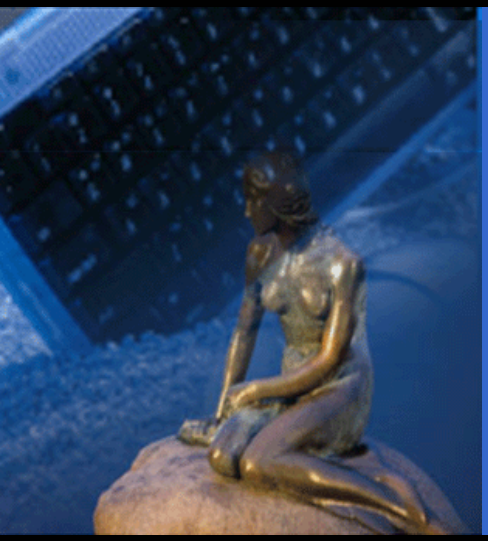


Factorial Markov Random Fields

European Conference on Computer Vision 2002

Junhwan Kim and Ramin Zabih

Computer Science Department
Cornell University

Problem

- How can we deal with image layers systematically?

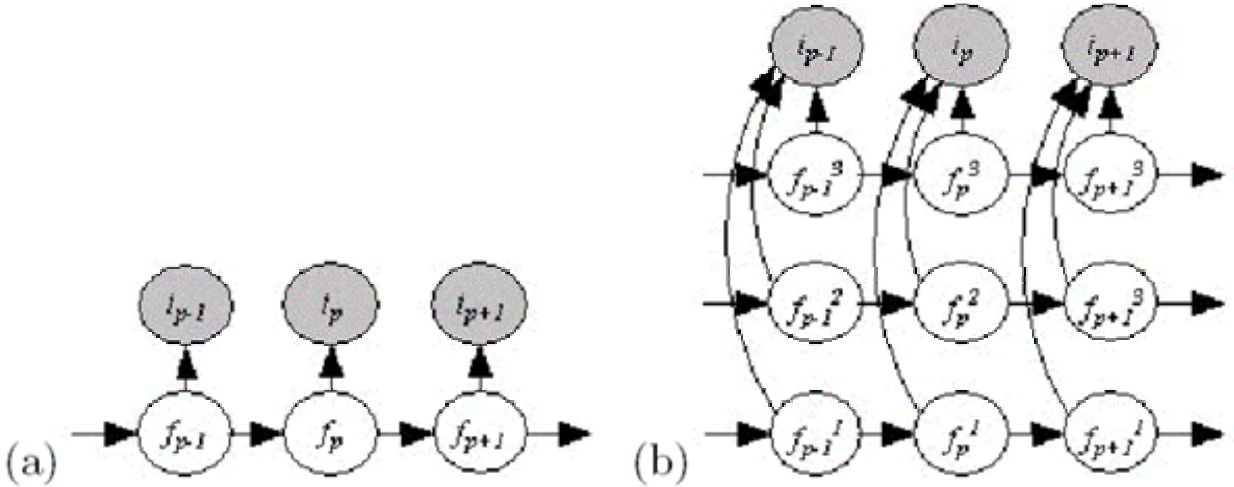
Our approach

- A new graphical model to represent image layers
- An efficient algorithm for inference

Layer representations

- Iterative clustering motion models [Wang and Anandan]
- EM algorithm for robust ML estimation [Ayer and Sawhney]
- Multiple smooth flow fields [Weiss]
- Bayesian network for appearance-based layer [Frey]

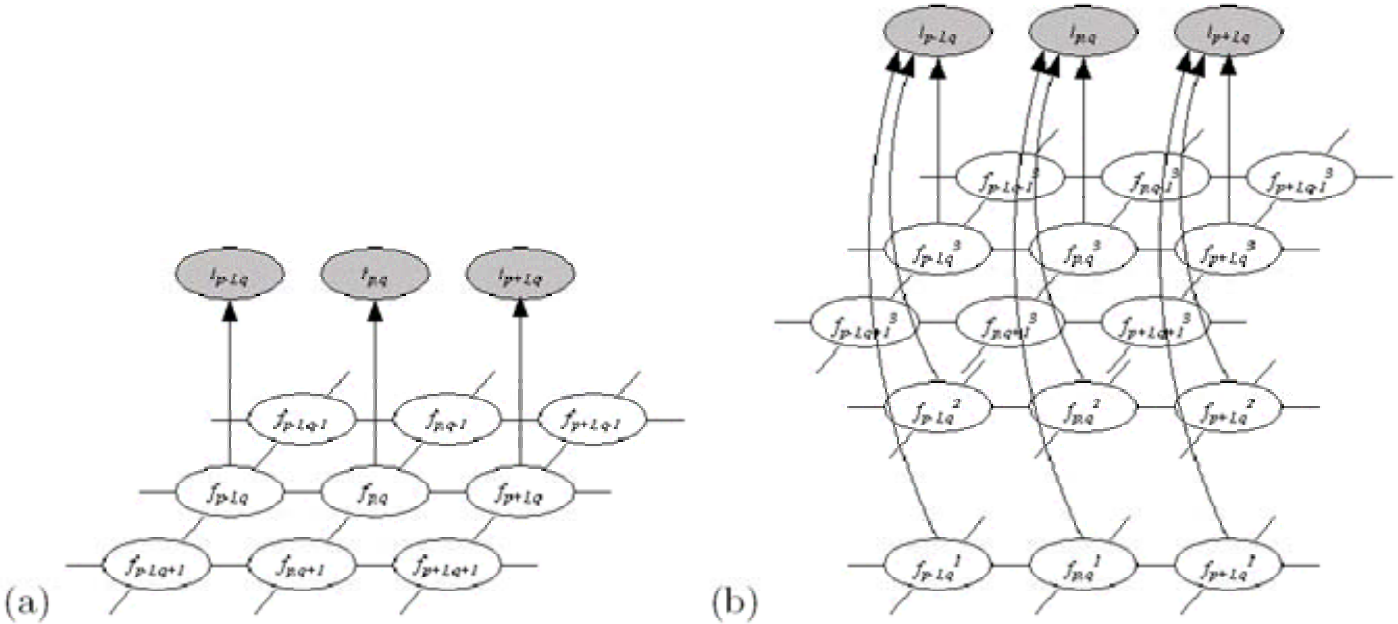
Factorial Hidden Markov Model



HMM

Factorial HMM
[Ghahramani and Jordan]

Factorial Markov Random Fields

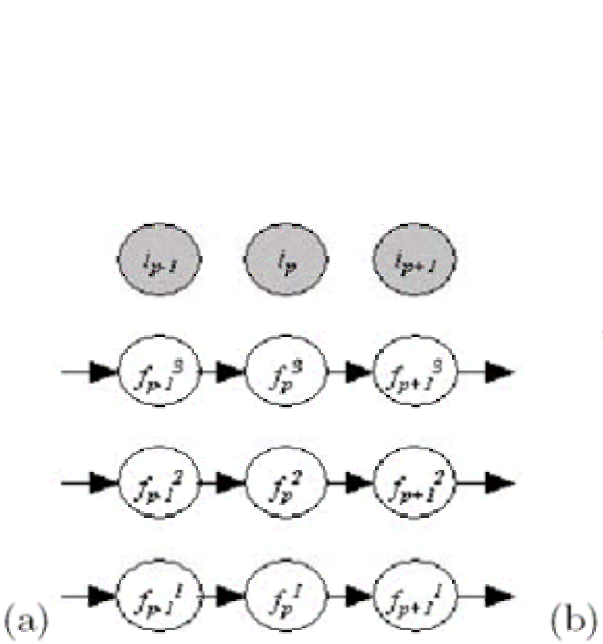


MRF

Factorial MRF

Exact inference is intractable -> Need approximation

Structural approximation



Independence across chain [Ghahramani and Jordan]

Independence across layer

Now, inference is tractable

Maximization step

- Opaque layers
  - Closer object *totally* occludes farther object
- Transparent layers
  - Closer object *partially* occludes farther object

Expectation step

Pseudo-observable

Forward rendering algorithm

↓

MAP estimation

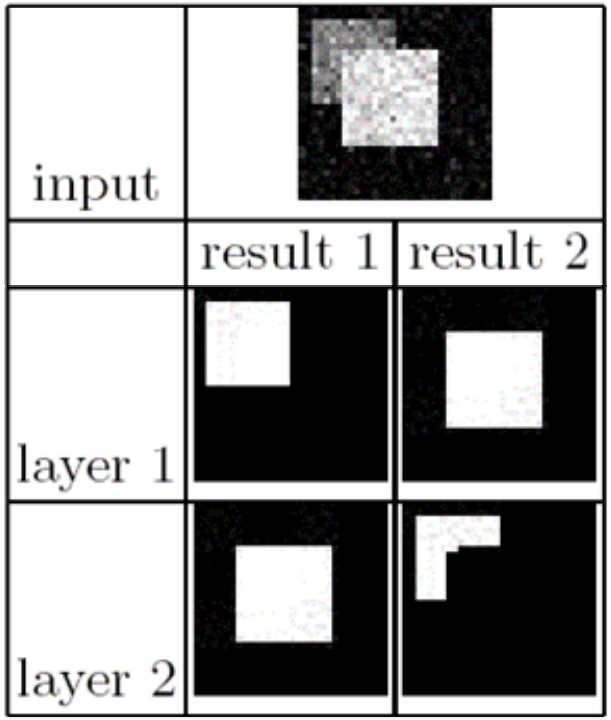
2-way graph cut algorithm

↓

Expectation

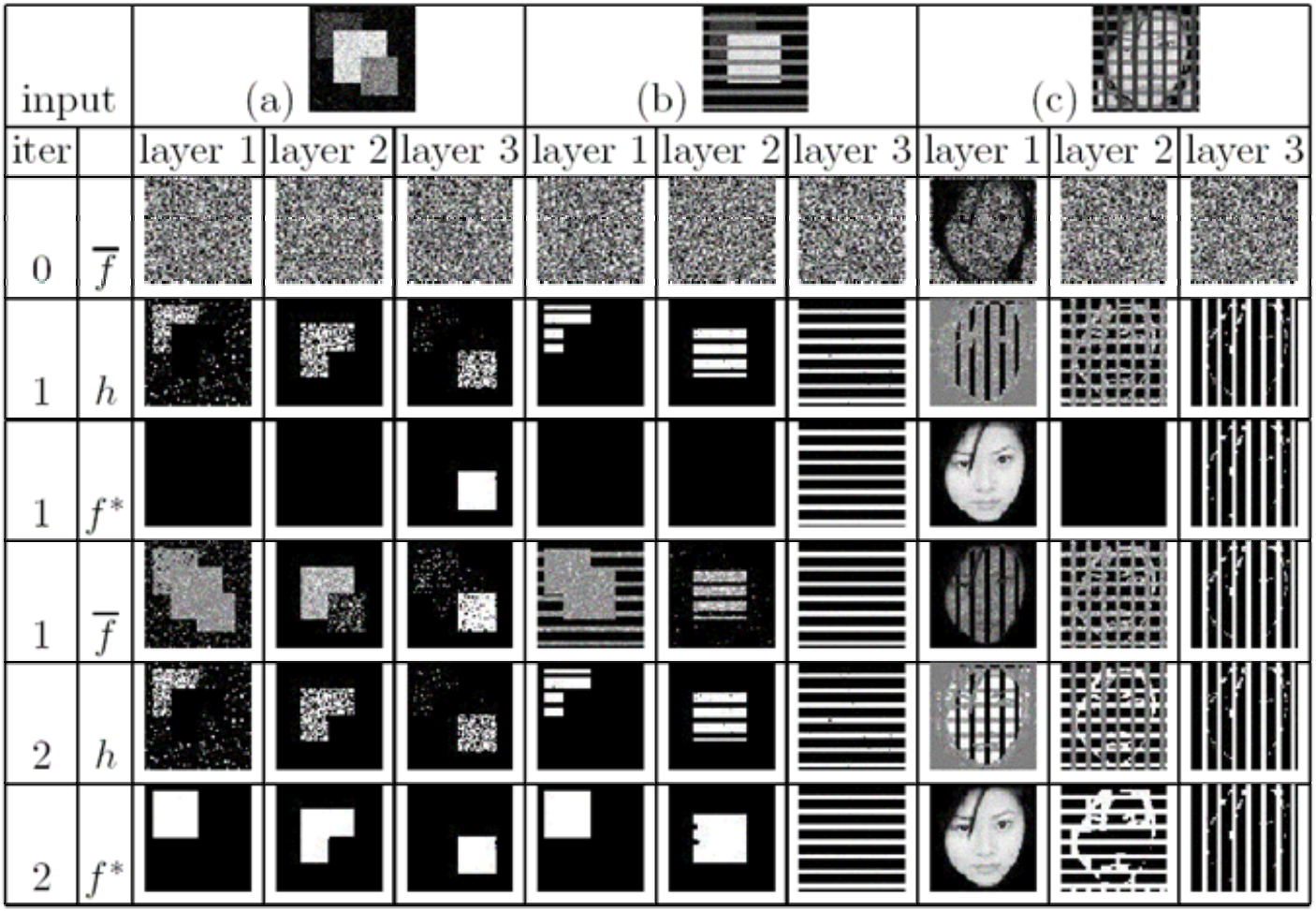
2^{nd} order neighborhood approximation

Convergence

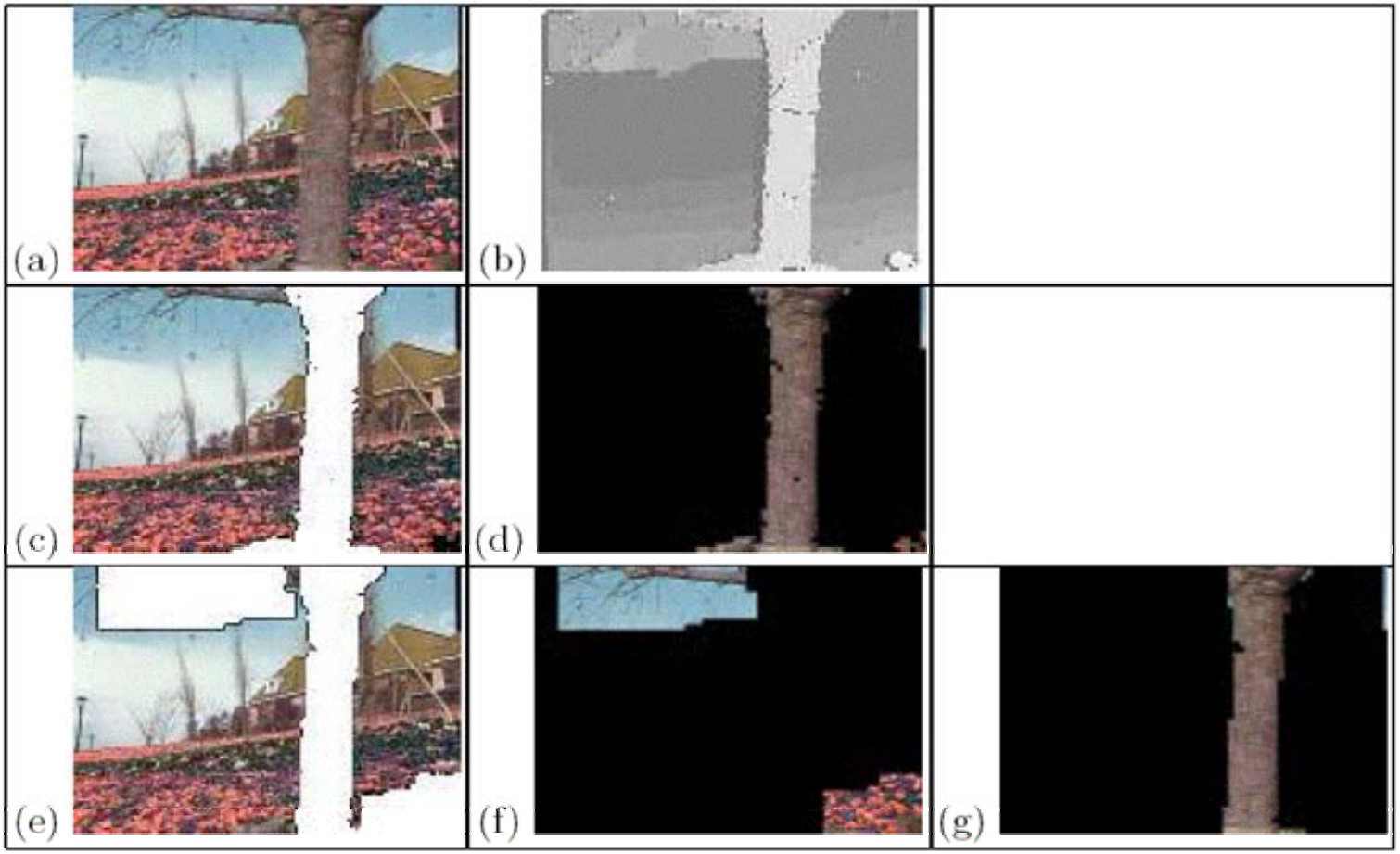


Two different decomposition

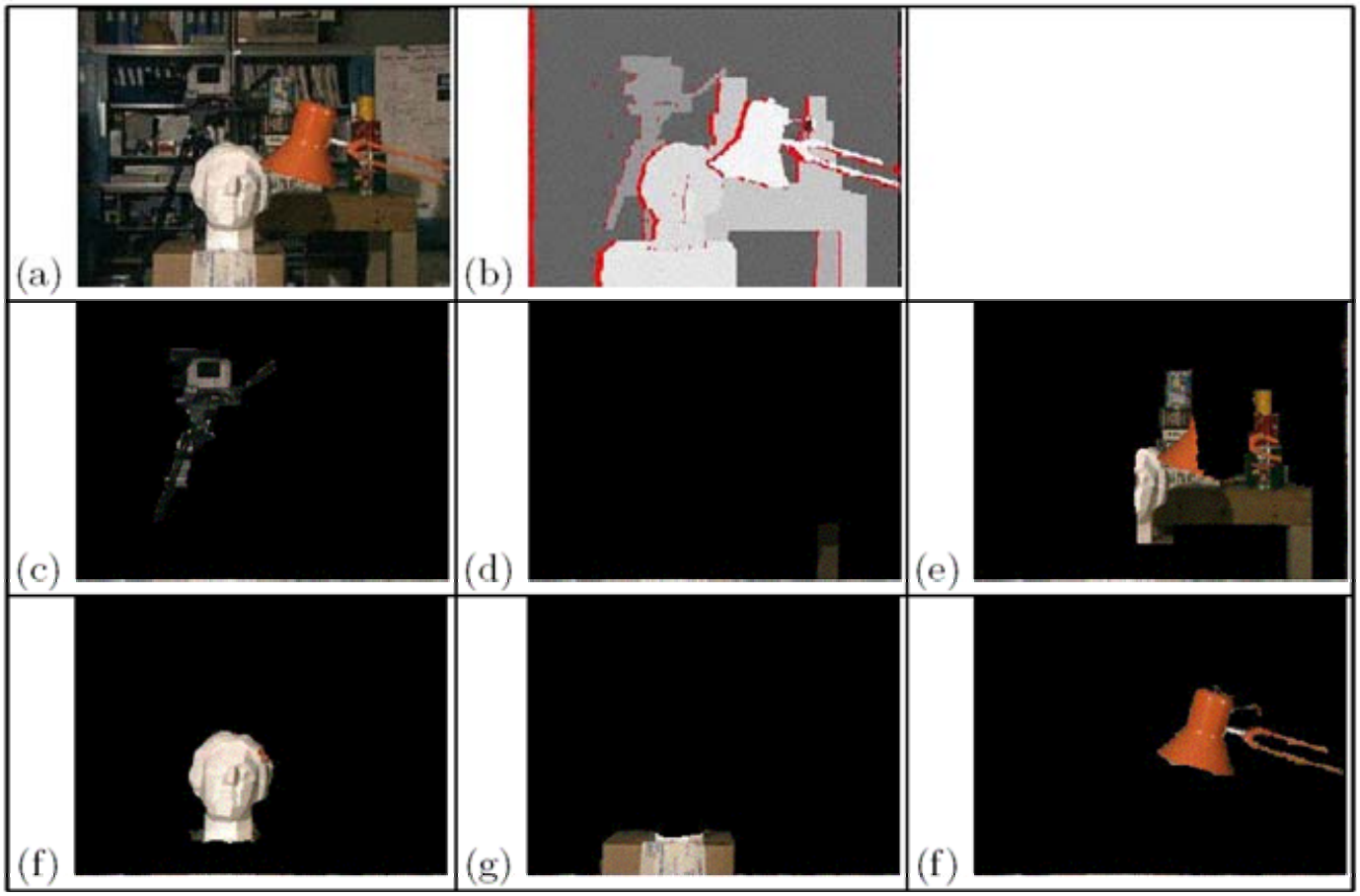
Synthetic image



Real image



Real image



Contributions

- A new graphical model to represent image layers
- An efficient algorithm for inference

Furture works

- Automatic determination of number of layers

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