Uptake Data Fellows Natural Language Processing Workshop

Hello! I'm Michael Miller Yoder

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What is natural language processing (NLP)?

Computational processing of human language.

Examples: machine translation, dialogue systems, question answering, speech recognition, search engines

Computational processing of human language.

Often involves applying machine learning techniques to text or speech data

Use case: free-text survey data

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Many questions are categorical (yes/no/maybe) or on a numerical scale. But others may be open text response ("please explain...")

Topic modeling

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Statistical models for finding "topics" that occur in a collection of documents.

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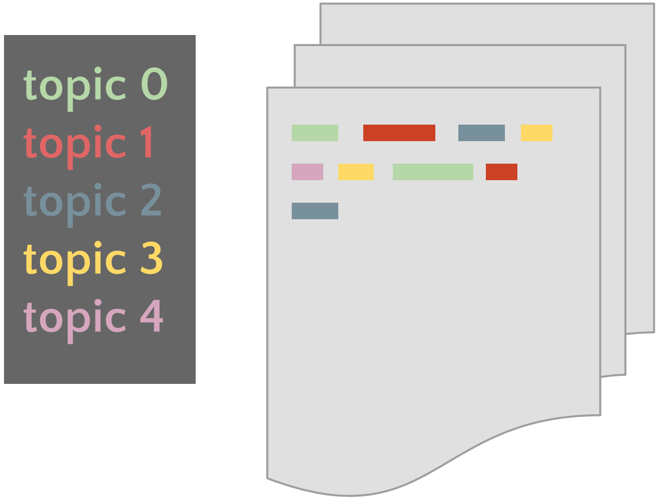
Statistical models for finding "topics" that occur in a collection of documents. Common approach is Latent Dirichlet Allocation (LDA) [Blei et al, 2003]

LDA (Latent Dirichlet Allocation)

- Unsupervised: no "true" topics

LDA (Latent Dirichlet Allocation)



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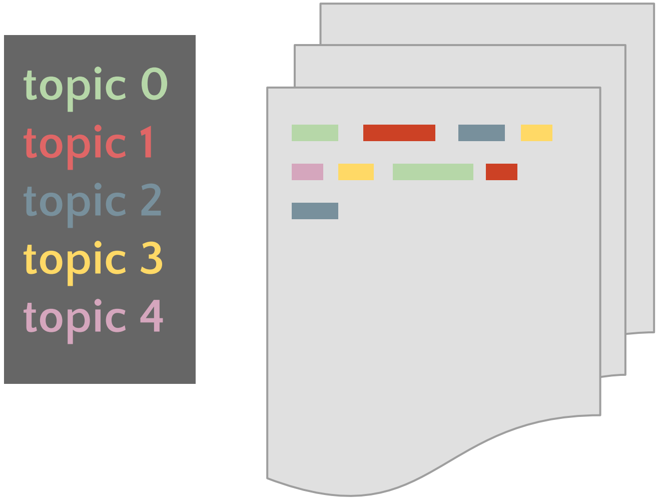
- Each document mixture of topics

LDA (Latent Dirichlet Allocation)



topic 0
topic 1
topic 2
topic 3
topic 4

- Unsupervised: no "true" topics
- Each document mixture of topics
- Each topic mixture of words

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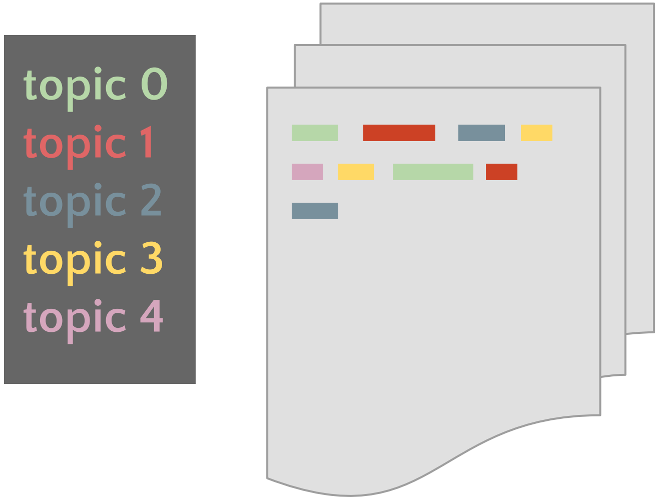

topic 0
topic 1
topic 2
topic 3
topic 4

- Unsupervised: no "true" topics
- Each document mixture of topics
- Each topic mixture of words
- Based on word co-occurrence

Exercise: topic modeling

tokenization

What is a word?
What words count?

Exercise: topic modeling

tokenization

What is a word?
What words count?

feature extraction

Words to numbers
(bag-of-words).

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LDA interpretation

Do some unsupervised ML! Play around, interpret results.

BIKE PGH!

Data:
Autonomous vehicle survey

Autonomous vehicle survey from cyclists and pedestrians

Context

Pittsburgh is a testing ground for AVs from Uber, ArgoAI and other companies.

Bike Pittsburgh

Bike Pittsburgh, bike and pedestrian advocacy organization, made an online survey in 2017 and 2019.

Download:

bit.ly/2EJ3kLv

Choose your environment

Python

Jupyter Notebook:

https://github.com/michaelmilleryoder/av-survey-topic-modeling/av-survey-topic-modeling_python.ipynb

R

Jupyter Notebook:

https://github.com/michaelmilleryoder/av-survey-topic-modeling/av-survey-topic-modeling_r.ipynb

Choose a text field

- interaction_details
- positive_av_interaction
- negative_av_interaction
- other_av_regulations
- elaborate_bikepgh_position
- other_comments

Workflow

- Tokenize: split into words
- Extract features: words to word IDs (bag-of-words model)
- Run LDA with varying numbers of topics
- Interpret topics
  - Look at high-ranking words for each topic
  - Look at high-ranking documents for each topic

…If you get to it

- Correlate topics with categorical and numerical fields
- Predict non-text fields with a machine learning algorithm such as logistic regression from topic distributions or text features
- Look into the Structural Topic Model (R package)

Thanks!

Any *questions* ?

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