Online Learning to Diversify from Implicit Feedback

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Overview

Present simple, efficient online learning algorithms for learning both relevance and diversity in rankings, which are shown to be theoretically and empirically robust.

Example: News Recommendation

1. Users have multiple different interests
2. Each day they are presented with lists of different news articles
3. Of which they choose to read articles that are of interest and not redundant.
4. Which is then used as feedback to learn the interests of the user and the diversity they desire in their news lists.
5. Which helps present better results in the future.

Motivation:

• Most research on focused on extrinsic diversity.
• Intrinsic Diversity: Diversity in the aspects of a single information need.
• No previous method for learning required amount of diversity from user feedback/click data.

Learning Diversity:

• Capture diversity via non-linear combination of document feature vectors:
  \[ \phi(x,y) = F(\{\phi(d_{i1}), \phi(d_{i2}), ..., \phi(d_{ik})\}) \]
• Choice of F determines how much redundancy in predicted rankings. Couple of examples:
  \[ F(A) = \frac{\sum_{a \in A} \phi(a)}{\max_{a \in A} \phi(a)} \]

Algorithm:

1. Start with \( w = 0 \)
2. Present ranking as per current \( w \)
3. Observe user feedback.
4. Perceptron Update:
   \[ w += \text{Feedback} \times \text{FeatVec} - \text{Presented FeatVec} \]
5. Repeat from step 2 for next user session

• Simple and efficient
• Theoretically guaranteed to converge to optimal
• Ranking in step 2 can be easily computed via simple greedy algorithm for any submodular \( F \).

• Outperforms supervised learning within few iterations despite not receiving true labels.

Experiments:

• Used 2 news datasets: RCV1 and 20NG
• Simulated diverse users with 5 interests.
• TFIDF values used for document features,

Findings:

• Highly robust to noisy user feedback and quality of feedback.
• Able to learn desired amount of diversity.

Future Directions:

• User study of model in recommendation system.
• Extending to extrinsic diversity.