FYS: AI in Healthcare

Unsupervised Learning

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October 2, 2018

Admin

- Assignment 3 followup

Admin

- Assignment 3 followup
- Assignment 5
    - Junior Year Writing crossover
    - Due 10/14/18 at 11:59pm (*Sunday*)

Unsupervised learning

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Used when your data is not labeled

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Two types

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- Clustering
    - group data together by some similarity metric

Unsupervised learning

Used when your data is not labeled

Two types

- Clustering
  - group data together by some similarity metric
- Dimensionality reduction
  - high dimension data → low dimension data

Today

Clustering

- k-means
- Hierarchical clustering
- Topic modeling

k-means clustering

Algorithm

- Initialize the k means
- Until convergence:
    - Assign data to clusters based on the closest mean (Euclidean distance)
    - Recalculate means using cluster assignments

k-means demo

https://www.naftaliharris.com/blog/visualizing-k-means-clustering/

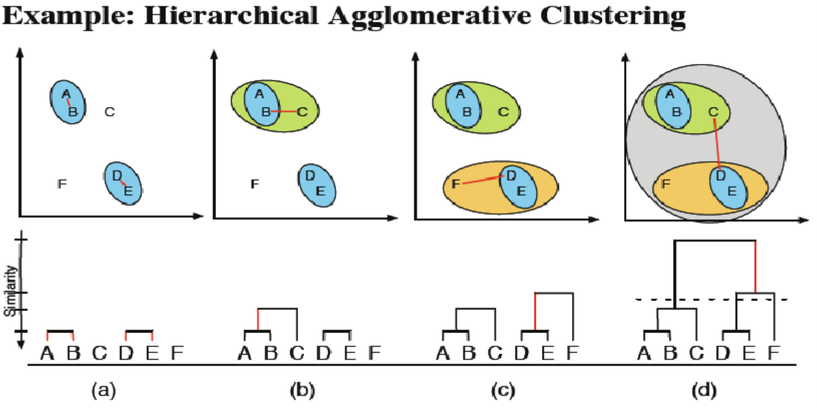
Hierarchical clustering

Two types: bottom-up (“agglomerative”) and top-down (“divisive”)

Janssen, Peter et al. Cluster analysis to understand socio-ecological systems: a guideline.

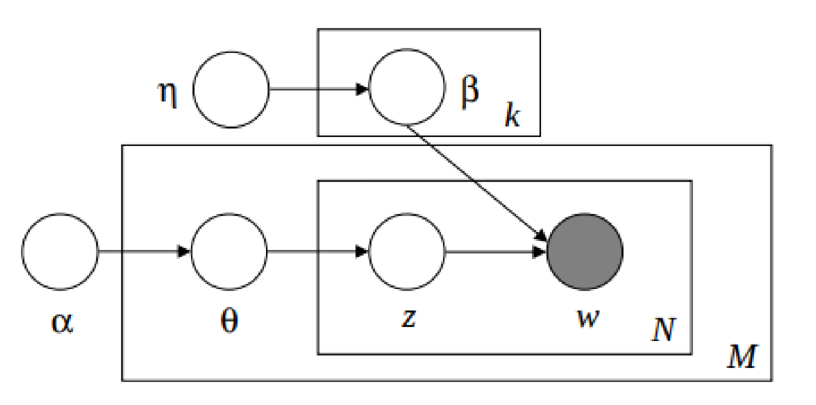
Hierarchical clustering

Two types: bottom-up ("agglomerative") and top-down ("divisive")



Janssen, Peter et al. Cluster analysis to understand socio-ecological systems: a guideline.

Topic modeling



Topic modeling

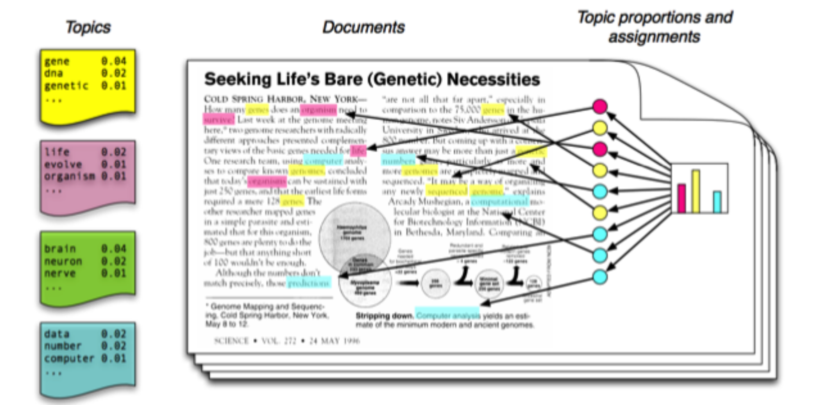


Figure source: Blei, D. M. (2012). Probabilistic topic models. *Communications of the ACM*, *55*(4), 77-84.

Next week

Dimensionality reduction

Activity: Nearest Neighbors

Warm-up

Training set: 1, 7, 13

Test set: 3, 17

$k = 1$

Round 1

Training set: 1, 2

Test set: 14, 16

$k = 1$

Round 1

Training set: 1, 2

Test set: 14, 16

$k = 1$

Training data is important

Round 2

Training set: 5, 15

Test set: 4, 12

$k = 2$

Round 2

Training set: 5, 15

Test set: 4, 12

$k = 2$

Use an odd $\#$ of neighbors

Round 3

Training set: 3

Test set: 13

$k = 1$

Round 3

Training set: 3

Test set: 13

$k = 1$

“Nearest” might not be very close

Round 4

Training set: 17

Test set: 7

$k = 1$

Round 4

Training set: 17

Test set: 7

$k = 1$

“Nearest” might not be very close

Round 5

Training set: 8, 10, 11, 12, 18

Test set: 9, 19

$k = 3$

Round 5

Training set: 8, 10, 11, 12, 18

Test set: 9, 19

$k = 3$

KNN is slow at test time

Round 6

Training set: 6

Test set: 7

$k = 1$

Round 6

Training set: 6

Test set: 7

$k = 1$

Be mindful of outliers!