http://poloclub.gatech.edu/cse6242

CSE6242 / CX4242: Data & Visual Analytics

Data Mining Concepts

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Partly based on materials by

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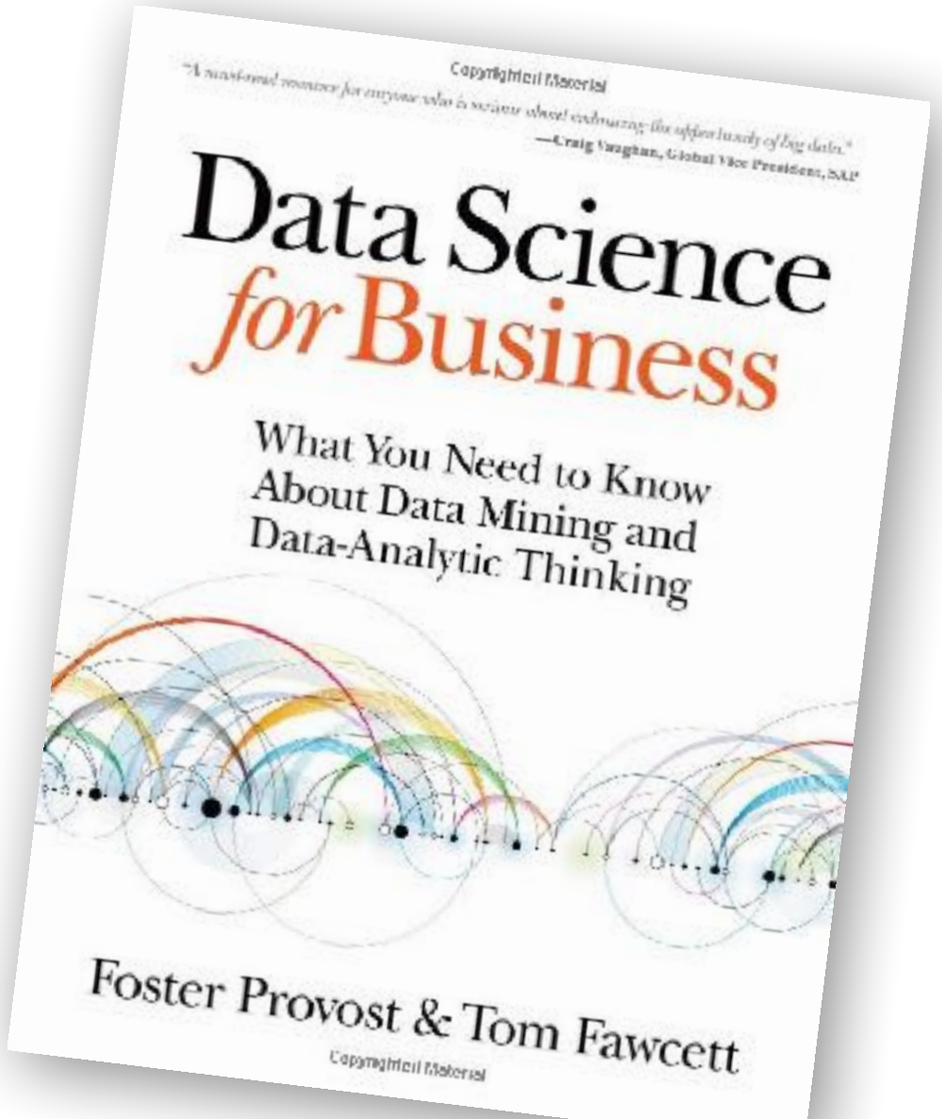
A critical skill in data science is the ability to decompose a data-analytics problem into pieces such that each piece matches a known task for which tools are available. Recognizing familiar problems and their solutions avoids wasting time and resources reinventing the wheel. It also allows people to focus attention on more interesting parts of the process that require human involvement—parts that have not been automated, so human creativity and intelligence must come into play.



http://www.amazon.com/Data-Science-Business-data-analytic-thinking/dp/1449361323

1. Classification

(or Probability Estimation)

Predict which of a (small) set of classes an entity belong to.

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- email spam (y, n)
- sentiment analysis (+, -, neutral)
- news (politics, sports, …)
- medical diagnosis (cancer or not)
- shirt size (s, m, l)
- face/cat detection
    - face detection (baby, middle-aged, etc)
- buy /not buy - commerce
- fraud detection
- census: gender

2. Regression (“value estimation”)

Predict the **numerical value** of some variable for an entity.

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Predict the **numerical value** of some variable for an entity.

- point value of wine (50-100)
- credit score (start with classification; default or not)
- stock prices — wall street
- relationship between price and sales
- weather
- sports and game scores

3. Similarity Matching

Find similar entities (from a large dataset) based on what we know about them.

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- recommending items you may want to buy
- find similar gene sequences (that may be repeating, or does similar things)
- online dating
- building auditing (energy consumption)
- patent search
- carpool matching (find people to carpool)
- detecting fake identities

4. Clustering (unsupervised learning)

Group entities together by their similarity. (For most algorithms, user provides # of clusters)

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Group entities together by their similarity.

- groupings of similar bugs in code
- topical analysis (tweets?)
- land cover: tree/road/…
- for advertising: grouping users for marketing purposes
- cluster people by accents (y’all, you all)
- ~=dimensionality reduction

5. Co-occurrence grouping

(Many names: frequent itemset mining, association rule discovery, market-basket analysis)

Find associations between entities based on transactions that involve them

(e.g., bread and milk often bought together)

How Target Figured Out A Teen Girl Was Pregnant Before Her Father Did

http://www.forbes.com/sites/kashmirhill/2012/02/16/how-target-figured-out-a-teen-girl-was-pregnant-before-her-father-did/

6. Profiling / Pattern Mining / Anomaly Detection (unsupervised)

Characterize **typical** behaviors of an entity (person, computer router, etc.) so you can find **trends** and **outliers**.

Examples?
computer instruction prediction
removing noise from experiment (data cleaning)
detect anomalies in network traffic
moneyball
weather anomalies (e.g., big storm)
google sign-in (alert)
smart security camera
embezzlement
trending articles

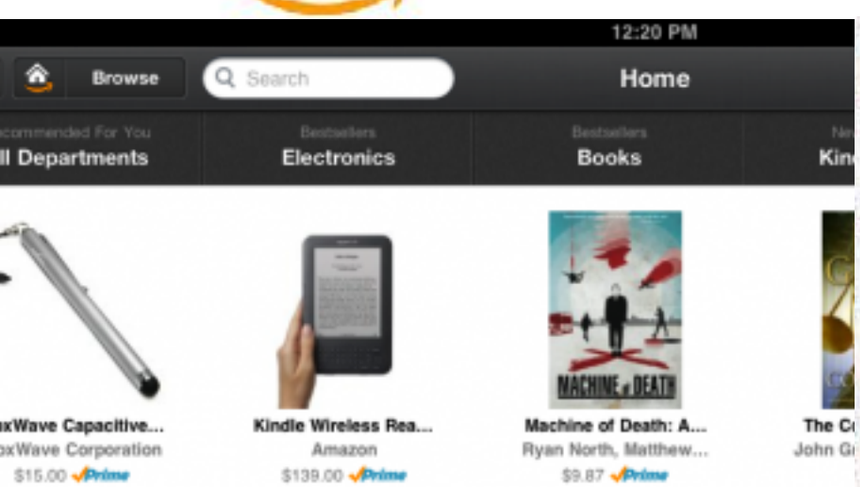
7. Link Prediction / Recommendation

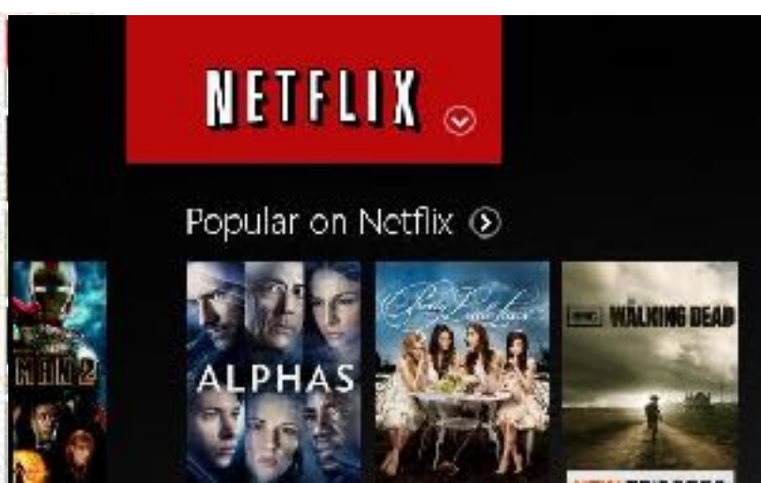
Predict if two entities should be connected, and how strongly that link should be.

linkedin/facebook: people you may know

amazon/netflix: because you like terminator…

suggest other movies you may also like





8. Data reduction (“dimensionality reduction”)

Shrink a large dataset into smaller one, with as little loss of information as possible

1. if you want to visualize the data (in 2D/3D)
2. faster computation/less storage
3. reduce noise

Start Thinking About Project!

- What problems do you want to solve?
- Using what (large) datasets?
- What techniques do you need?