Summary Statistics II

Introduction to Recommender Systems

Introduction

- Last 2 lectures:
  - how to collect data
  - what we present to users
- This lecture: how to do it
  - what predictions to show
  - how to rank

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Learning Objectives

- Understand several ways of computing and displaying predictions
- Understand how to rank items with sparse, time-shifting data
- Understand several points in the design space for prediction and recommendation, and some of their tradeoffs

Overview

- Example
- Displaying Aggregate Preferences (*predict*)
- Ranking Items (*recommend*)

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Overview

- **Example**
- Displaying Aggregate Preferences (*predict*)
- Ranking Items (*recommend*)

Example - Reddit

- Social news aggregator
- Non-personalized news recommender
- Users vote on items to determine top item

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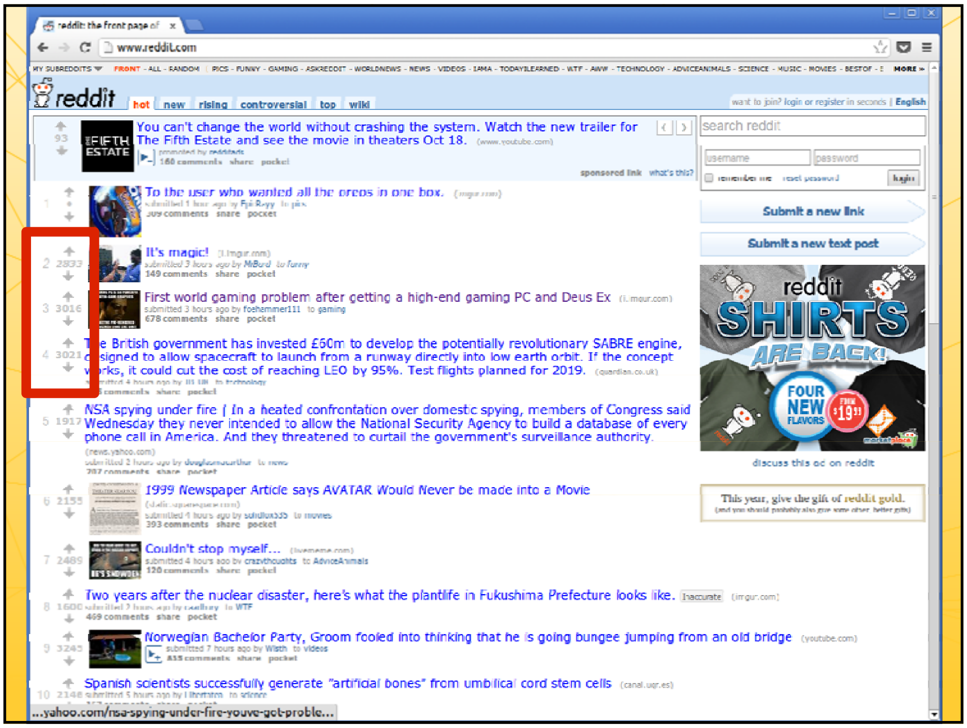
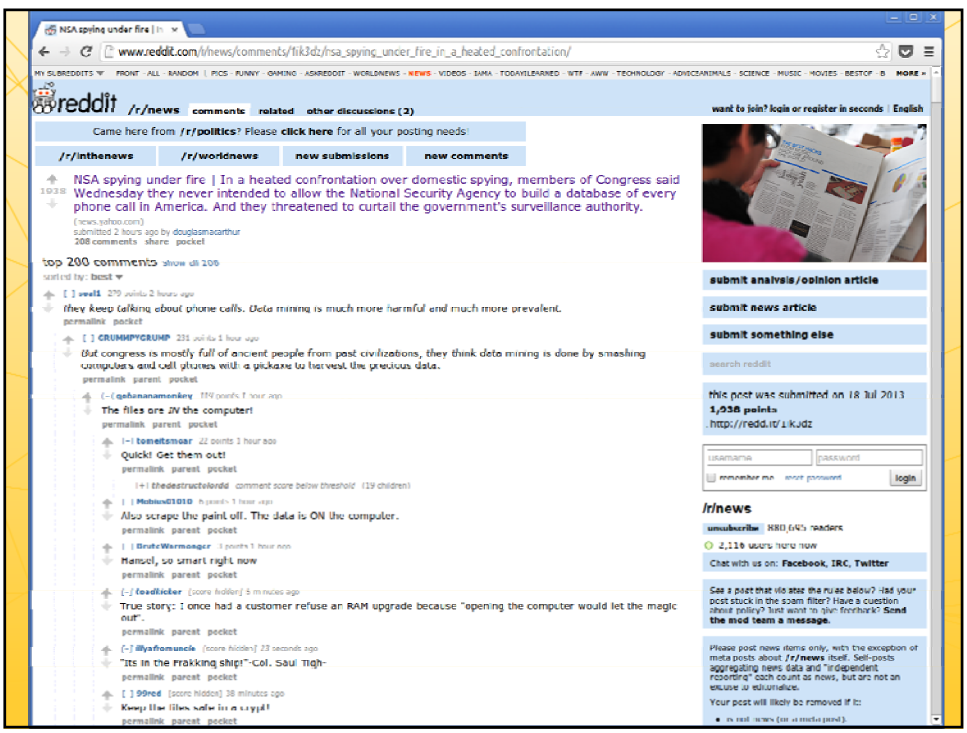

www.reddit.com
reddit
hot
new
rising
controversial
top
wiki
You can't change the world without crashing the system. Watch the new trailer for The Fifth Estate and see the movie in theaters Oct 18.
To the user who wanted all the dreos in one box.
It's magic!
First world gaming problem after getting a high-end gaming PC and Deus Ex
The British government has invested £60m to develop the potentially revolutionary SABRE engine, designed to allow spacecraft to launch from a runway directly into low earth orbit. If the concept works, it could cut the cost of reaching LEO by 95%. Test flights planned for 2019.
NSA spying under fire | In a heated confrontation over domestic spying, members of Congress said Wednesday they never intended to allow the National Security Agency to build a database of every phone call in America. And they threatened to curtail the government's surveillance authority.
1999 Newspaper Article says AVATAR Would Never be made into a Movie
Couldn't stop myself...
Two years after the nuclear disaster, here's what the plantlife in Fukushima Prefecture looks like.
Norwegian Bachelor Party, Groom fooled into thinking that he is going bungee jumping from an old bridge
Spanish scientists successfully generate "artificial bones" from umbilical cord stem cells
Submit a new link
Submit a new text post
reddit
SHIRTS
ARE BACK!
FOUR NEW FLAVORS
discuss this ad on reddit
This year, give the gift of reddit gold.


www.reddit.com/r/news/comments/1ik3dz/nsa_spying_under_fire_in_a_heated_confrontation/
reddit
/r/news
comments
related
other discussions (2)
want to join? login or register in seconds | English
Came here from /r/politics? Please click here for all your posting needs!
/r/inthenews
/r/worldnews
new submissions
new comments
NSA spying under fire | In a heated confrontation over domestic spying, members of Congress said Wednesday they never intended to allow the National Security Agency to build a database of every phone call in America. And they threatened to curtail the government's surveillance authority.
top 200 comments
They keep talking about phone calls. Data mining is much more harmful and much more prevalent.
But congress is mostly full of ancient people from past civilizations, they think data mining is done by smashing computers and cell phones with a pickaxe to harvest the precious data.
The files are IN the computer!
Quick! Get them out!
Also scrape the paint off. The data is ON the computer.
Hansel, so smart right now
True story: I once had a customer refuse an RAM upgrade because "opening the computer would let the magic out".
"Its in the Frakking ship!" -Col. Saul Tigh-
Keep the files safe in a crypt!
submit analysis/opinion article
submit news article
submit something else
this post was submitted on 18 Jul 2013
1,938 points
/r/news
Chat with us on: Facebook, IRC, Twitter

Overview

- Example
- **Displaying Aggregate Preferences (*predict*)**
- Ranking Items (*recommend*)

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Simple Display Approaches

- Average rating / upvote proportion
- Net upvotes / # of likes
- % >= 4 stars ('positive')
- Full distribution

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Goal of Display

To help users decide to buy/read/view the item.

Simple Display Approaches (again)

- Average rating / upvote proportion
  - Of people who vote, do they like it?
  - Doesn't show popularity
- Net upvotes / # of likes
  - Shows popularity
  - No controversy
- % >= 4 stars (‘positive’)
- Full distribution
  - Complicated

Example: Amazon.com

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Reddit

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Overview

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Ranking

- What do you put at the top of Reddit?
- What is at the top of the e-Bay search list?
- You don't have to rank by prediction

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Why not rank by score?

- Too little data (one 5-star rating)
- Score may be multivariate (histogram)
- Domain or business considerations
  - Item is old
  - Item is 'unfavored'

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Ranking Considerations

- Confidence
  - How confident are we that this item is good?
- Risk tolerance
  - High-risk, high-reward
  - Conservative recommendation
- Domain and business considerations
  - Age
  - System goals

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Damped means

- Problem: low confidence w/ few ratings
- Solution: assume that, without evidence, everything is average
- Ratings are evidence of non-averageness
- *k* controls strength of evidence required

$$\frac{\sum_u r_{ui} + k\mu}{n + k}$$

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设k=5时，
5个4分，5个5分
则n=10，
Sum=20+25=45
最后得到
(45+5*3)/(10+5)=4

Confidence Intervals

- From the reading: lower bound of statistical confidence interval (95%)
- Choice of bound affects risk/confidence
  - Lower bound is conservative: be sure it's good
  - Upper bound is risky: there's a chance of amazing
- Reddit uses Wilson interval (for binomial) to rank comments

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Domain Consideration: Time

- Reddit: old stories aren't interesting
  - even if they have many upvotes!
- eBay: items have short lifetimes

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Scoring news stories

Originally,
alpha=0.8
gamma=1.8
P is the penalty/priority for each news

- Hacker News
-
-
-

$$\frac{(U - D - 1)^{\alpha}}{(t_{\text{now}} - t_{\text{post}})^{\gamma}} \times P$$

- Net upvotes, polynomially decayed by age
- Old items scored mostly by vote
- Multiplied by item penalty terms
  - incorporate community goals into score

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https://medium.com/hacking-and-gonzo/how-reddit-ranking-algorithms-work-ef111e33d0d9

Reddit algorithm (c. 2010)

$$log_{10} max(1, |U - D|) + \frac{sign(U - D) t_{post}}{45000}$$

- Log term applied to votes
  - decrease marginal value of later votes
- Time is seconds since Reddit epoch
- Buries items with negative votes
- Time vs. vote impact independent of age
- Scores news items, not comments

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Ranking Wrap-Up

- There are some theoretically grounded approaches (confidence interval, damping)
- Many sites use ad-hoc methods
- Most formulas have constants, will be highly service-dependent
- Can manipulate for ‘good’ or ‘evil’
- Build based on domain properties, goals

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Predict with sophisticated score?

- Theoretically a fine thing to do
- Be careful with transparency/scrutability
  - If you say ‘average rating’ for damped mean, and show ratings, users may be confused
  - Most important case (low ratings) also easiest to hand-verify

Conclusion

- Sparsity, inconsistency, temporal concerns make data messy
- Simple scoring doesn't necessarily match the domain or business
- There are good ways to deal with this (decay, time, penalties, damping)
- We'll see more normalizations later

Summary Statistics II