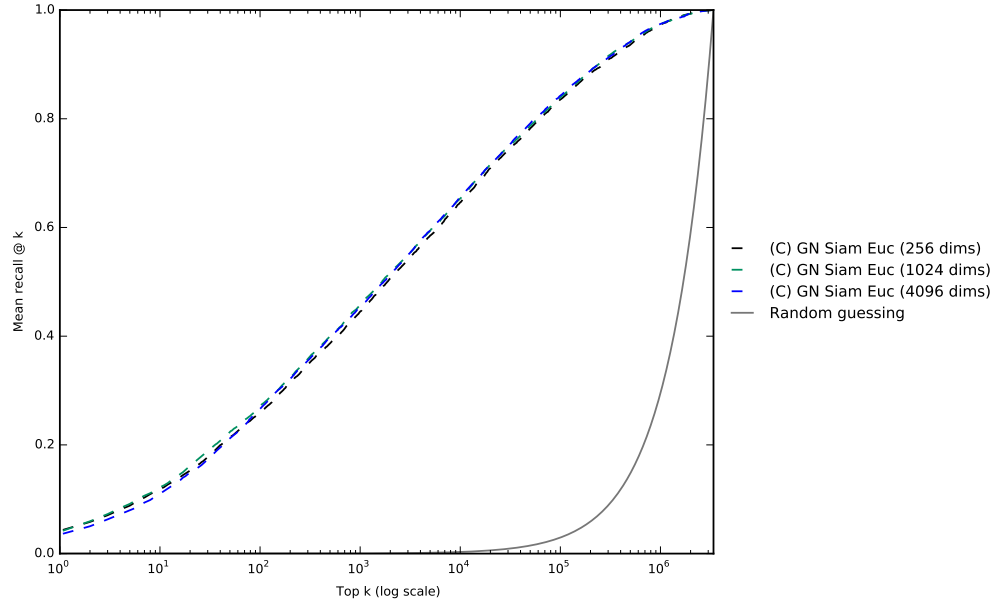
**Table 1:** AN: AlexNet, GN: GoogLeNet. See the main paper (Figure 5) for details on the architectures (A, B, C, D).

### 2 Additional quantitative evaluation plots

Figure 1 is a larger version of Figure 12 from the main paper, showing the full range of  $k$ , and Figure 2 shows the performance as dimension changes. Since all dimensions perform about the same (in fact 4096 performs worse for small  $k$ ), we use 256 dimensions for all experiments. This suggests that an even smaller number of dimensions might also work, but this was not tested.



**Figure 1:** Quantitative evaluation (log scale). Recall (whether or not the single tagged item was returned) as a function of the number of items returned ( $k$ ). Recall for each query is either 0 or 1, and is averaged across 10,000 items. “GN”: GoogLeNet, “AN”: AlexNet, “Euc”: Euclidean distance, “Cos” cosine distance, “Siam”: trained with a Siamese network, “Cat”: trained with object categories, “IN”: ImageNet weights (not trained at all), “P=16”: the box is expanded so that after warping to a square, there are 16 pixels of padding. Random guessing is flat along the bottom. We emphasize that the left portion of the plot is the most important ( $k < 10$ ).



**Figure 2:** Dimension evaluation (log scale). See Figure 1 for explanation (or see Figure 12 from the main paper).

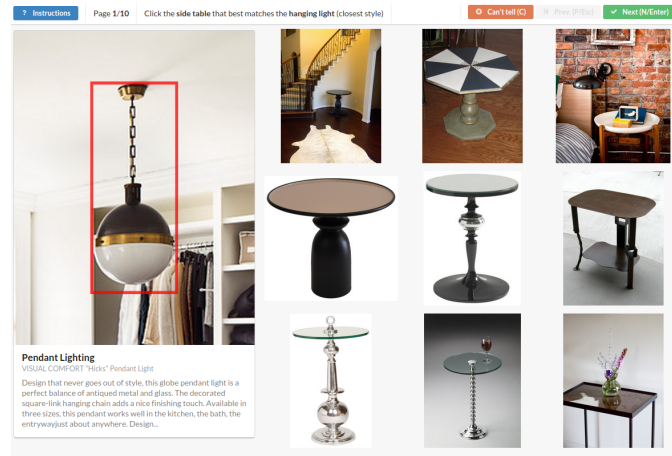
### 3 MTurk user study

Figure 3 shows a screenshot of our user study. 8 models generate 8 suggestions, and the remaining choices are randomly sampled from the product database. If two models suggested the same product, only one was kept and marked as associated with both models. For example, if all 8 models suggest the same product, then the other 8 will be randomly sampled; but if all 8 models suggest distinct products, then only 1 extra will be sampled. This ensures we always have 9 choices, and no two choices are the same.

See the `mturk` directory of the supplemental for screenshots of the instructions, and a video of the UI for the main task:

Name	Description
<code>mturk/mturk-box-instructions.png</code>	Instructions for the “draw a box” task (Sec 5.1 of main paper)
<code>mturk/mturk-box-task.mp4</code>	Video of an author using the interface
<code>mturk/mturk-style-instructions.png</code>	Instructions for the user study task (Sec 6.2, “user study”)
<code>mturk/mturk-style-task.png</code>	Screenshot of the user study task

Code for the UI is included on our website (<http://productnet.cs.cornell.edu>).



**Figure 3:** User study screenshot. Users were shown an example in-situ product on the left, and 9 candidate matching on the right. Users had to click exactly 1 choice, or “I can’t tell”.



## 4 Additional t-SNE visualizations

In the supplemental zip archive, we include full versions of Figure 10 (`tsne/tsne-200k-all.jpg`) as well as visualizations of individual object categories:

Name	Description
<code>tsne/tsne-200k-all.jpg</code>	200,000 images from all categories
<code>tsne/tsne-2k-artwork.jpg</code>	2000 artwork images
<code>tsne/tsne-2k-chairs.jpg</code>	2000 chair images (note that many chair sub-categories were combined)
<code>tsne/tsne-2k-lighting.jpg</code>	2000 pendant lighting images
<code>tsne/tsne-2k-teapots.jpg</code>	2000 teapot images

When sampling random products for the 200k t-SNE figure, we sample round-robin through the categories to obtain a balanced set of products. On our website (<http://productnet.cs.cornell.edu>), we also have a web-browsable version of the full 200k t-SNE figure.

## 5 Detailed photo sources

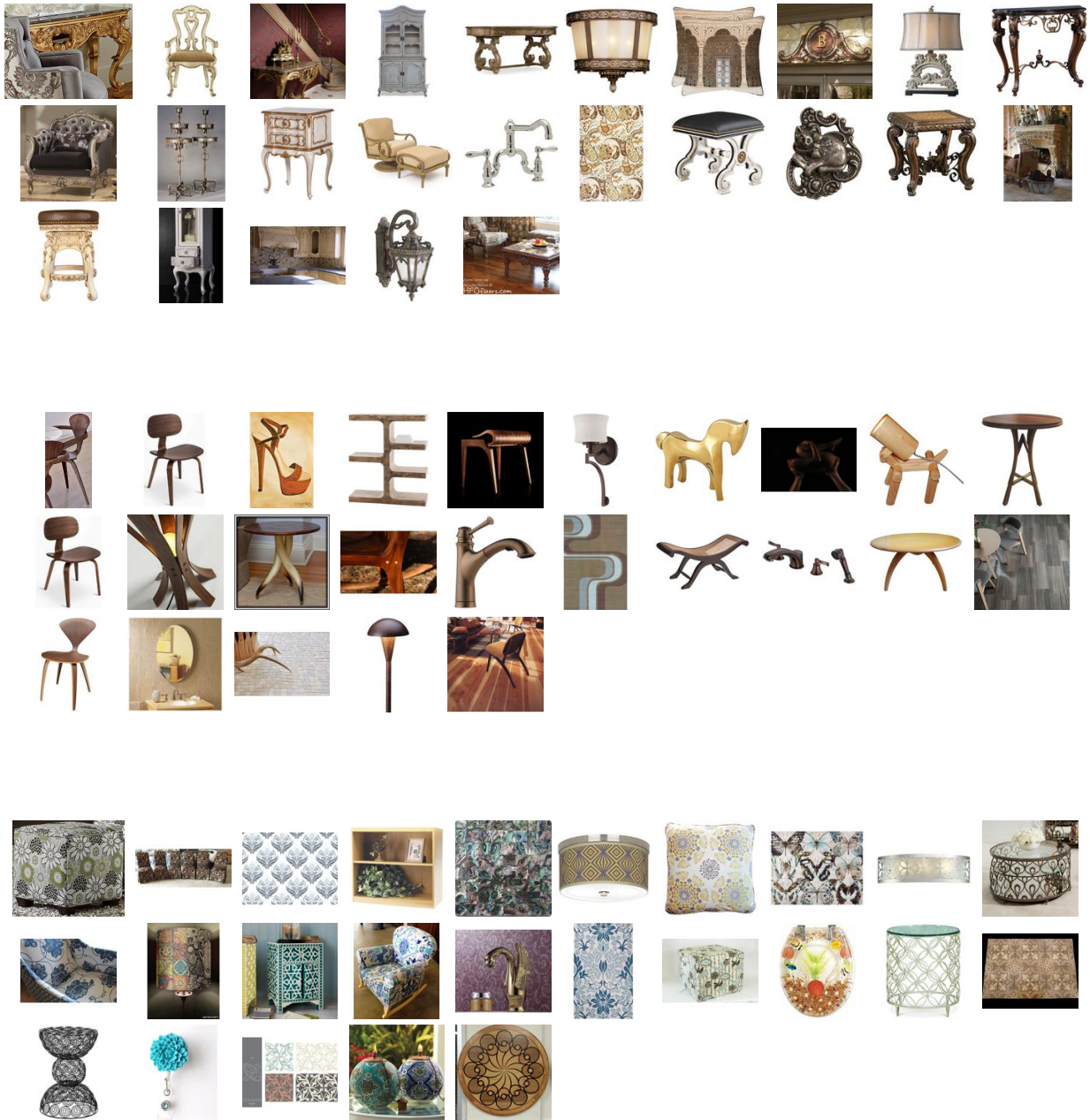
The following images appear in the main paper or supplemental:

Location	URL	Name
Fig 1 (top left)	<a href="http://houzz.com/photos/607038">houzz.com/photos/607038</a>	Crisp Architects, Rob Karosis
Fig 1 (top right 1)	<a href="http://houzz.com/photos/307526">houzz.com/photos/307526</a>	West Elm
Fig 1 (top right 2)	<a href="http://houzz.com/photos/237635">houzz.com/photos/237635</a>	Etsy
Fig 1 (top right 3)	<a href="http://houzz.com/photos/708833">houzz.com/photos/708833</a>	Candelabra
Fig 1 (top right 4)	<a href="http://houzz.com/photos/7116989">houzz.com/photos/7116989</a>	Arcadian Home & Lighting
Fig 1 (top right 5)	<a href="http://houzz.com/photos/2946139">houzz.com/photos/2946139</a>	Remains Lighting
Fig 1 (top right 6)	<a href="http://houzz.com/photos/7876228">houzz.com/photos/7876228</a>	Shades of Lighting
Fig 1 (bottom left)	<a href="http://houzz.com/photos/112877">houzz.com/photos/112877</a>	Design Within Reach
Fig 1 (bottom right 1)	<a href="http://houzz.com/photos/13675430">houzz.com/photos/13675430</a>	Jim Tschetter
Fig 1 (bottom right 2)	<a href="http://houzz.com/photos/1654766">houzz.com/photos/1654766</a>	des ewing
Fig 1 (bottom right 3)	<a href="http://houzz.com/photos/16707645">houzz.com/photos/16707645</a>	Freestyle Joinery
Fig 1 (bottom right 4)	<a href="http://houzz.com/photos/59364">houzz.com/photos/59364</a>	Urban Homes
Fig 3 (left)	<a href="http://houzz.com/photos/3049851">houzz.com/photos/3049851</a>	Austin Rooke
Fig 3 (top right)	<a href="http://houzz.com/photos/117795">houzz.com/photos/117795</a>	Design Within Reach
Fig 3 (bottom right)	<a href="http://houzz.com/photos/4101796">houzz.com/photos/4101796</a>	Up Interiors
Fig 6 (left)	<a href="http://houzz.com/photos/45350">houzz.com/photos/45350</a>	Fiorella Design
Fig 6 (center)	<a href="http://houzz.com/photos/394906">houzz.com/photos/394906</a>	Quality Bath
Fig 6 (right)	<a href="http://houzz.com/photos/236170">houzz.com/photos/236170</a>	Holly Hunt
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Fig 8 (center)	<a href="http://houzz.com/photos/988364">houzz.com/photos/988364</a>	Increation Interiors Ltd
Fig 9 (a, b top left)	<a href="http://houzz.com/photos/3049851">houzz.com/photos/3049851</a>	Austin Rooke
Fig 9 (a, b top left, center)	<a href="http://houzz.com/photos/117795">houzz.com/photos/117795</a>	Design Within Reach
Fig 9 (a, b bottom left, center)	<a href="http://houzz.com/photos/4101796">houzz.com/photos/4101796</a>	Up Interiors
Fig 10	<a href="http://houzz.com/photos/[ID]">houzz.com/photos/[ID]</a> , with IDs listed in <code>source-ids/fig10-ids.txt</code>	
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Supplemental reverse queries	<a href="http://houzz.com/photos/[ID]">houzz.com/photos/[ID]</a> , with IDs listed in <code>source-ids/supp-reverse-ids.txt</code>	

## 6 Example cross-category queries

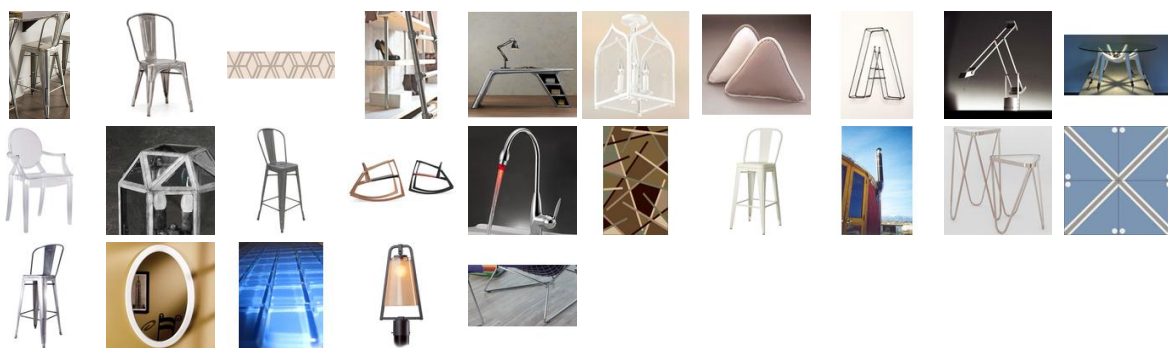
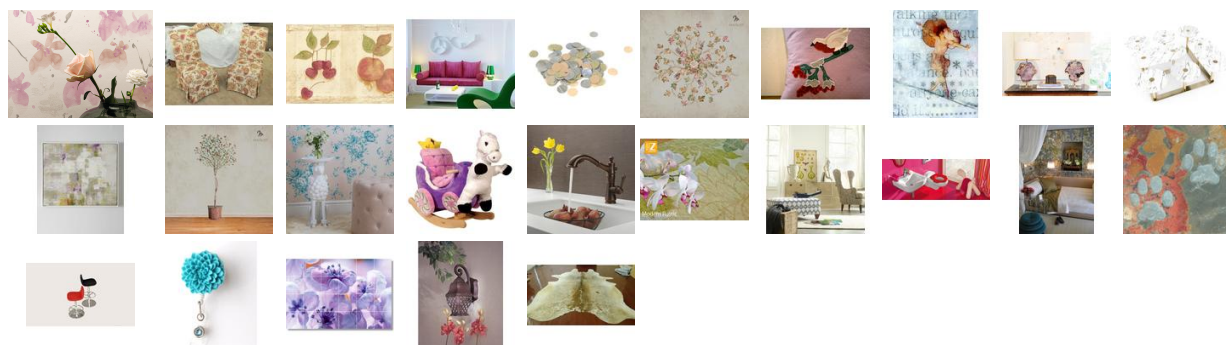
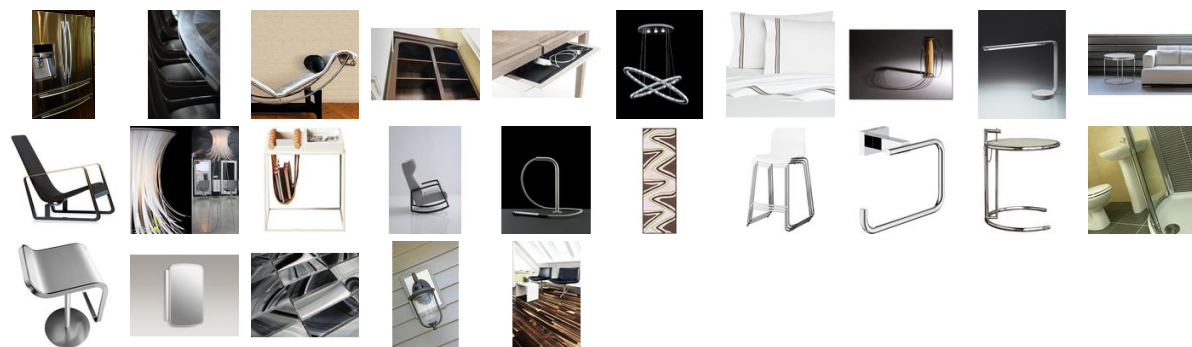
In this section, we show example visual search results where the results are constrained to come from different object category. Given the query image (top left), we search each of 24 different object categories.

Note that the figures in this section were obtained with an earlier version of our work, so the test-train split is different. All other sections and the main paper use the same (newer) split. Specifically, the model used for these queries was a siamese GoogLeNet CNN with training architecture **B** (see main paper) using 78,991 positive examples, 1,263,856 negative examples, a dropout of 0.7, momentum of 0.9, L2 weight decay 0.0002, margin  $\sqrt{100}$ , constant learning rate  $10^{-5}$ , and trained for 200,000 mini-batches of size 16. Object categories were not known to the algorithm when training.






















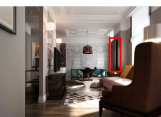

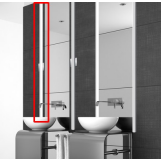









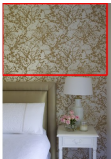









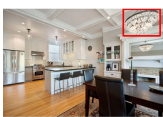










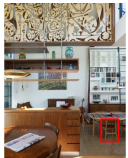


















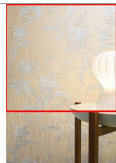
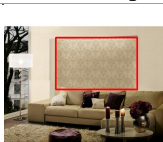
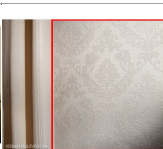


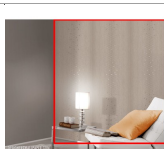
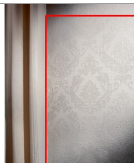


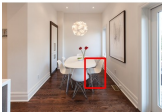


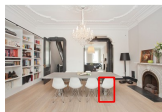



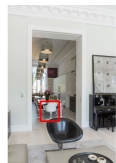













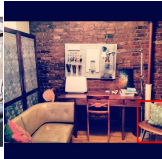

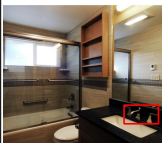
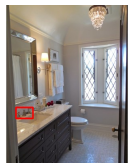










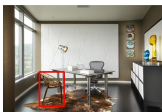











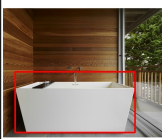
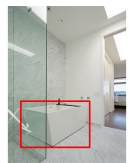








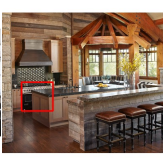












## 7 Example test set reverse queries

In this section, we show the top 7 nearest neighbors for 98 randomly sampled and shuffled input product queries from the test set. None of the retrieved images were seen during training.


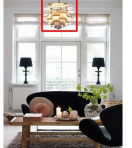



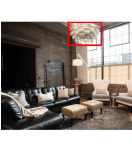

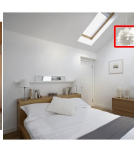


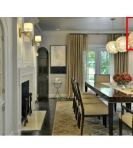
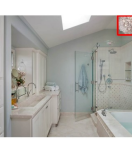







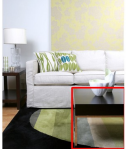
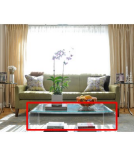




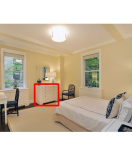





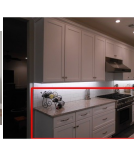










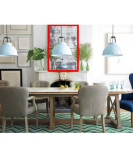



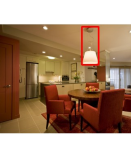



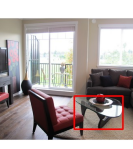




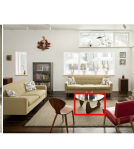







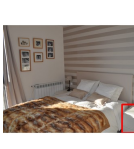

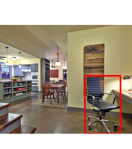

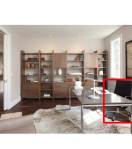
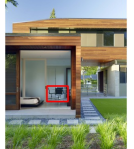
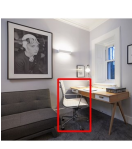


In each row, the first image is the in-situ query product, and the last 7 columns are the returned scenes for that query with bounding boxes. For a quantitative evaluation, see the main paper.

Product	Top 7 retrievals: test scenes predicted to contain this product						
							
							
							
							
							
							
							
							




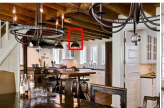





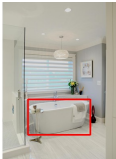

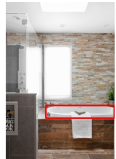
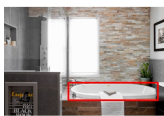
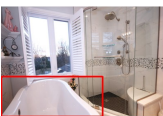












































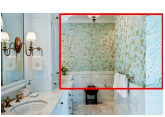

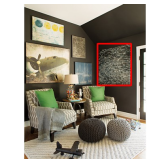
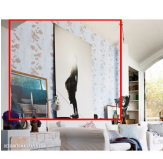

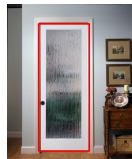

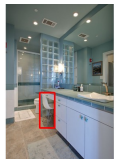



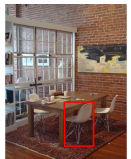

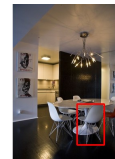




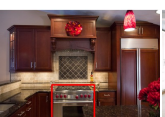





Product	Top 7 retrievals: test scenes predicted to contain this product							
								
								
								
								
								
								
								
								
								
								




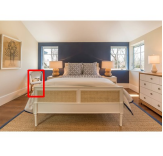


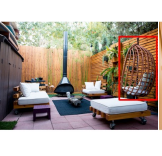






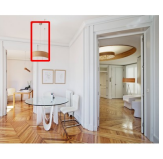




















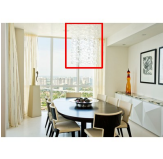

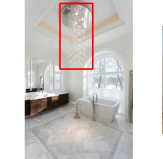
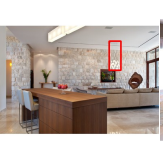







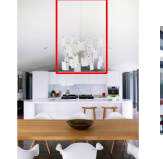
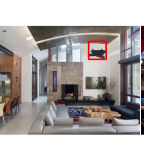





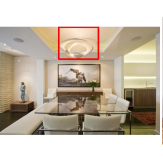
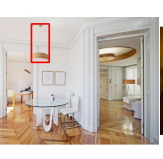







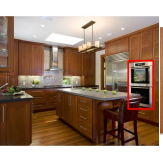




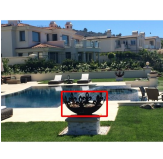


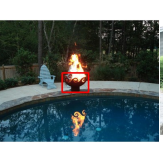






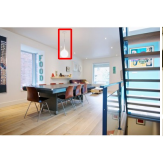
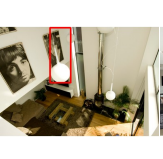

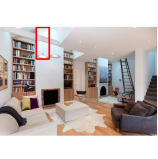


Product	Top 7 retrievals: test scenes predicted to contain this product							
								
								
								
								
								
								
								
								
								




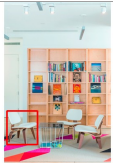










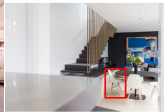












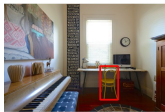
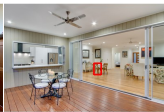















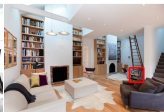

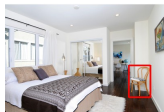
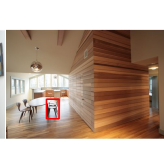

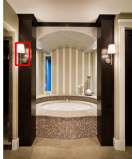



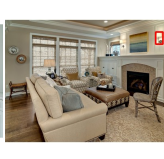
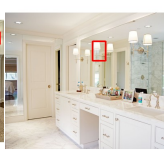
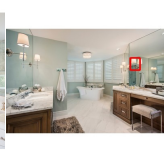





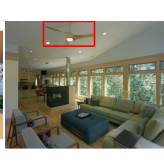
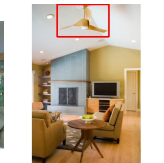








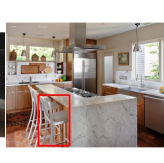










Product	Top 7 retrievals: test scenes predicted to contain this product						
							
							
							
							
							
							
							
							
							
							























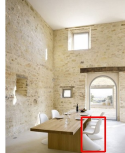




















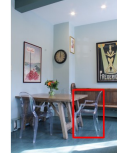
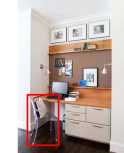





































Product	Top 7 retrievals: test scenes predicted to contain this product						
							
							
							
							
							
							
							
							
							
							




Product	Top 7 retrievals: test scenes predicted to contain this product						
							
							
							
							
							
							
							
							
							
							




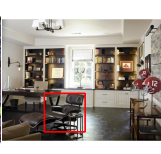

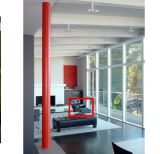



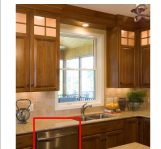

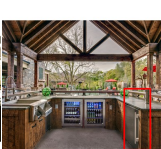

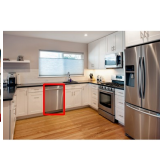
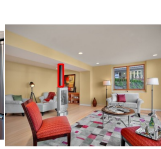



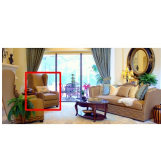
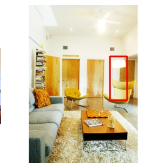
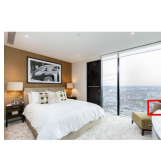
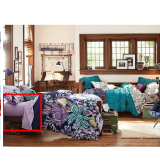
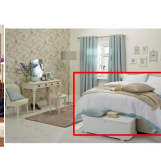






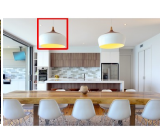



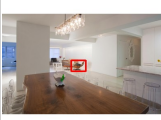

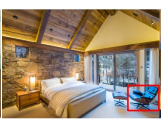






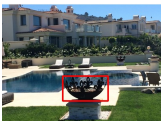


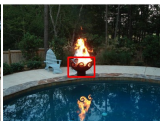

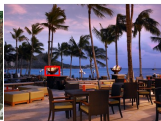










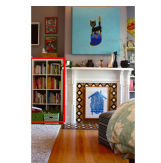

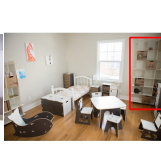
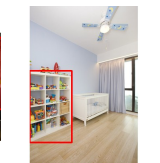

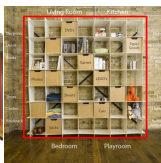

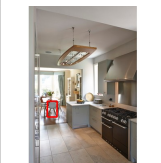

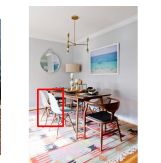


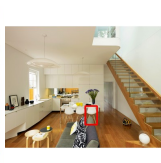
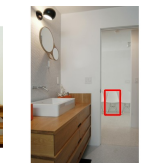

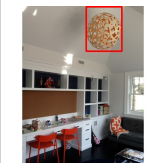

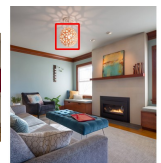
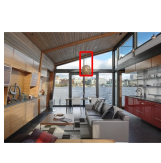
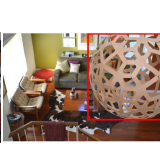
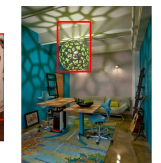
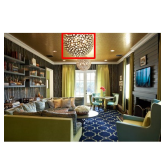


Product	Top 7 retrievals: test scenes predicted to contain this product							
								
								
								
								
								
								
								
								
								
								





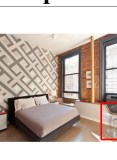

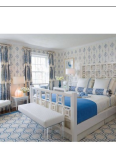



























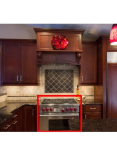







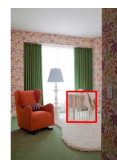




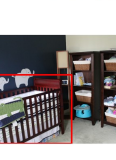




























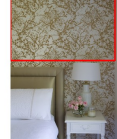





Product	Top 7 retrievals: test scenes predicted to contain this product						
							
							
							
							
							
							
							
							
							
							



Product	Top 7 retrievals: test scenes predicted to contain this product							
								
								
								
								
								
								
								
								
								
								





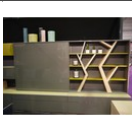

















































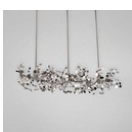
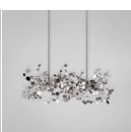


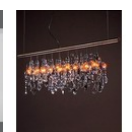
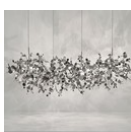


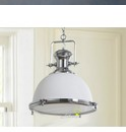





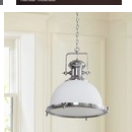
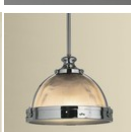








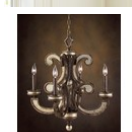


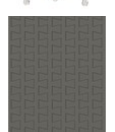
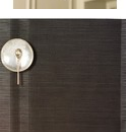









Product	Top 7 retrievals: test scenes predicted to contain this product							
								
								
								
								
								
								
								
								
								
								
































































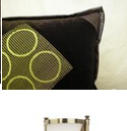
























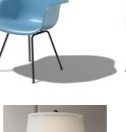





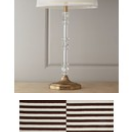

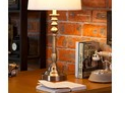
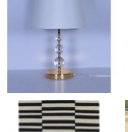



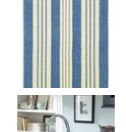



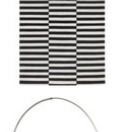

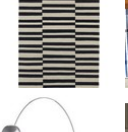
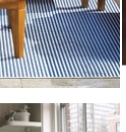









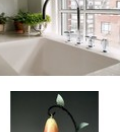










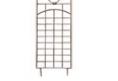
## 8 Example test set queries

In this section, we show the top 8 nearest neighbors for 500 randomly sampled and shuffled input queries from the test set (the full test set contains 10,000 images). None of the query images  $I_q$  were seen during training.

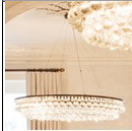



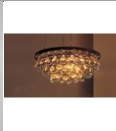





















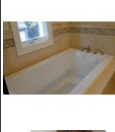




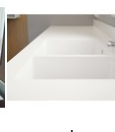

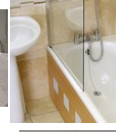











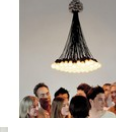




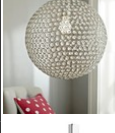
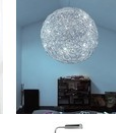
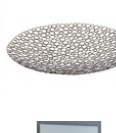
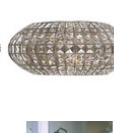


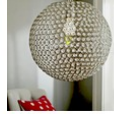












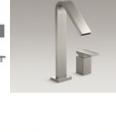
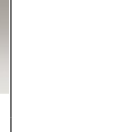



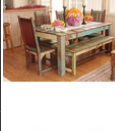


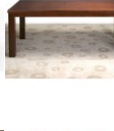
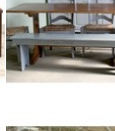


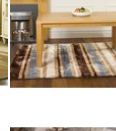


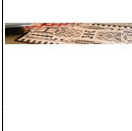


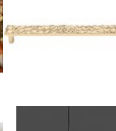
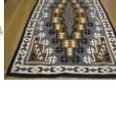
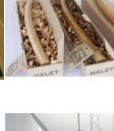


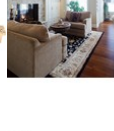
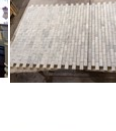


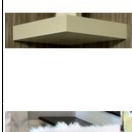


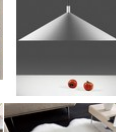

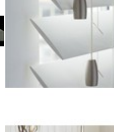

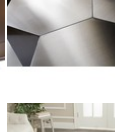




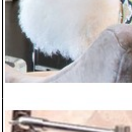

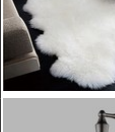
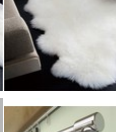
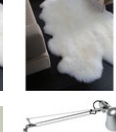
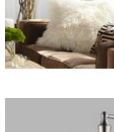
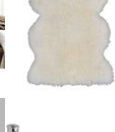
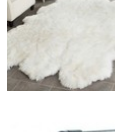
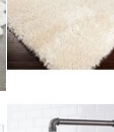
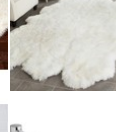


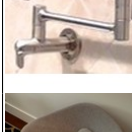

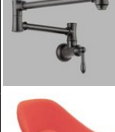

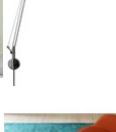



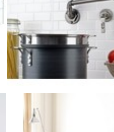










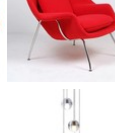
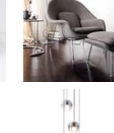
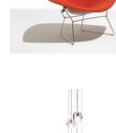














In each row, the first image is the in-situ query image  $I_q$ , the second is the tagged positive example  $I_p$ , and the last 8 images are the returned images for that query. For a quantitative evaluation, see the main paper.

Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									

















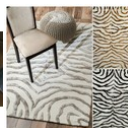


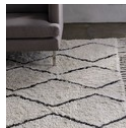



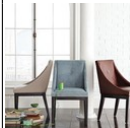






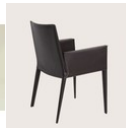















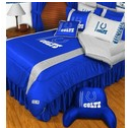







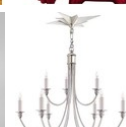


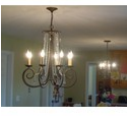




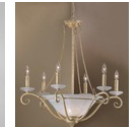

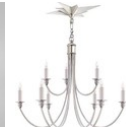
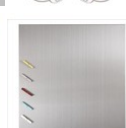







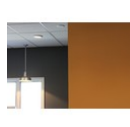

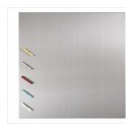






















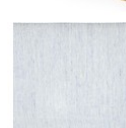



























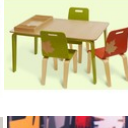














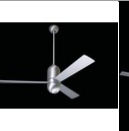




























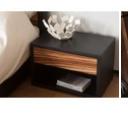
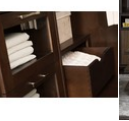
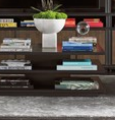

















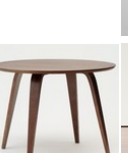
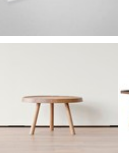


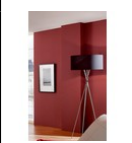




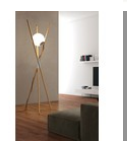
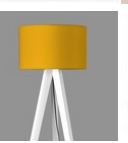

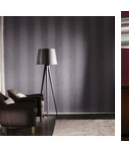




















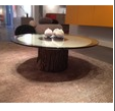


































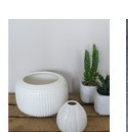
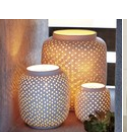




Query	Tag	Top 8 retrievals							
									
									
									
									
			 x2 						
									
									
									
									
									
									
									
									





































































































































Query	Tag	Top 8 retrievals									
											
											
											
											
											
											
											
											
											
											
											
											
											























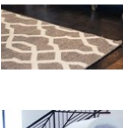


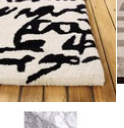
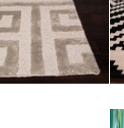
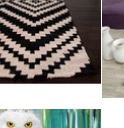

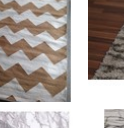
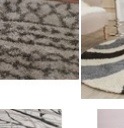


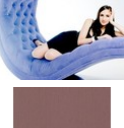
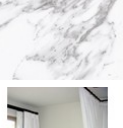
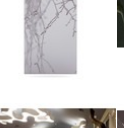
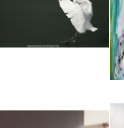
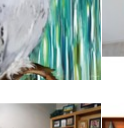
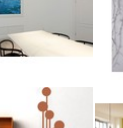
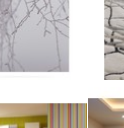
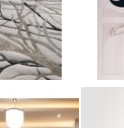

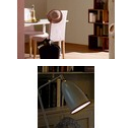
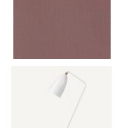
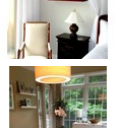
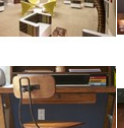

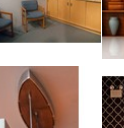

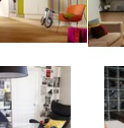
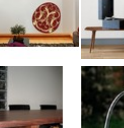





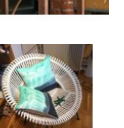

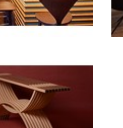






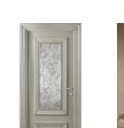
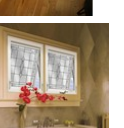
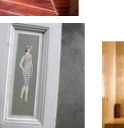
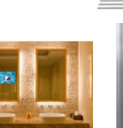
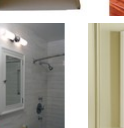












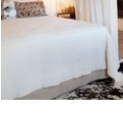


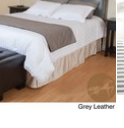
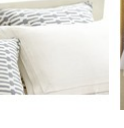
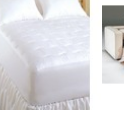

















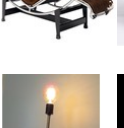
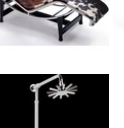
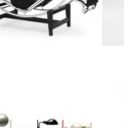
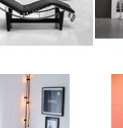
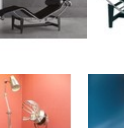
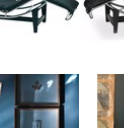




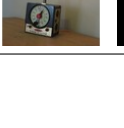


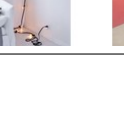
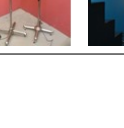
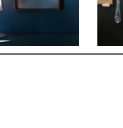
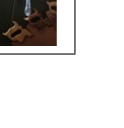
Query	Tag	Top 8 retrievals									
											
											
											
											
											
											
											
											
											
											
											
											

Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									






























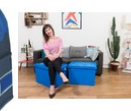




























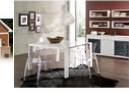
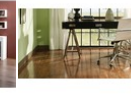



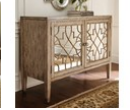





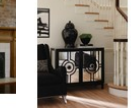






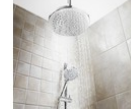


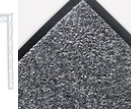







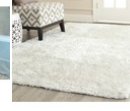









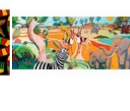


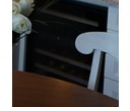









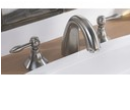







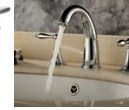













Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									














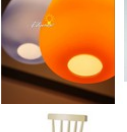
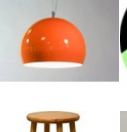
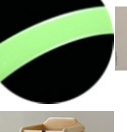
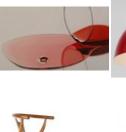
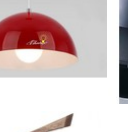
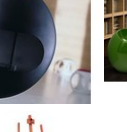




























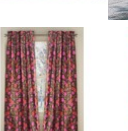







































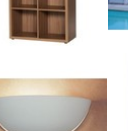
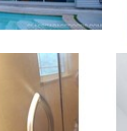


















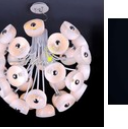
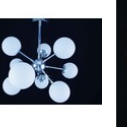
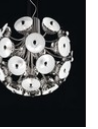


Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									



















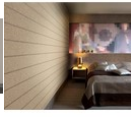









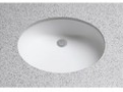

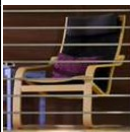
















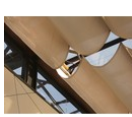























































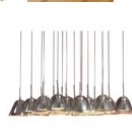




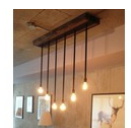























Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									



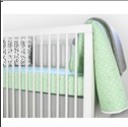







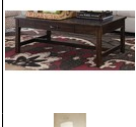

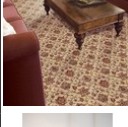
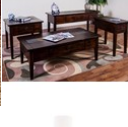
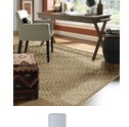





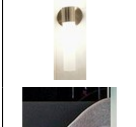

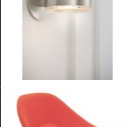










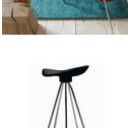






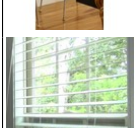


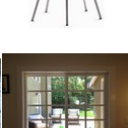








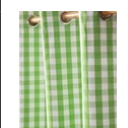

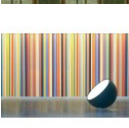

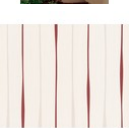

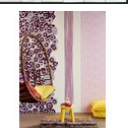
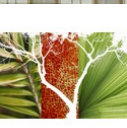










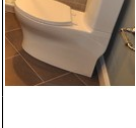









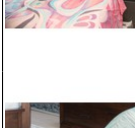

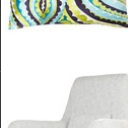



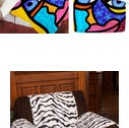

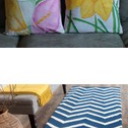
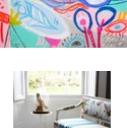



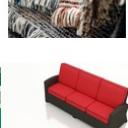








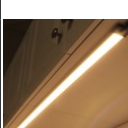
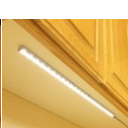

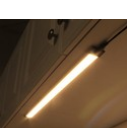
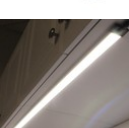
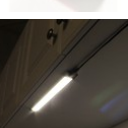

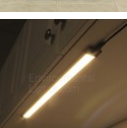


Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									

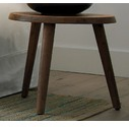









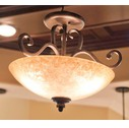








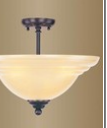




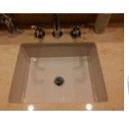



















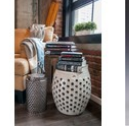

























































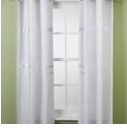


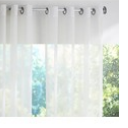




















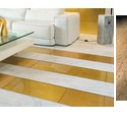





Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									























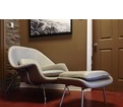




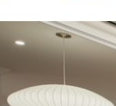








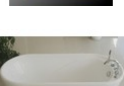



Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									






















































































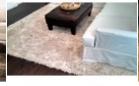




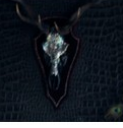




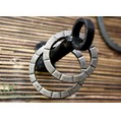








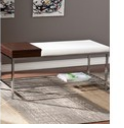
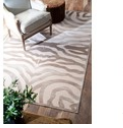








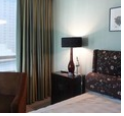
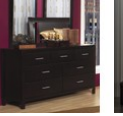


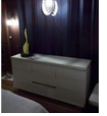
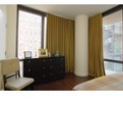























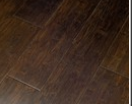




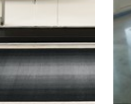





















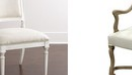













































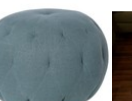







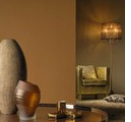


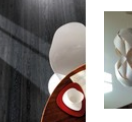
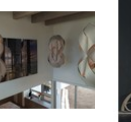
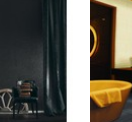


















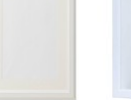













Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									






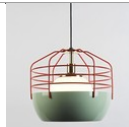


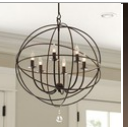










































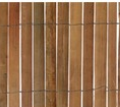















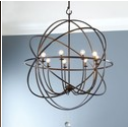














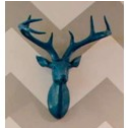

















































Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									

































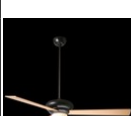


































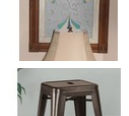




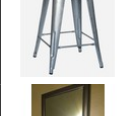



















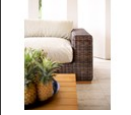










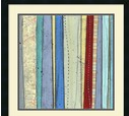



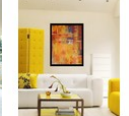



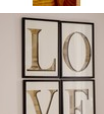




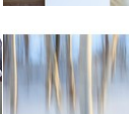




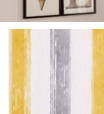

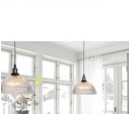


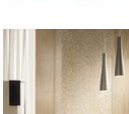

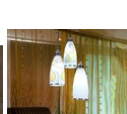
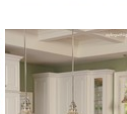





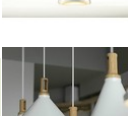






Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									




























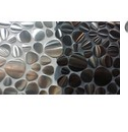
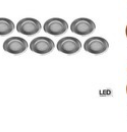



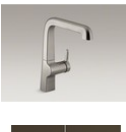
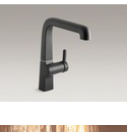

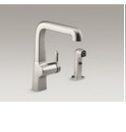
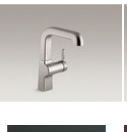
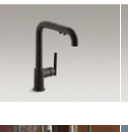
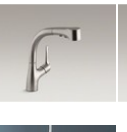






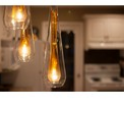
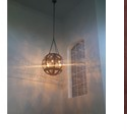

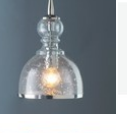



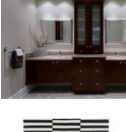




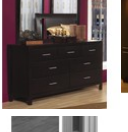
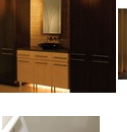



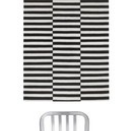







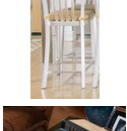







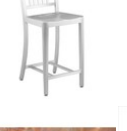

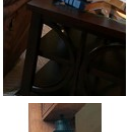

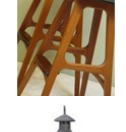

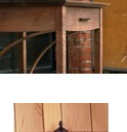
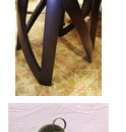
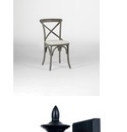


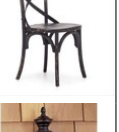












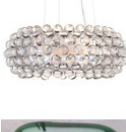






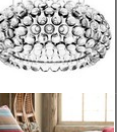
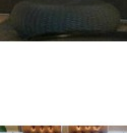




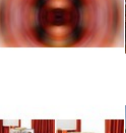


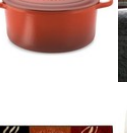
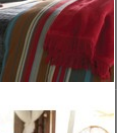










Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									








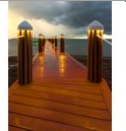


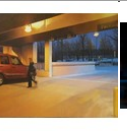













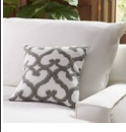



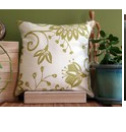











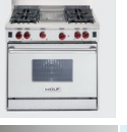

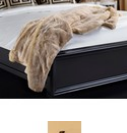




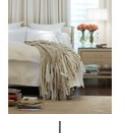
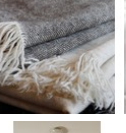
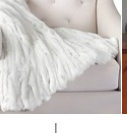
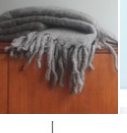







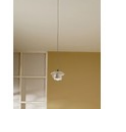





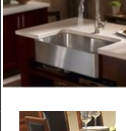



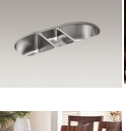
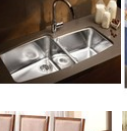


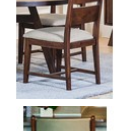

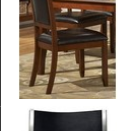


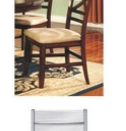

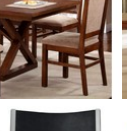




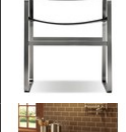



























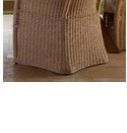












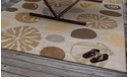






Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									

Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									
									














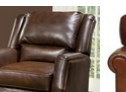

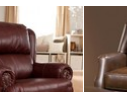




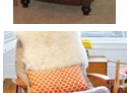


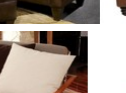


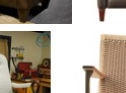

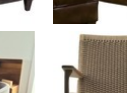



















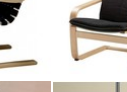




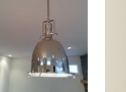
































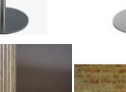






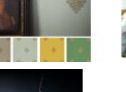

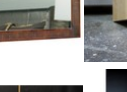
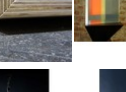








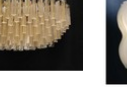


























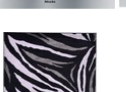
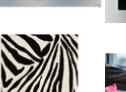

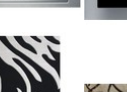
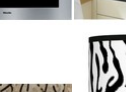






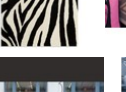


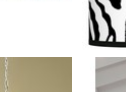
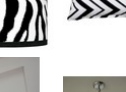






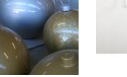
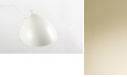

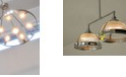
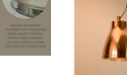



Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									



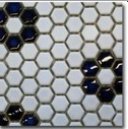




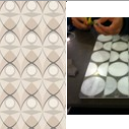








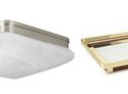











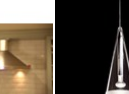


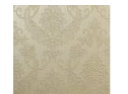
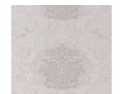
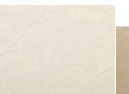
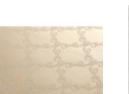





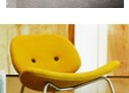






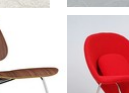
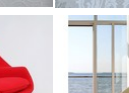




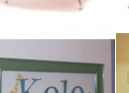
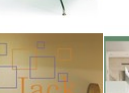

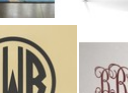
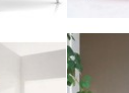
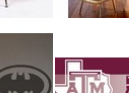





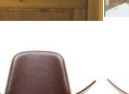
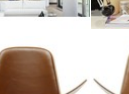




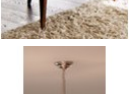















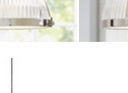
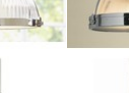
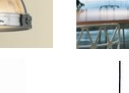
















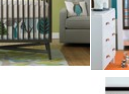
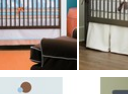



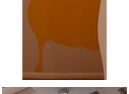


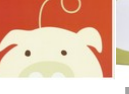

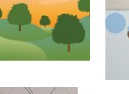
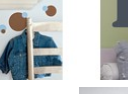

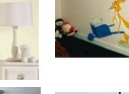













Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									
























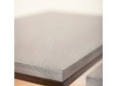



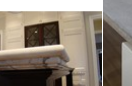






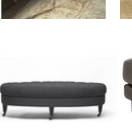


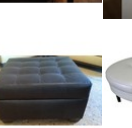

































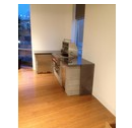










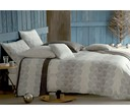

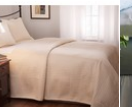





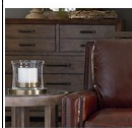


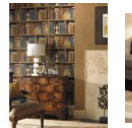
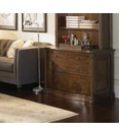





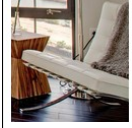




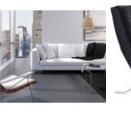
























Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									















































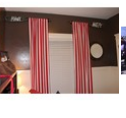





















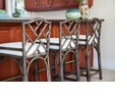
















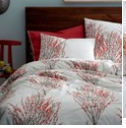
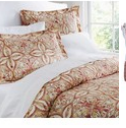







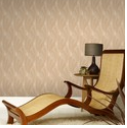
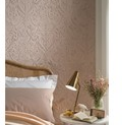
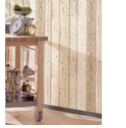
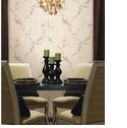
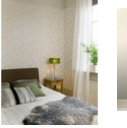
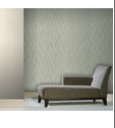






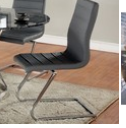
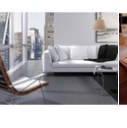
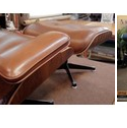















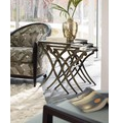







Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									













































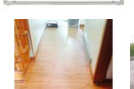







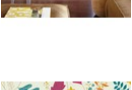




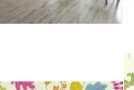








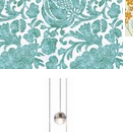



















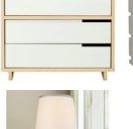

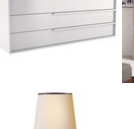

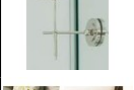





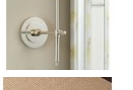
























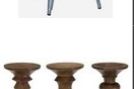
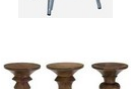
















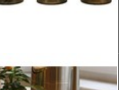












Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									








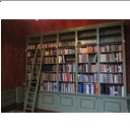










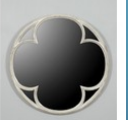


















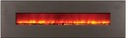






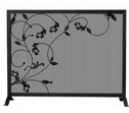









































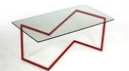
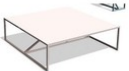



































































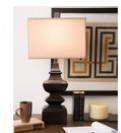







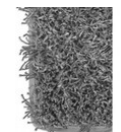


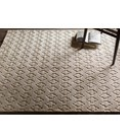















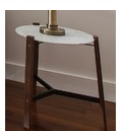









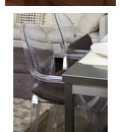















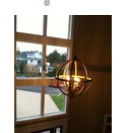




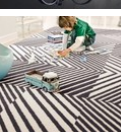

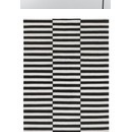

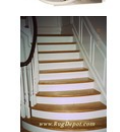

















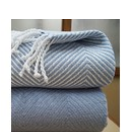





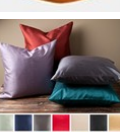









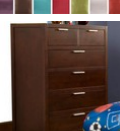










Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									





























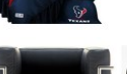



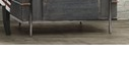






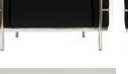







































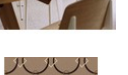
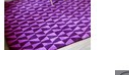





























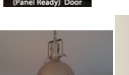





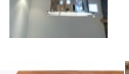
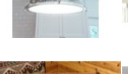



















































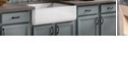


Query	Tag	Top 8 retrievals									
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											




























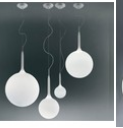




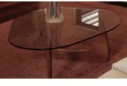






































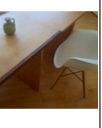

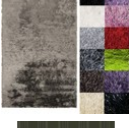


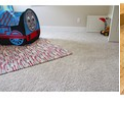

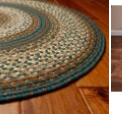
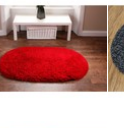




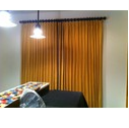
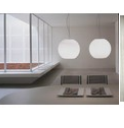

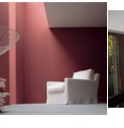











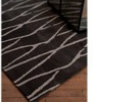



Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									

Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									



















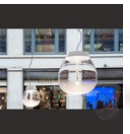

































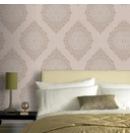
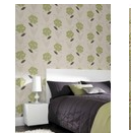
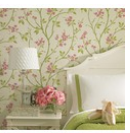
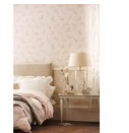
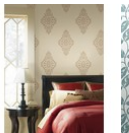











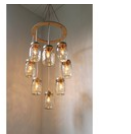




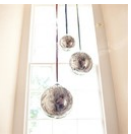




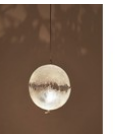





















































Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									





















































































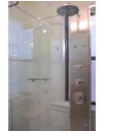






























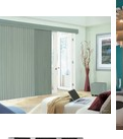
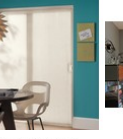











Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									















































































































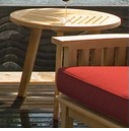
















































































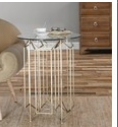






































































Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									



Query	Tag	Top 8 retrievals							
									
									
									
									
									
									
									
									
									
									
									
									
									













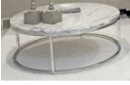





















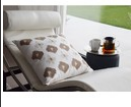
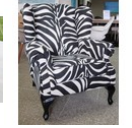
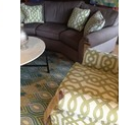


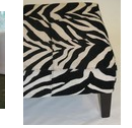
















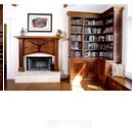
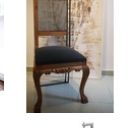
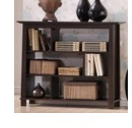

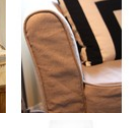

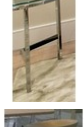





















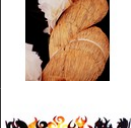



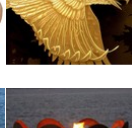
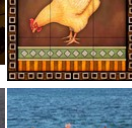
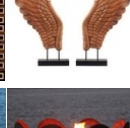
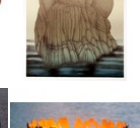







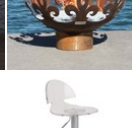
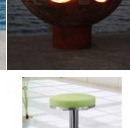






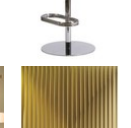


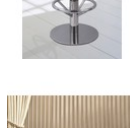



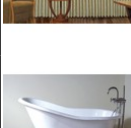
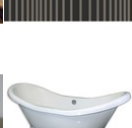

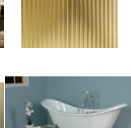

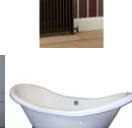
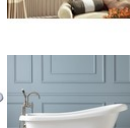
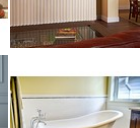

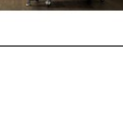
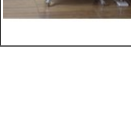

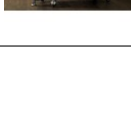
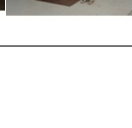
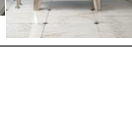
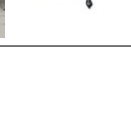
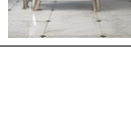
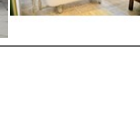
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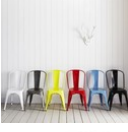










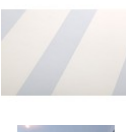


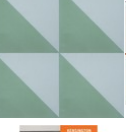
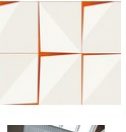



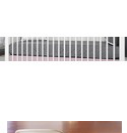

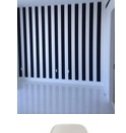

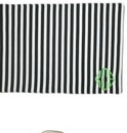

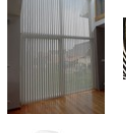
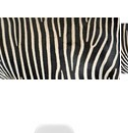



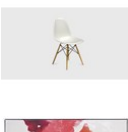




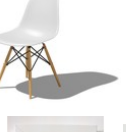
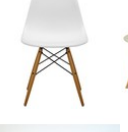





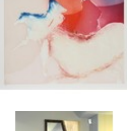


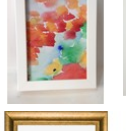
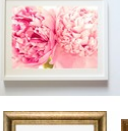





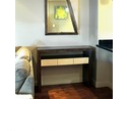
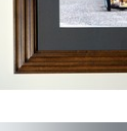
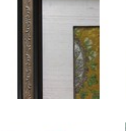
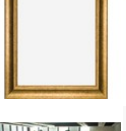
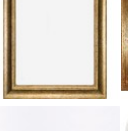
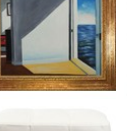





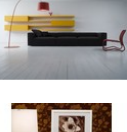
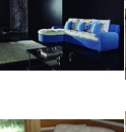
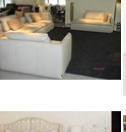
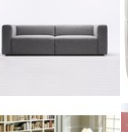
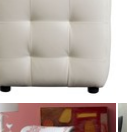
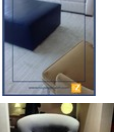


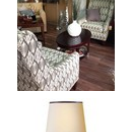

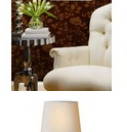





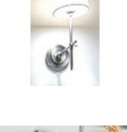

















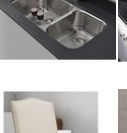























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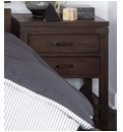





































































































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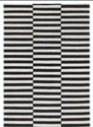


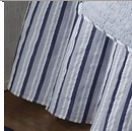








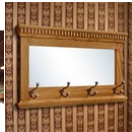









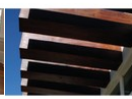








































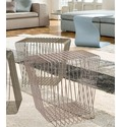








































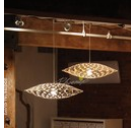
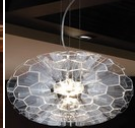






















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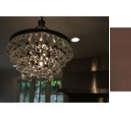
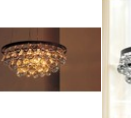














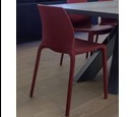













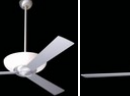




































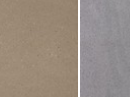
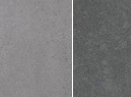
















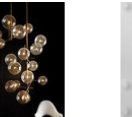






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