1-4(a): Taxonomy of Recommender Systems (part 1 of 2)

UNIVERSITY OF MINNESOTA

Introduction to Recommender Systems

Learning Objectives

- To understand the different types of recommender systems
  - A framework for analyzing recommender systems in general
  - A specific overview of different recommendation algorithms
- To acquire a roadmap for the rest of the course, based on the algorithms studied

Copyright 2016 Joseph A. Konstan. All rights reserved.

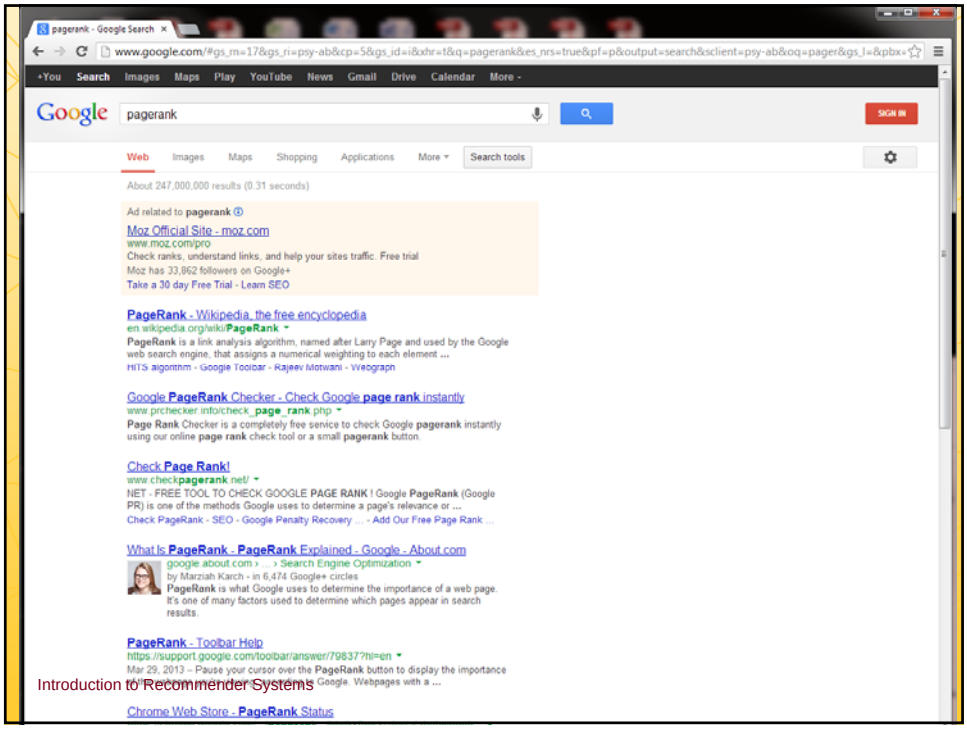
Analytical Framework

- Dimensions of Analysis
  - Domain
  - Purpose
  - Recommendation Context
  - Whose Opinions
  - Personalization Level
  - Privacy and Trustworthiness
  - Interfaces
  - Recommendation Algorithms

Domains of Recommendation

- Content to Commerce and Beyond
  - News, information, "text"
  - Products, vendors, bundles
  - Matchmaking (other people)
  - Sequences (e.g., music playlists)
- One particularly interesting property
  - New items (e.g., movies, books, …)
  - Re-recommend old ones (e.g., groceries, music)

Copyright 2016 Joseph A. Konstan. All rights reserved.

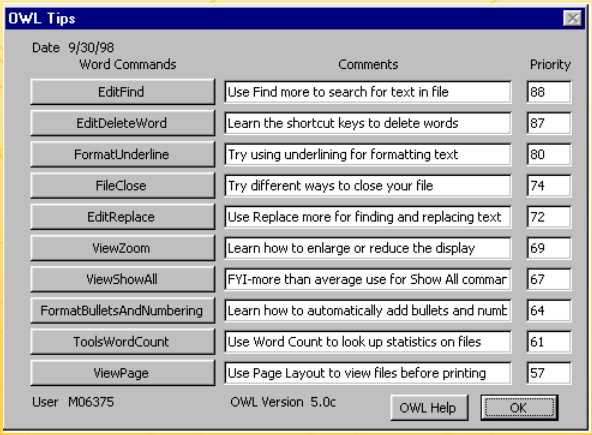


Copyright 2016 Joseph A. Konstan. All rights reserved.

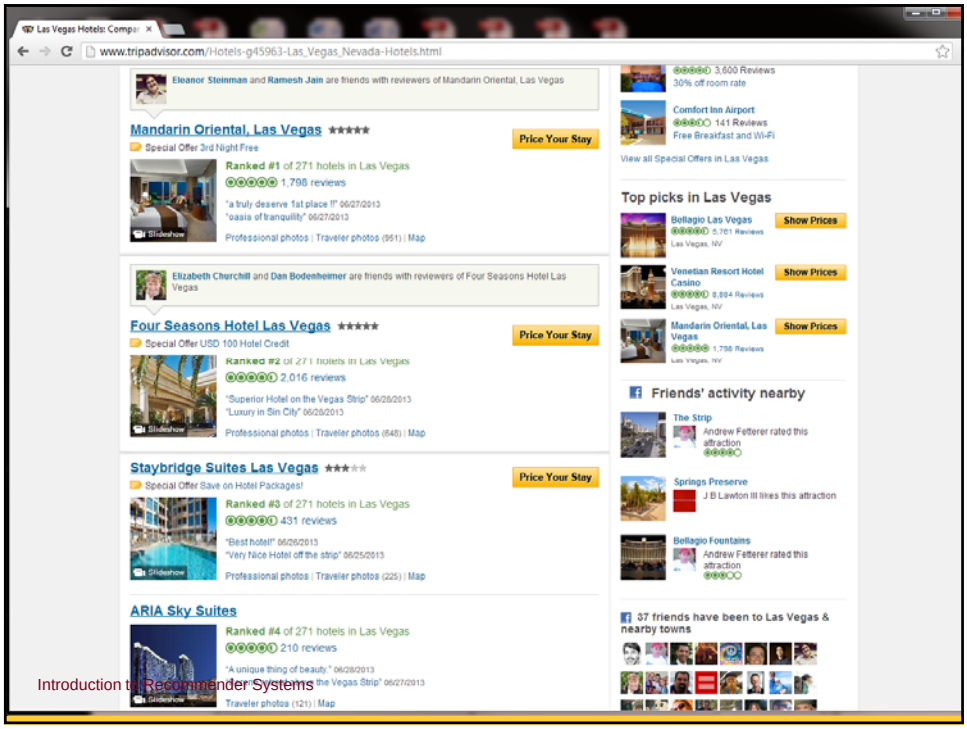
Purposes of Recommendation

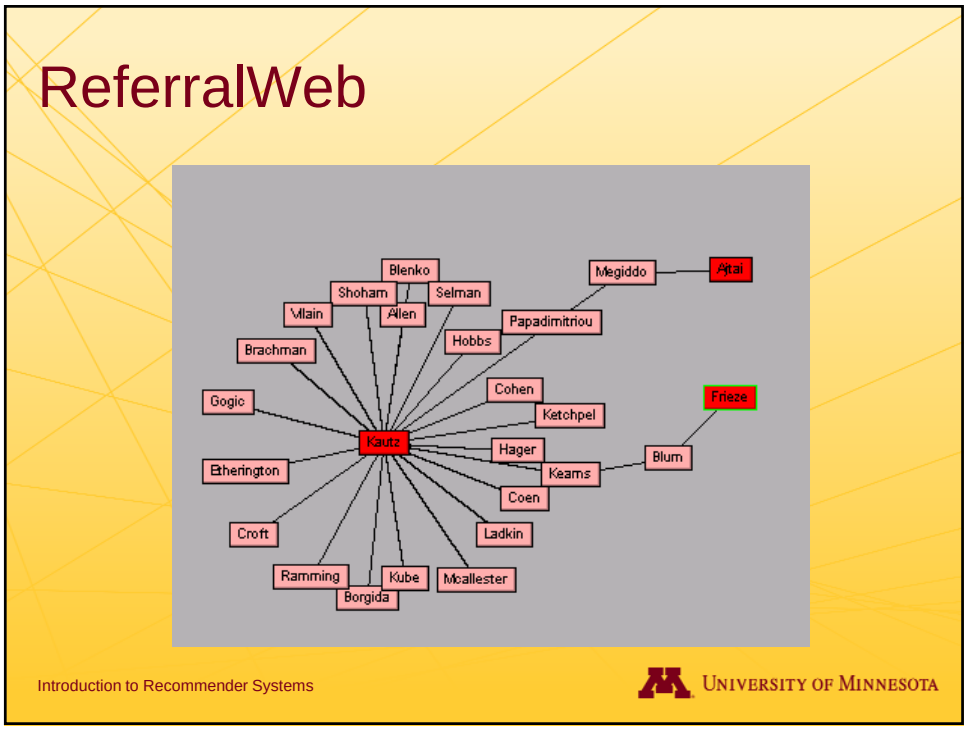
- The recommendations themselves
  - Sales
  - Information
- Education of user/customer
- Build a community of users/customers around products or content

OWL Tips



Copyright 2016 Joseph A. Konstan. All rights reserved.

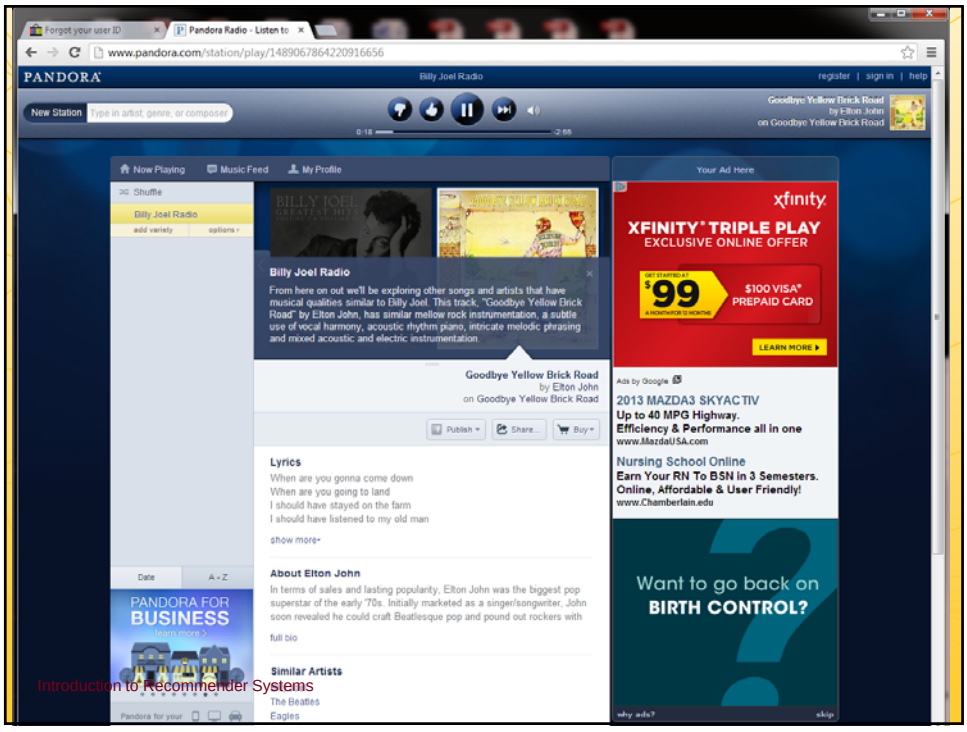




Copyright 2016 Joseph A. Konstan. All rights reserved.

Recommendation Context

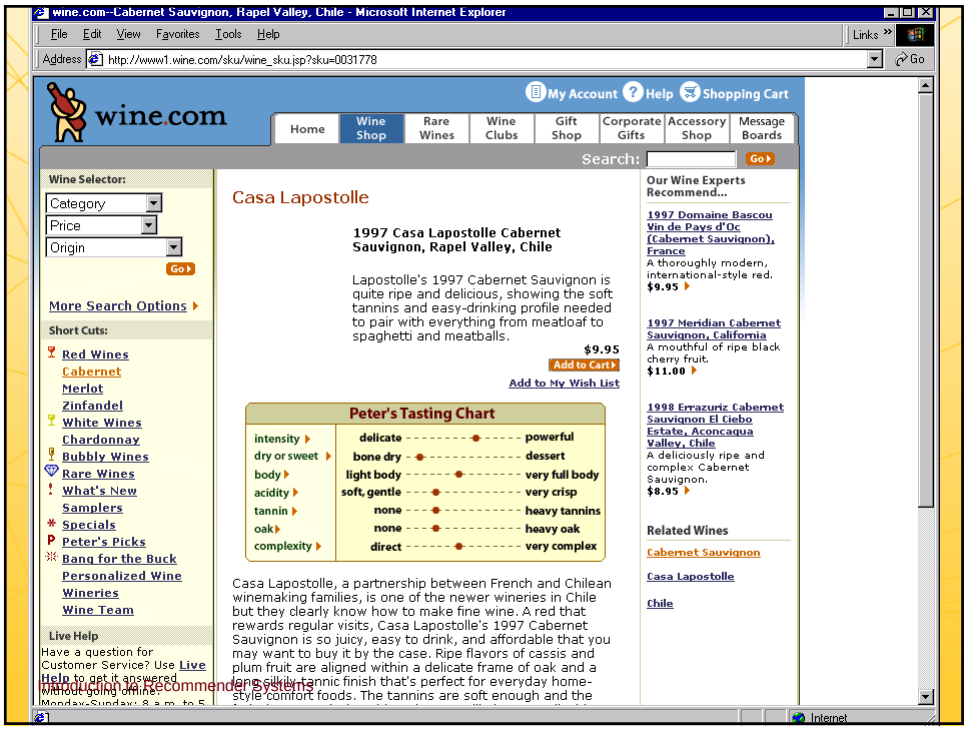
- What is the User doing at the time of recommendation?
  - Shopping
  - Listening to Music
  - Hanging out with other people
- How does the context constrain the recommender?
  - Groups, automatic consumption (vs. suggestion), level of attention, level of interruption?



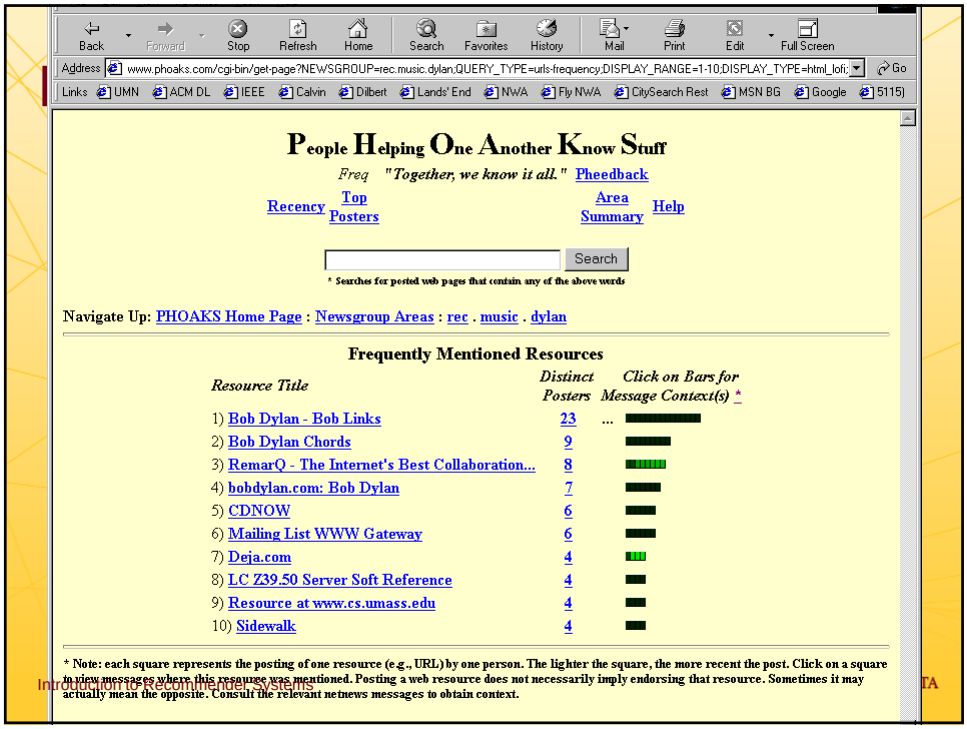
Copyright 2016 Joseph A. Konstan. All rights reserved.

Whose Opinion?

- "Experts"
- Ordinary "phoaks"
- People like you



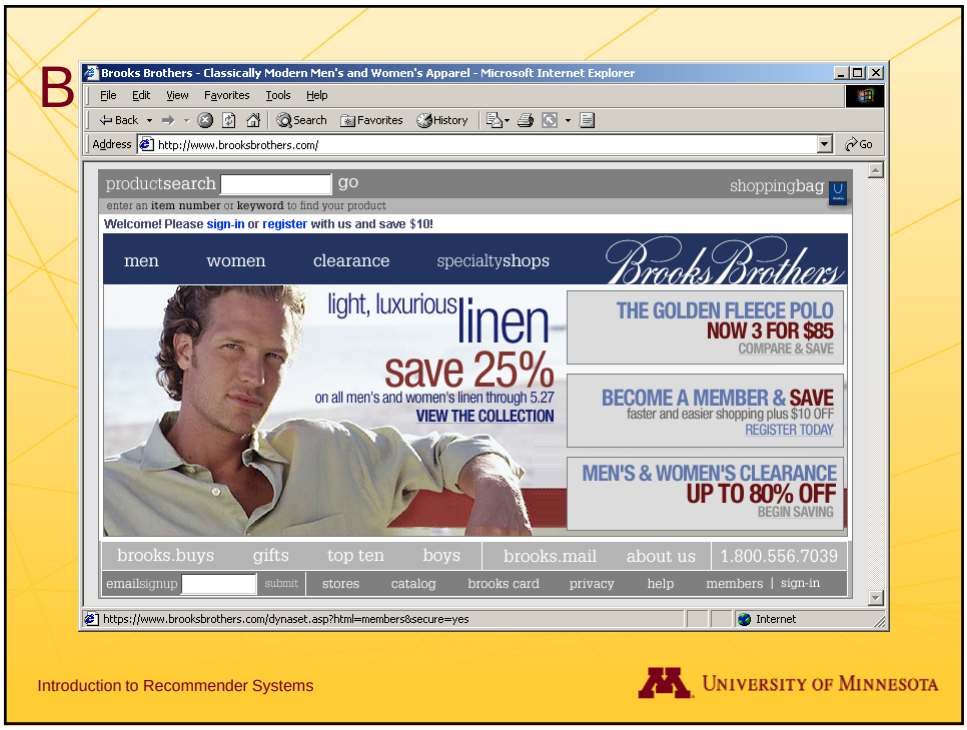
Copyright 2016 Joseph A. Konstan. All rights reserved.



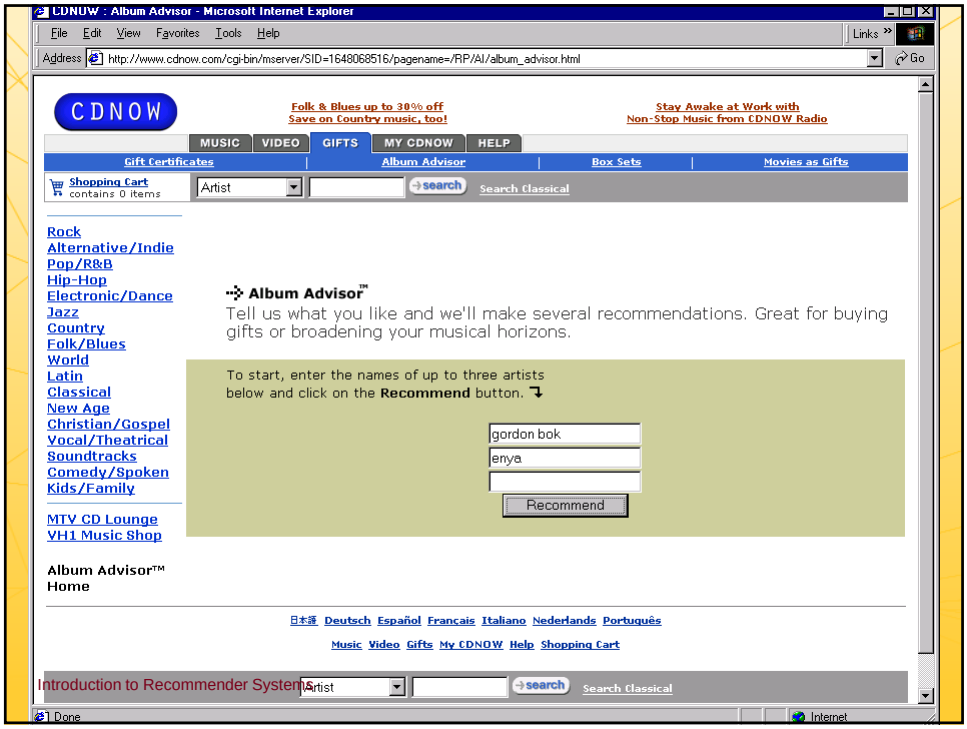
Personalization Level

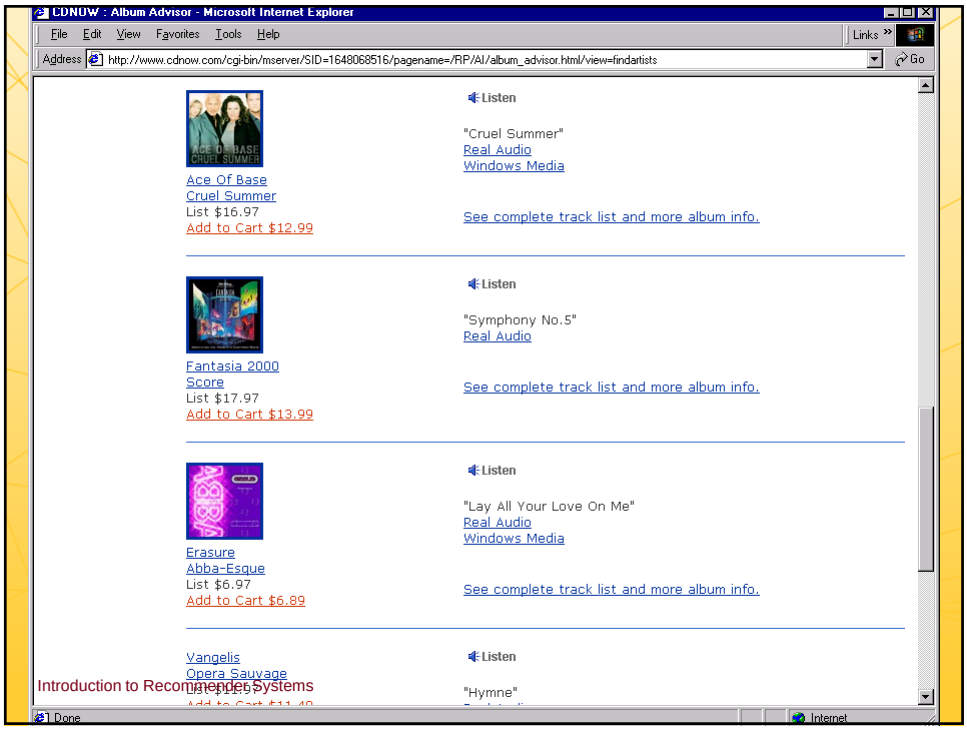
- Generic / Non-Personalized
  - Everyone receives same recommendations
- Demographic
  - Matches a target group
- Ephemeral
  - Matches current activity
- Persistent
  - Matches long-term interests

Copyright 2016 Joseph A. Konstan. All rights reserved.



Copyright 2016 Joseph A. Konstan. All rights reserved.





Copyright 2016 Joseph A. Konstan. All rights reserved.

Privacy and Trustworthiness

- Who knows what about me?
  - Personal information revealed
  - Identity
  - Deniability of preferences
- Is the recommendation honest?
  - Biases built-in by operator
    - "business rules"
  - Vulnerability to external manipulation
  - Transparency of "recommenders"; Reputation

Copyright 2016 Joseph A. Konstan. All rights reserved.

Interfaces

- Types of Output
  - Predictions
  - Recommendations
  - Filtering
  - *Organic vs. explicit presentation*
    - Agent/Discussion Interface
- Types of Input
  - Explicit
  - Implicit

Recommendation Algorithms

- Non-Personalized Summary Statistics
- Content-Based Filtering
  - Information Filtering
  - Knowledge-Based
- Collaborative Filtering
  - User-User
  - Item-Item
  - Dimensionality Reduction
- Others
  - Critique / Interview Based Recommendations
  - Hybrid Techniques

Copyright 2016 Joseph A. Konstan. All rights reserved.

1-4(b): Taxonomy of Recommender Systems (part 2 of 2)

UNIVERSITY OF MINNESOTA

Introduction to Recommender Systems

Recommendation Algorithms

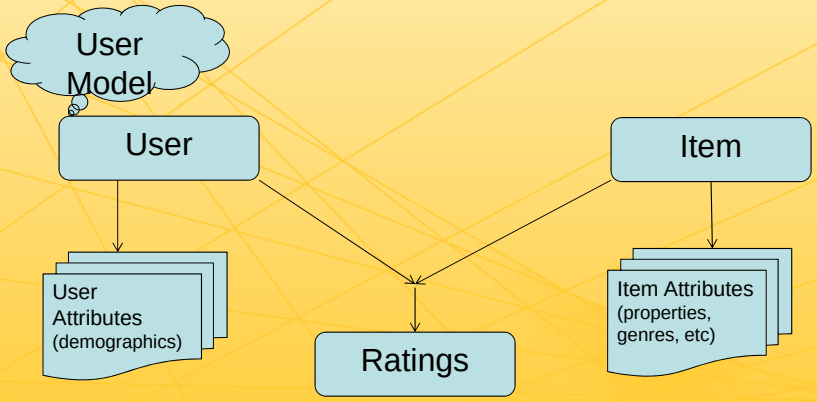
- Non-Personalized Summary Statistics
- Content-Based Filtering
  - Information Filtering
  - Knowledge-Based
- Collaborative Filtering
  - User-User
  - Item-Item
  - Dimensionality Reduction
- Others
  - Critique / Interview Based Recommendations
  - Hybrid Techniques

Copyright 2016 Joseph A. Konstan. All rights reserved.

From the Abstract to the Specific

- Basic Model
  - Users
  - Items
  - Ratings
  - (Community)

Linking these together



Copyright 2016 Joseph A. Konstan. All rights reserved.

Non-Personalized Summary Stats

- External Community Data
  - Best-seller; Most popular; Trending Hot
- Summary of Community Ratings
  - Best-liked
- Examples
  - Zagat restaurant ratings
  - Billboard music rankings
  - TripAdvisor hotel ratings

Content-Based Filtering

- User Ratings x Item Attributes => Model
- Model applied to new items via attributes
- Alternative: knowledge-based
  - Item attributes form model of item space
    - Users navigate/browse that space
- Examples
  - Personalized news feeds
  - Artist or Genre music feeds

Copyright 2016 Joseph A. Konstan. All rights reserved.

Personalized Collaborative Filtering

- Use opinions of others to predict/recommend
- User model – set of ratings
- Item model – set of ratings
- Common core: sparse matrix of ratings
  - Fill in missing values (predict)
  - Select promising cells (recommend)
- Several different techniques

Collaborative Filtering Techniques

- User-user
  - Select neighborhood of similar-taste people
    - Variant: select people you know/trust
  - Use their opinions
- Item-item
  - Pre-compute similarity among items via ratings
  - Use own ratings to triangulate for recommendations
- Dimensionality reduction
  - Intuition: taste yields a lower-dimensionality matrix
  - Compress and use a taste representation

Copyright 2016 Joseph A. Konstan. All rights reserved.

Note on Evaluation

- To properly understand relative merits of each approach, we will spend significant time on evaluation
  - Accuracy of predictions
  - Usefulness of recommendations
    - Correctness
    - Non-obviousness
    - Diversity
  - Computational performance

Other Approaches

- Interactive recommenders
  - Critique-based, dialog-based
- Hybrids of various techniques

Copyright 2016 Joseph A. Konstan. All rights reserved.

Moving Forward

- Next Lecture: A Tour of Amazon.Com, organized by our taxonomy
- Then, you should be able to:
  - Analyze a recommender application on your own
- Course Structure:
  - We step through the recommendation algorithms, with six major modules
  - Related topics intermingled

1-4: Taxonomy of Recommender Systems

UNIVERSITY OF MINNESOTA

Copyright 2016 Joseph A. Konstan. All rights reserved.