Recommender Systems
Introduction

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Today

- motivation
- main notions
- course organization
- project discussion
Motivation

- information overload
  - many choices available
  - “the paradox of choice”
- recommender system
  - provide aid
  - set of items + user “context” ⇒ selection of items (predicted to be “good” for the user)

(definition?)
Motivation

1. What recommender systems do you know?
2. What recommender systems would you like to have?
Examples of Applications

- movies
- music
- books
- software (apps)
- products in general
- research articles
- people (dating)
- services (restaurants, accommodation, ...)
- jokes
Value of Recommendations

- Netflix: 2/3 of the movies watched
- Amazon: 35% sales
- Google news: recommendations ⇒ 38% more clickthrough
Types of Recommender Systems

Recommender systems reduce information overload by estimating relevance

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Types of Recommender Systems

User profile & contextual parameters → Recommendation component → Recommendation list

Personalized recommendations

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Recommender Systems: An Introduction (slides)
Types of Recommender Systems

Collaborative: "Tell me what's popular among my peers"

Recommendation component

Recommendation list

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Types of Recommender Systems

Content-based: "Show me more of the same what I've liked"

User profile & contextual parameters

Recommendation component

Recommendation list

Product features

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Types of Recommender Systems

Knowledge-based: "Tell me what fits based on my needs"

User profile & contextual parameters

Product features

Knowledge models

Recommender Systems: An Introduction (slides)
Types of Recommender Systems

Hybrid: combinations of various inputs and/or composition of different mechanism

User profile & contextual parameters
Community data
Product features
Knowledge models

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Recommender Systems: An Introduction (slides)
Types of Recommender Systems

- non-personalized
- demographic
- collaborative filtering
- content based
- knowledge-based
- hybrid
Provider's point of view:

- sell more items
- sell more diverse items (long tail)
- increase user satisfaction, fidelity
- better understand what users want
Long Tail

Recommender System Functions

User’s point of view:

- looking for something:
  - find some good items
  - find all good items (closer to IR)
  - recommend a sequence, a bundle
- just browsing
- side-effects (collaborative filtering systems):
  - express self
  - help others
  - influence others
Information retrieval is the activity of obtaining information resources relevant to an information need from a collection of information resources. (Wikipedia)

- RecSys and IR closely connected (many similar or analogical techniques)
- different goals:
  - IR – “I know what I’m looking for”
  - RecSys – “I’m not sure what I’m looking for”
Serendipity

- unsought finding
- unexpected, but useful result
- do not recommend items the user already knows or would find anyway, try something more interesting
- example – books:
  - I like books by Remarque, Potok, Skácel
  - recommending another book by Remarque not very useful
  - recommending Munro = serendipity
A Brief History

- 1990s’ – first systems (e.g., GroupLens), basic algorithms
- 1995-2000 – rapid commercialization, challenges of scale
- 2000-2005 – research explosion, mainstream applications
- 2006 – Netflix prize
- 2007 – the first Recommender Systems conference
- now – very active research, many applications
Netflix Prize

- Netflix – video rental company
- contest: 10% improvement of the quality of recommendations
- collaborative filtering
- prize: 1 million dollars
- data: user ID, movie ID, time, rating
Collaborative Filtering

- one of the most often and successfully used techniques
- widely applicable, does not need any domain knowledge
- interesting analogies, metaphors, questions
  - ants, social insect: communication via pheromone
  - recommender systems: people \(\sim\) ants, pheromone \(\sim\) ratings (clicks)
  - between human intelligence and (good old-fashioned) artificial intelligence
Ratings

- explicit
  - Likert scale (5 stars), like/dislike
  - require additional effort from users

- implicit
  - buying an item, visiting a page, viewing a video
  - easier to collect, less precise
  - more “honest”
RecSys and Educational Domain

- learning materials – direct application
- problems, exercises:
  - users ~ students
  - items ~ problems
  - ratings ~ performance (correctness of answers, problem solving times)
Our Projects at FI

educational systems:
  - tutor.fi.muni.cz
  - slepemapy.cz
Course Organization

( preliminary )

- \sim 6 \text{ weeks}
  - lectures: main notions of the field
  - discussions: relations of notions to your projects

- \sim 6 \text{ weeks}
  - work on projects
  - consultations

- final 2 weeks
  - presentation of projects
Focus of This Course

- practical experience
- collaborative filtering
- educational applications

more focus on consultations / discussions than on lectures
(good lectures available online)
Prerequisites

- programming
- math (basic linear algebra, statistics)
- (basics of machine learning – not strictly necessary)

(depends also on the choice of project)
Materials, Sources

- Introduction to Recommender Systems book
  - http://www.recommenderbook.net/
  - slides freely available – more details than in course slides
- Recommender Systems Handbook
- Video lectures: Coursera, Machine learning summer school

(links at course web page)
Projects

2 main options:

- "application": development of a simple recommender systems recommended for AP, INS, SSME students
- "research": development and experimental evaluation of algorithms used by recommender systems recommended for TEI, UMI students
“Application”: System Development

build a simple recommender system, 1-4 students

- ”short text” recommendations: jokes, quotes, poetry, baby names, recipes, ...
- ”local” recommendations (Brno): restaurants, cultural events, places, ...
- educational recommendations: courses (MU, MOOC), foreign language vocabulary, learning materials, ...
- product recommendation (specialized for a particular domain): board games, books for children, ...

requirements: simple web portal implementation (PHP or Python / MySQL / JavaScript)
“Research”: Models, Evaluation

individual project

- develop a model for predicting user ratings / student performance
- evaluate the model, visualize results
- provided: specifics datasets (movies, slepemapy.cz data), guidelines, baseline model implementations (in Python)

requirements: data analysis (Python recommended), implementation of machine learning techniques
Alternatives Possible

- creating good Wikipedia articles in Czech
- creating educational video (tutorial) in Czech
- giving a presentation about some specific topic
- own proposal

(high demands, only in case of strong interest, not as an “escape” from programming)
Colloquium – Requirements

- interesting project
- active participation during semester or solid knowledge of covered topics (discussion at the end of the semester)