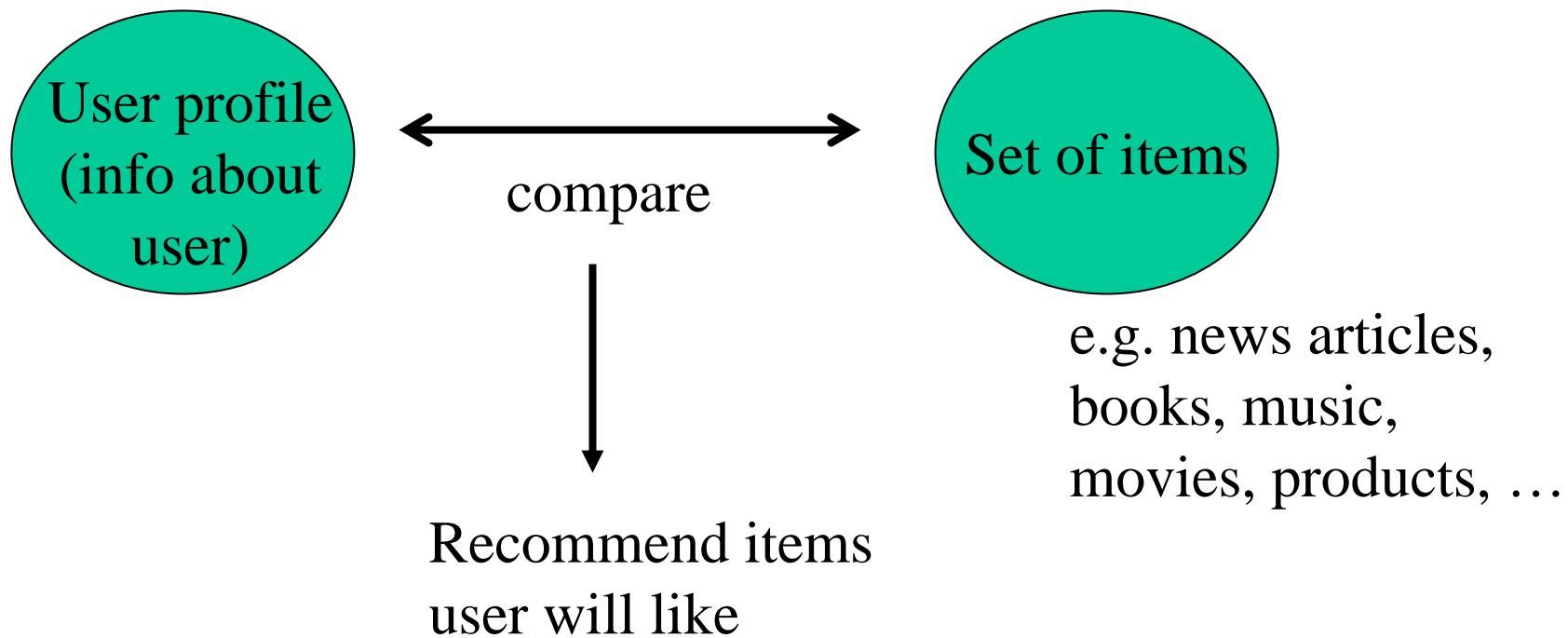


# User Modeling, Recommender Systems & Personalization

Pattie Maes

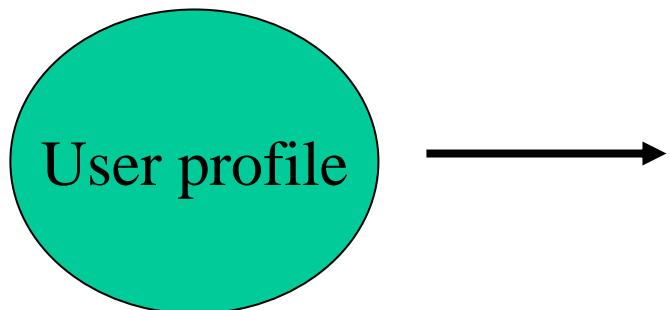
MAS 961- Week 6

# Recommender Systems: General idea



# Personalization: General Idea

Personalization = user adaptive systems



interaction is adapted based on  
data about an individual user  
Eg personal websites,  
personalized tutoring,  
personalized recommendations,  
etc.

# Why relevant to this class?

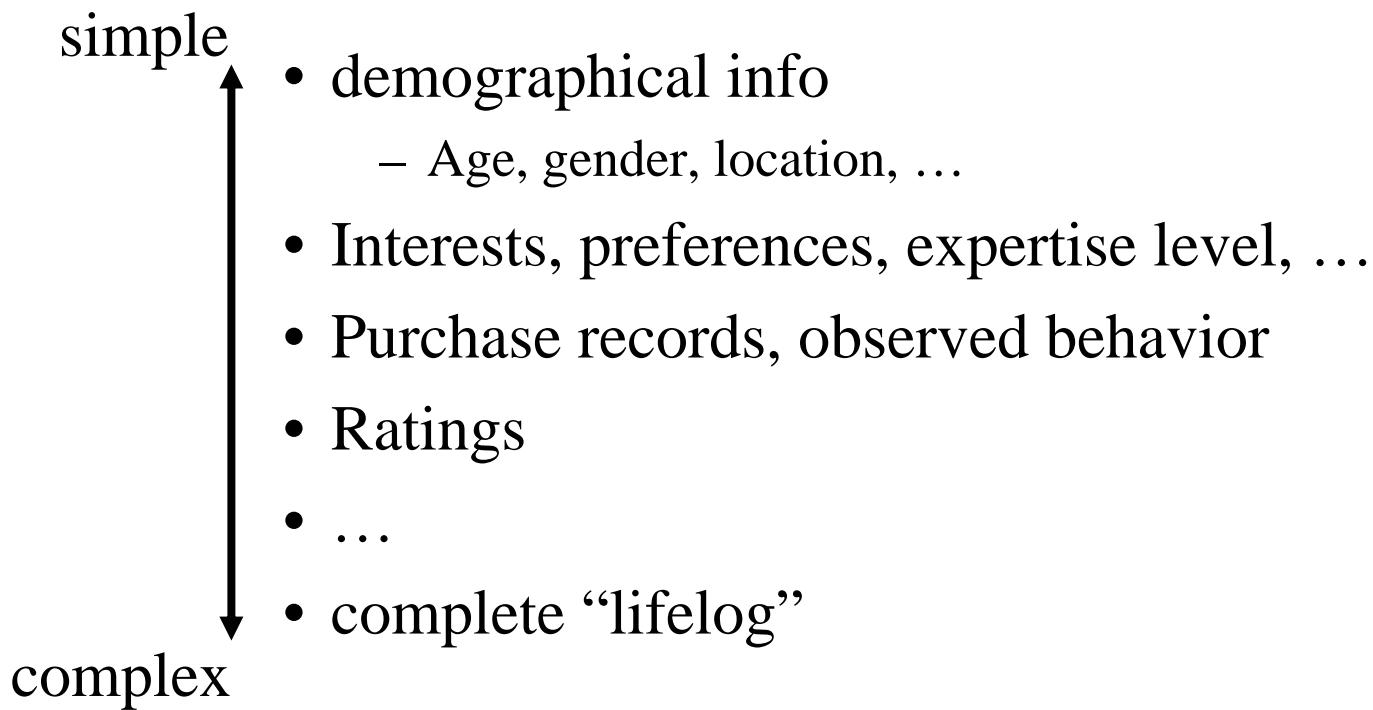
Ambient Intelligence =

Ubiquitous Computing

+

Intelligent Interfaces (eg personalization)

# User Profile



# Source of User Profile

- Entered explicitly by user (questionnaire)
- Gathered implicitly by system
  - Observing/recording person's behavior
  - Learning/inferring interests/preferences/level...
- Combination of both approaches
- Another dimension: public/private

# Acquired User Profiles

Form:

- raw data
- generalization (find patterns & generalize)
  - statistical ML methods
  - knowledge based ML methods
- keep both forms (to relearn/adapt over time)
  - keep “window” of raw data

# Generic User Modeling

- Separate user modeling from applications/use
  - Reusable across applications
- Still mostly theory, not practice
- State of art: every application does its own user modeling specific to the task at hand

# Recommendation algorithms

- Case-based/Stereotype based
- Feature-based/Content-based
- Collaborative Filtering

# Case-Based/Stereotype-Based

- Acquire info about user
- Classify user in a bucket (as a particular “case” or stereotype) based on facts about user
  - Eg soccer moms, poor grad student, ... (there may be a hierarchy, rather than list of stereotypes)
- Certain assumptions about what appeals to a certain stereotype
  - Eg which items appeal to certain case/category of users
- Recommend those to the user
- Example: demographics-based recommendations

# Feature-based/Content-based Filtering

- One approach: learning from item examples
  - Look at all items a user likes
    - Features of items
  - Find patterns among items and generalize (often also involves clustering)
  - Then recommend more items that fit same pattern(s)
  - Eg recommend movies based on features of those movies (genre, actors, ...)

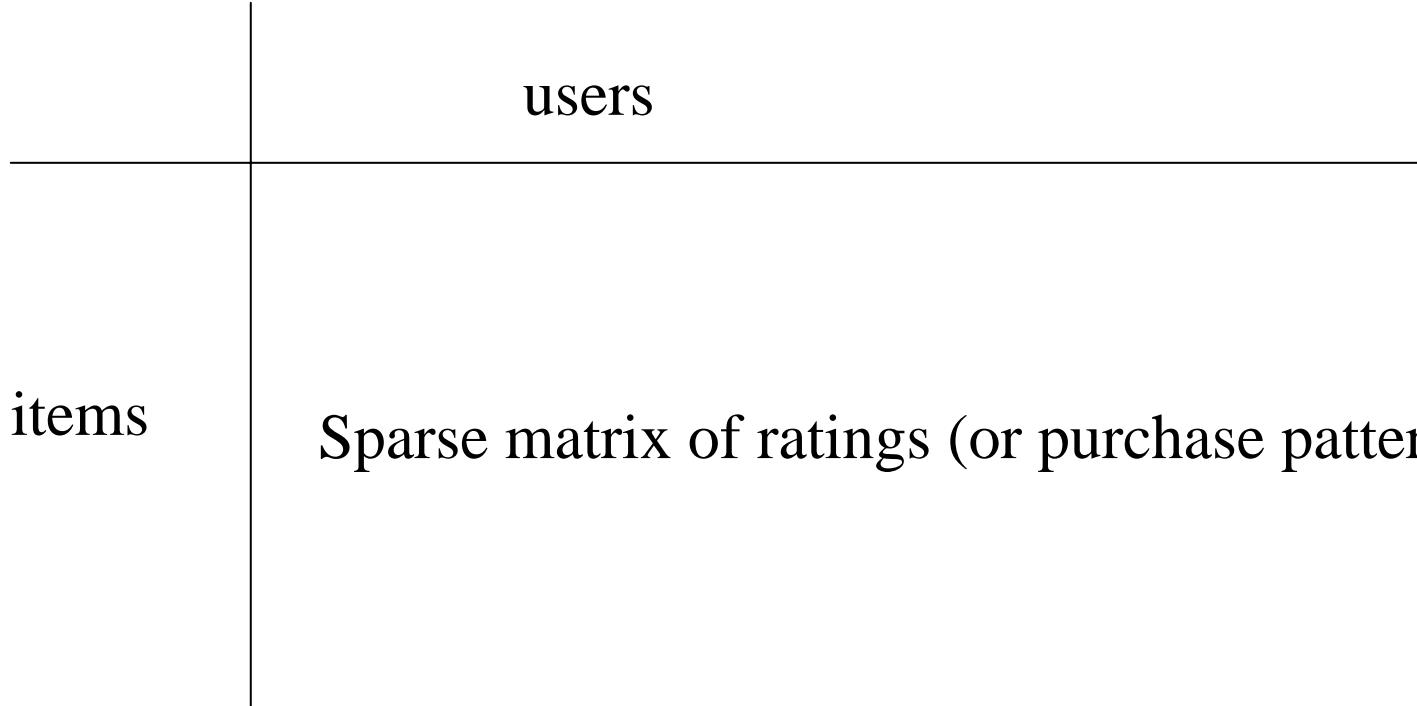
# Feature-based/Content-based Filtering

- Another approach: learning stereotypes from user examples
  - Given a category of items
  - Given set of users with features & values
  - Given information on which users like what items
  - Generalize on what types of users like a category of items
  - Recommend items based on what case user falls into

# Knowledge-based Techniques

- Special case of feature-based where background knowledge of item space or user space is used to generalize
- Eg use ConceptNet or Interest Map
  - Know what people are related (InterestMap)
  - Know what items are related (ConceptNet)

# Collaborative Filtering



Algorithms: recommend items based on item similarities (rows) or based on user similarities (columns), typically weighted average of K nearest neighbors, with weight inverse proportional to distance

# Pros & Cons different techniques

- Collaborative filtering
  - Pros:
    - Does not require analysis of the items (features)
    - Better at qualitative judgements
  - Cons:
    - Bootstrapping
    - Ratings required
    - Critical mass required

# Mixed Techniques

- Use ratings as additional features in the generalization task
  - ML algorithm can learn what features are best predictors (content features or ratings by others or both)

# User Profile

- Short term information
  - Eg current context, current activity/focus
- Long term info
  - Eg longer term interests
- You typically want to use both
- Update them on different timescale

# Location of User Profile

- Centralized
  - Generic
  - Device & application independent
  - Easier to apply generalization across users
- Distributed
  - Mobile use
  - Better privacy
- Mixed forms

# Tunnel vision problem & importance of serendipity

- Feedback loop:
  - Systems recommends items of type X
  - User consumes items of type X
- Importance of “exploration” or “serendipity” (recommending items outside user’s interest space)

# Avoiding the tunnel vision problem

Delightful Scenery.

A black and white portrait of a man wearing glasses and a suit, looking slightly to the left.

A black and white portrait of a man with dark hair and a prominent mustache. He is wearing a suit jacket over a light-colored shirt. The image is framed by a thick black border.

the Country club, located  
from the business side,  
the Farmers club, the  
Lions, tennis courts and a  
number of other organizations.  
Business will set having  
**Personnel of the Press**  
-- **Licenses** --  
There were 100 applications  
and three candidates for  
a ticket. C. C. Corriveau is  
business man of this city.  
He is the owner of the  
firm of Grindwald-Sahl Co.,  
Village and Blacksmith's band-  
tins, on Spring street.  
The contractor and live  
stock dealer, respectively.  
The other two candidates  
for trustee, are the son  
George J. Fournier, and live  
stock dealer, and the  
beautiful sculptor home,

A black and white portrait of a young man with dark hair, wearing a suit jacket, a white shirt, and a bow tie. He is looking slightly to his left.

Highlight  
recommendations ★  
but present all  
choices



# Other problems

- Noisy/incorrect data used in user modeling
  - User needs to be able to inspect & “correct” user model
- Trust
  - Recommendation system needs transparency!!
- Privacy
- Control

# Variant: one person as recommender

- E.g. see world through Marvin's eyes
- Have a famous critic as your guide

# Next Week:Ambient & Tangible Interfaces

- Required reading:
  - Ishii & Ullmer, Media Lab, Tangible bits, Chi 97,  
<http://web.media.mit.edu/~anjchang/ti01/ishii-chi97-tangbits.pdf>

# Next Week:Ambient & Tangible Interfaces

- Gross' work- Frauenhofer - **Amy**
  - Ambient Interfaces: design challenges & recommendations  
[http://ieeexplore.ieee.org/xpl/abs\\_free.jsp?arNumber=994231](http://ieeexplore.ieee.org/xpl/abs_free.jsp?arNumber=994231)
  - Ambient Interfaces in a web-based theater of work
- Cohen & McGee, Tangible Multi-modal Interfaces - **Amy**  
<http://www.cse.ogi.edu/CHCC/Publications/cacm-actual.pdf>
- Personal & Ubiquitous Computing Journal Vol 8 Nr 5 Special Issue on Tangible Computing – selection – **Edison (2) & Minna (2)**