CS276B

Text Retrieval and Mining
Winter 2005

Project Practicum 2

Plan for today

- General discussion of your proposals
- Sample project overview (what you have to turn in on Tuesday)
- More tools you might want to use
- More examples of past projects

General feedback on proposals

- We need more specifics on what exactly you're planning to build.
  - Vagueness was fine for the proposals, but it's not appropriate for your overview.
  - Avoid discussion of "possible applications" – your overview is a commitment to develop a fleshed-out, polished application.
  - Be ambitious but realistic. It's okay if at some future point you realize that you don't have time to implement every feature described in your overview; but your final product should not deviate too far from the scope of your overview.

General feedback on proposals

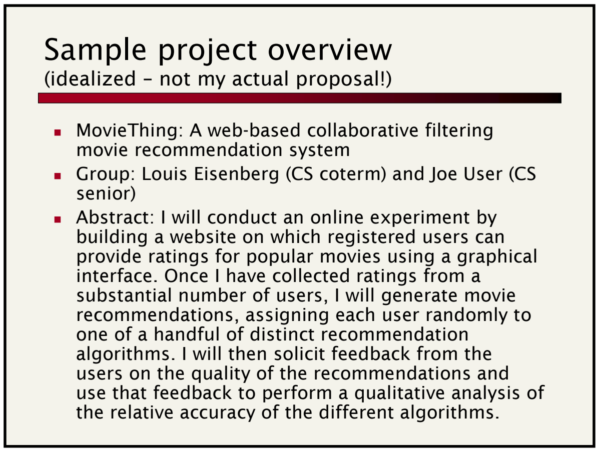
- Measurement criteria are essential
  - Creating a cool application is great but not sufficient – you also need a predetermined standard for evaluating the success or failure of your work.
  - Some kind of scientific numerical analysis of your system's performance in comparison to a baseline or rival system:
    - precision/recall
    - user satisfaction ratings
    - correlation or mean squared error (if you're predicting values)
    - processing time, main memory requirements, disk space

General feedback on proposals

- Remember: a successful project doesn't have to achieve great performance!
  - Of course it's better to get good results…
  - But there can be significant value in trying something interesting and finding that it doesn't work very well.
  - So don't be afraid to explore an idea that isn't guaranteed to pan out – as long as there's reason to believe that it might.

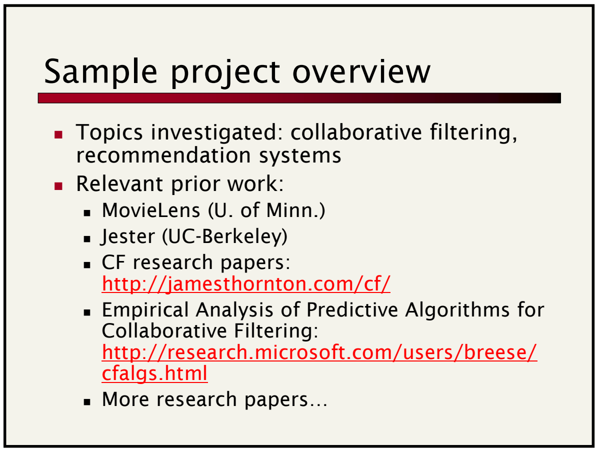
Project overview: Suggested structure

- Title
- Group members
- Abstract (one short paragraph)
- Topic(s) investigated
- Relevant prior work (paper citations, actual systems)
- Delineation of group member responsibilities
- Data sources
- Technologies (programming languages, software, etc.)
- Existing tools leveraged
- Implementation details
- Submission calendar:
  - Block 1
  - Block 2
  - Block 3 (final product)



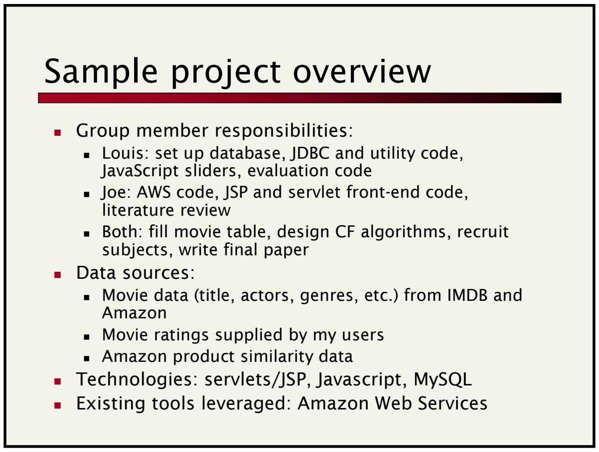
Sample project overview
(idealized – not my actual proposal!)

- MovieThing: A web-based collaborative filtering movie recommendation system
- Group: Louis Eisenberg (CS coterm) and Joe User (CS senior)
- Abstract: I will conduct an online experiment by building a website on which registered users can provide ratings for popular movies using a graphical interface. Once I have collected ratings from a substantial number of users, I will generate movie recommendations, assigning each user randomly to one of a handful of distinct recommendation algorithms. I will then solicit feedback from the users on the quality of the recommendations and use that feedback to perform a qualitative analysis of the relative accuracy of the different algorithms.



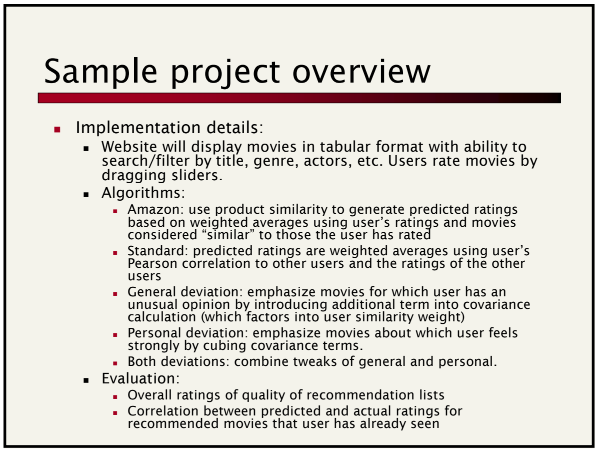
Sample project overview

- Topics investigated: collaborative filtering, recommendation systems
- Relevant prior work:
  - MovieLens (U. of Minn.)
  - Jester (UC-Berkeley)
  - CF research papers: http://jamesthornton.com/cf/
  - Empirical Analysis of Predictive Algorithms for Collaborative Filtering: http://research.microsoft.com/users/breese/cfalgs.html
  - More research papers…



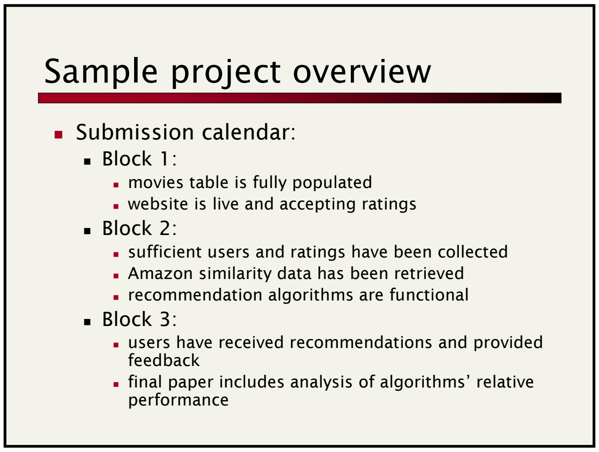
Sample project overview

- Group member responsibilities:
  - Louis: set up database, JDBC and utility code, JavaScript sliders, evaluation code
  - Joe: AWS code, JSP and servlet front-end code, literature review
  - Both: fill movie table, design CF algorithms, recruit subjects, write final paper
- Data sources:
  - Movie data (title, actors, genres, etc.) from IMDB and Amazon
  - Movie ratings supplied by my users
  - Amazon product similarity data
- Technologies: servlets/JSP, Javascript, MySQL
- Existing tools leveraged: Amazon Web Services



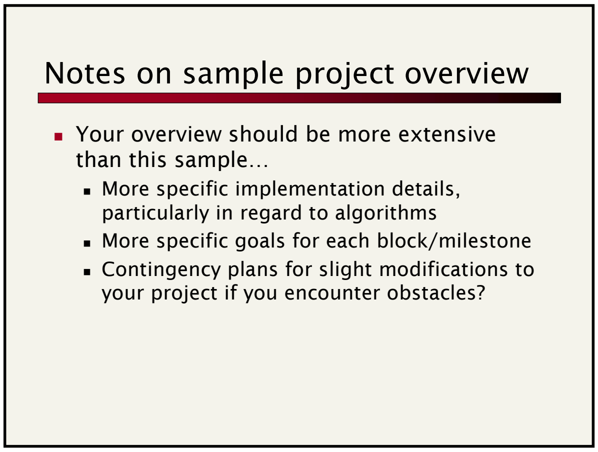
Sample project overview

- Implementation details:
  - Website will display movies in tabular format with ability to search/filter by title, genre, actors, etc. Users rate movies by dragging sliders.
  - Algorithms:
    - Amazon: use product similarity to generate predicted ratings based on weighted averages using user's ratings and movies considered "similar" to those the user has rated
    - Standard: predicted ratings are weighted averages using user's Pearson correlation to other users and the ratings of the other users
    - General deviation: emphasize movies for which user has an unusual opinion by introducing additional term into covariance calculation (which factors into user similarity weight)
    - Personal deviation: emphasize movies about which user feels strongly by cubing covariance terms.
    - Both deviations: combine tweaks of general and personal.
  - Evaluation:
    - Overall ratings of quality of recommendation lists
    - Correlation between predicted and actual ratings for recommended movies that user has already seen



Sample project overview

- Submission calendar:
  - Block 1:
    - movies table is fully populated
    - website is live and accepting ratings
  - Block 2:
    - sufficient users and ratings have been collected
    - Amazon similarity data has been retrieved
    - recommendation algorithms are functional
  - Block 3:
    - users have received recommendations and provided feedback
    - final paper includes analysis of algorithms' relative performance



Notes on sample project overview

- Your overview should be more extensive than this sample…
  - More specific implementation details, particularly in regard to algorithms
  - More specific goals for each block/milestone
  - Contingency plans for slight modifications to your project if you encounter obstacles?

More tools

MALLET

- A Machine Learning for Language Toolkit
- http://mallet.cs.umass.edu/
- "an integrated collection of Java code useful for statistical natural language processing, document classification, clustering, information extraction, and other machine learning applications to text"
- Minimally documented but has lots of stuff:
  - Building feature vectors
  - Various classification methods (Naïve Bayes, max-ent, boosting, winnowing)
  - Evaluation: precision, recall, F1, etc.
  - N-grams
  - Selecting features using information gain
- They have some examples of front-end code

MinorThird

- http://minorthird.sourceforge.net/
- "a collection of Java classes for storing text, annotating text, and learning to extract entities and categorize text"
- Documentation seems to be pretty good: comprehensive Javadocs, tutorial, FAQ…
- Has the concept of "spans" (sequences of words) that can be extracted and classified based on content or context
- Stored documents can be annotated in independent files using TextLabels (denoting, say, part-of-speech and semantic information)

Weka 3:
Data Mining Software in Java

- http://www.cs.waikato.ac.nz/~ml/weka/
- "Weka is a collection of machine learning algorithms for data mining tasks. The algorithms can either be applied directly to a dataset or called from your own Java code. Weka contains tools for data pre-processing, classification, regression, clustering, association rules, and visualization. It is also well-suited for developing new machine learning schemes."
- Has a GUI
- Extensive documentation
- Website lists a number of compatible datasets (regression and classification problems)
- Also lists many Weka-related projects

CLUTO

- http://www-users.cs.umn.edu/~karypis/cluto/
- "a software package for clustering low- and high-dimensional datasets and for analyzing the characteristics of the various clusters"
- Partitional, agglomerative and graph-partitioning algorithms
- Various similarity/distance metrics
- Many options/tools for visualizing and summarizing clustering results
- Claims to scale to hundreds of thousands of objects in tens of thousands of dimensions
- wCluto: web-based application built on CLUTO
- gCluto: cross-platform graphical application

MG4J: *Managing Gigabytes* for Java

- http://mg4j.dsi.unimi.it/
- "a collaborative effort aimed at providing a free Java implementation of inverted-index compression techniques; as a by-product, it offers several general-purpose optimised classes, including fast & compact mutable strings, bit-level I/O, fast unsynchronised buffered streams, (possibly signed) minimal perfect hashing for very large strings collections, etc."

Crawlers

- UbiCrawler
  - http://ubi.imc.pi.cnr.it/projects/ubicrawler/
  - Not available publicly, but “upon agreement with the authors for scientific purposes.”
  - Primary advantage: “a very effective assignment function (based on consistent hashing) for partitioning the domain to crawl”
- Teg Grenager’s crawler
  - See the links on the projects page of the course website
  - Easily extensible

TiMBL

- Tilburg Memory Based Learner
- http://ilk.kub.nl/software.html
- Nearest-neighbor classification software with lots of options:
  - k
  - voting scheme
  - feature weighting
  - optimizations
  - built-in leave-one-out testing and cross-fold validation

Stanford WebBase (more info)

- http://www-diglib.stanford.edu/~testbed/doc2/WebBase/
- Kayur Patel will supply a Java client to the WebBase data. It should be available by next Tuesday
- WebBase provides the source for a client written in C

More links than you can shake a stick at

- http://nlp.stanford.edu/links/statnlp.html
- Many options for all kinds of different NLP tools and tasks:
  - POS taggers
  - Probabilistic parsers
  - Named entity recognition
  - NP chunking
  - Information extraction/wrapper induction
  - Word sense disambiguation
  - Lots of datasets/corpora

Reminder: pubcrawl

- SULinux server
- Terabytes of disk space
- MySQL
- Tomcat upon request
- Email us if you want access

Tutorial on basic skills/tools

- http://www.stanford.edu/class/cs276b/2003/project_tools.html
- Provides basic instructions for using Java and some of its key packages, Ant, CVS, MySQL, Lucene, Tomcat, etc.
- Mostly stuff that the majority of you already know, but definitely worth browsing through

More datasets

- Another place to look for data: /usr/class/cs276a/data1
  - …/dmoz
  - …/selected-linguistic-data
  - …/linguistic-data
    - This is a superset of the selected-linguistic-data directory, but you need permission to access it (we'll take care of this soon)
    - More information on the contents of this directory at http://www.stanford.edu/dept/linguistics/corpora/

Some more examples of projects from two years ago

Returning Multiple Pages as Individual Search Results

- Angrish and Malhotra
- Idea: Find a group of logically linked documents that collectively satisfy the user's information need
- Logical link could be any number of things. They defined two URLs as logically linked if:
  - one is a "subdirectory" of another, or
  - they are within N degrees of each other in the Web's link graph
- Compared their approach (multiple-page algorithm) to baseline (single-page algorithm) by having human subjects in various fields run queries and judge results
- MAX_LEVEL and MAX_LINK: parameters that they didn't vary but should have

Sentiment Identification Using Maximum Entropy Analysis of Movie Reviews

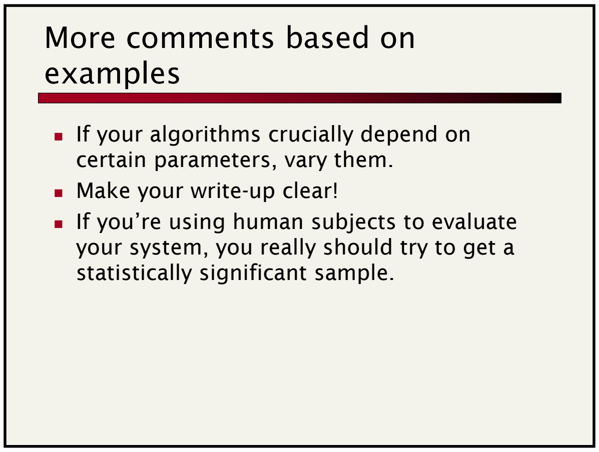
- Mehra, Khandelwal, and Patel
- Used movie reviews from rec.arts.movies.reviews
- Got people to rank their preferences for various movies on a website (but only had six users!)
- Implemented personalized classification: based on a user's movie preferences, used maximum entropy model to classify reviews to find ones that they would like…? I'm not even sure what they did.

News Meta-Search Across Multiple Languages

- Patel
- Built "Global Reporter" system that tried to implement CLIR for news articles
- Used Babel Fish to translate both queries and articles
- Evaluation: six users issued nine queries each using a) English-only and b) multi-language and judged relevance of results

Parametric Search Using In-memory Auxiliary Index

- Verman and Ravela
- Problem: traditional parametric search is slow because of disk accesses necessitated by frequent database reads
- Solution: since metadata is relatively small compared to corpus itself, store in main memory
- Used Lucene, MySQL, Citeseer Postscript docs with associated metadata



More comments based on examples

- If your algorithms crucially depend on certain parameters, vary them.
- Make your write-up clear!
- If you're using human subjects to evaluate your system, you really should try to get a statistically significant sample.