

2-4: Scoring and Ranking

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

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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- **Example**
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Example - Reddit

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

reddit: the front page of x

www.reddit.com

MY SUBREDDITS FRONT ALL RANDOM PICS FUNNY GAMING ASKREDDIT WORLDNEWS NEWS VIDEOS IAMA TODAYILEARNED WTF AWW TECHNOLOGY ADVICEANIMALS SCIENCE MUSIC MOVIES BESTOF E MORE

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93 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. (www.youtube.com) promoted by redditads 160 comments share pocket sponsored link what's this?

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3 3016 First world gaming problem after getting a high-end gaming PC and Deus Ex (i.imgur.com) submitted 3 hours ago by foehammer111 to gaming 678 comments share pocket

4 3021 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. (guardian.co.uk) submitted 4 hours ago by JB_UK to technology 149 comments share pocket

5 1917 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. (news.yahoo.com) submitted 2 hours ago by douglasmacarthur to news 207 comments share pocket

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8 1600 Two years after the nuclear disaster, here's what the plantlife in Fukushima Prefecture looks like. Inaccurate (imgur.com) submitted 2 hours ago by caadbury to WTF 469 comments share pocket

9 3245 Norwegian Bachelor Party, Groom fooled into thinking that he is going bungee jumping from an old bridge (youtube.com) submitted 7 hours ago by Wisth to videos 835 comments share pocket

10 2146 Spanish scientists successfully generate "artificial bones" from umbilical cord stem cells (canal.ugr.es) submitted 5 hours ago by Libertatea to science 153 comments share pocket

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1938

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.

(news.yahoo.com)

submitted 2 hours ago by [douglasmacarthur](#)

208 comments share pocket

top 200 comments [show all 208](#)sorted by: [best](#)[-] [soal1](#) 279 points 2 hours ago

They keep talking about phone calls. Data mining is much more harmful and much more prevalent.

[permalink](#) [pocket](#)[-] [GRUMMPYGRUMP](#) 231 points 1 hour ago

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.

[permalink](#) [parent](#) [pocket](#)[-] [gobananamonkey](#) 119 points 1 hour agoThe files are *IN* the computer![permalink](#) [parent](#) [pocket](#)[-] [tomeitsmoar](#) 22 points 1 hour ago

Quick! Get them out!

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Also scrape the paint off. The data is ON the computer.

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Hansel, so smart right now

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True story: I once had a customer refuse an RAM upgrade because "opening the computer would let the magic out".

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"Its in the Frakking ship!"-Col. Saul Tigh-

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Keep the files safe in a crypt!

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this post was submitted on 18 Jul 2013

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Your post will likely be removed if it:

- is not news (or a meta post).

Overview

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- **Displaying Aggregate Preferences (*predict*)**
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Simple Display Approaches

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

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


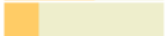
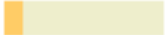

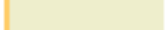
Example: Amazon.com

Canon PowerShot A2300 16.0 MP Digital Camera with 5x Di Wide-Angle Lens with 720p HD Video Recording (Red)

by [Canon](#)

★★★★☆ ☒ (135 customer reviews)

4.2 out of 5 stars

5 star:		(78)
4 star:		(29)
3 star:		(17)
2 star:		(5)
1 star:		(6)

[See all 135 reviews](#)

“ It is easy to use and takes great pictures and video. ”

Marc Jaffrey | 39 reviewers made a similar statement

“ I highly recommend it for other point-and-shooters as well. ”

Troldilocks | 12 reviewers made a similar statement

“ It easily fits in my purse or pocket for easy carrying. ”

Lois | 14 reviewers made a similar statement

Reddit

- 4  3021  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. (guardian.co.uk)
submitted 4 hours ago by JB_UK to technology
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- 5  1917  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.
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393 comments share pocket

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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

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’

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

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

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

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

Domain Consideration: Time

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

Scoring news stories

- 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

Reddit algorithm (c. 2010)

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

- 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

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

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

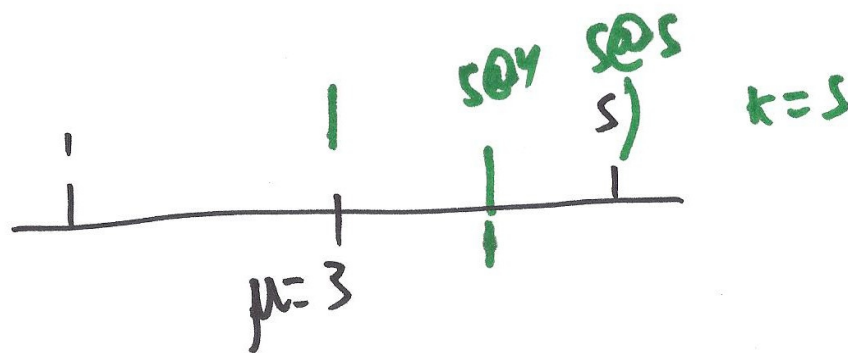
Conclusion

- 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

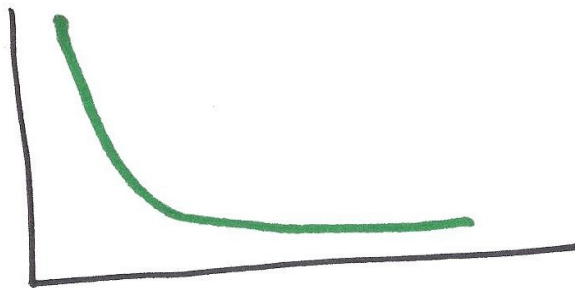
2-4: Scoring, Ranking, and Normalization

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

\mathbb{L} strength required



$$\frac{\overbrace{(U-D-1)^{\alpha=0.8}}^{\text{net upvotes}}}{\underbrace{(t_{\text{now}} - t_{\text{post}})^{r=1.8}}_{\text{Lage}}} \cdot \underline{P}$$



$$\log_{10} \max(1, \underline{|u-D|}) + \frac{\text{sign}(u-D) \tau_{\text{post}}}{45,000}$$

Pred.

$$P_{a,i} = \frac{\sum_{u=1}^n r_{u,i}}{n}$$

↑ ↑
User item
a i

← ratings

$$P_{a,i} = \bar{r}_i + \frac{\sum_{u=1}^n (r_{u,i} - \bar{r}_u)}{n}$$

$$P_{a,i} = \frac{\sum_{u=1}^n r_{u,i} \cdot w_{a,u}}{\sum_{u=1}^n w_{a,u}}$$

$$P_{a,i} = \bar{r}_a + \frac{\sum_{v=1}^n (r_{v,i} - \bar{r}_v) * \textcircled{w_{a,v}}}{\sum_{v=1}^n w_{a,v}}$$

similarity
predictive-
ness

$$w_{a,v} = \frac{\sum_{i=1}^m (r_{a,i} - \bar{r}_a)(r_{v,i} - \bar{r}_v)}{\sigma_a \sigma_v}$$

- m small?
- unary?

top-n?