objective

GENERAL GOAL

- Predict similar restaurants with Yelp reviews

TECH GOALS

- NLP preprocessing techniques
- Topic modeling with sentiment analysis
- Google Cloud Exposure
- Flask

DELIVERABLES

Build a usable flask web application that is:

- Given a restaurant as input
- Outputs similar restaurants in a another city

YELP! (I NEED SOMEBODY...)

USING MACHINE LEARNING TO RECOMMEND RESTAURANTS

AUGUST 2, 2019

THE TEAM

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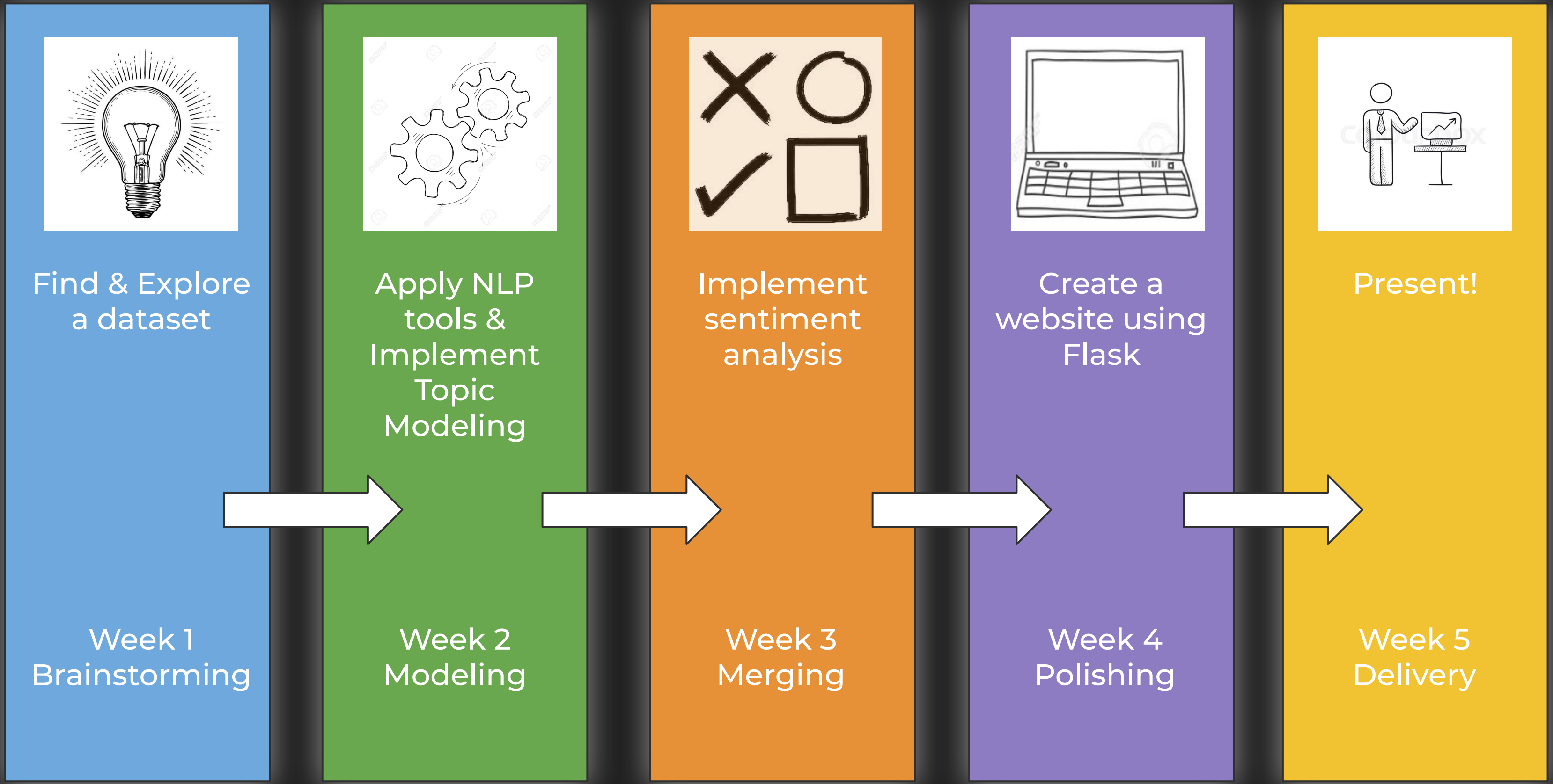
TIMELINE



Find & Explore a dataset

Week 1 Brainstorming

Apply NLP tools & Implement Topic Modeling

Week 2 Modeling

Implement sentiment analysis

Week 3 Merging

Create a website using Flask

Week 4 Polishing

Present!

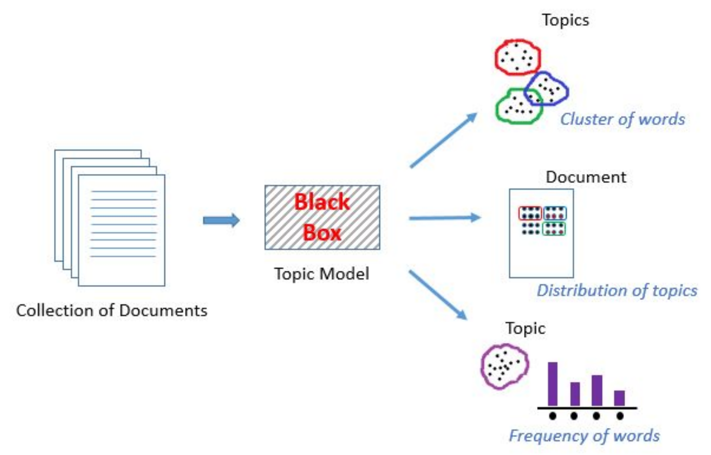
Week 5 Delivery

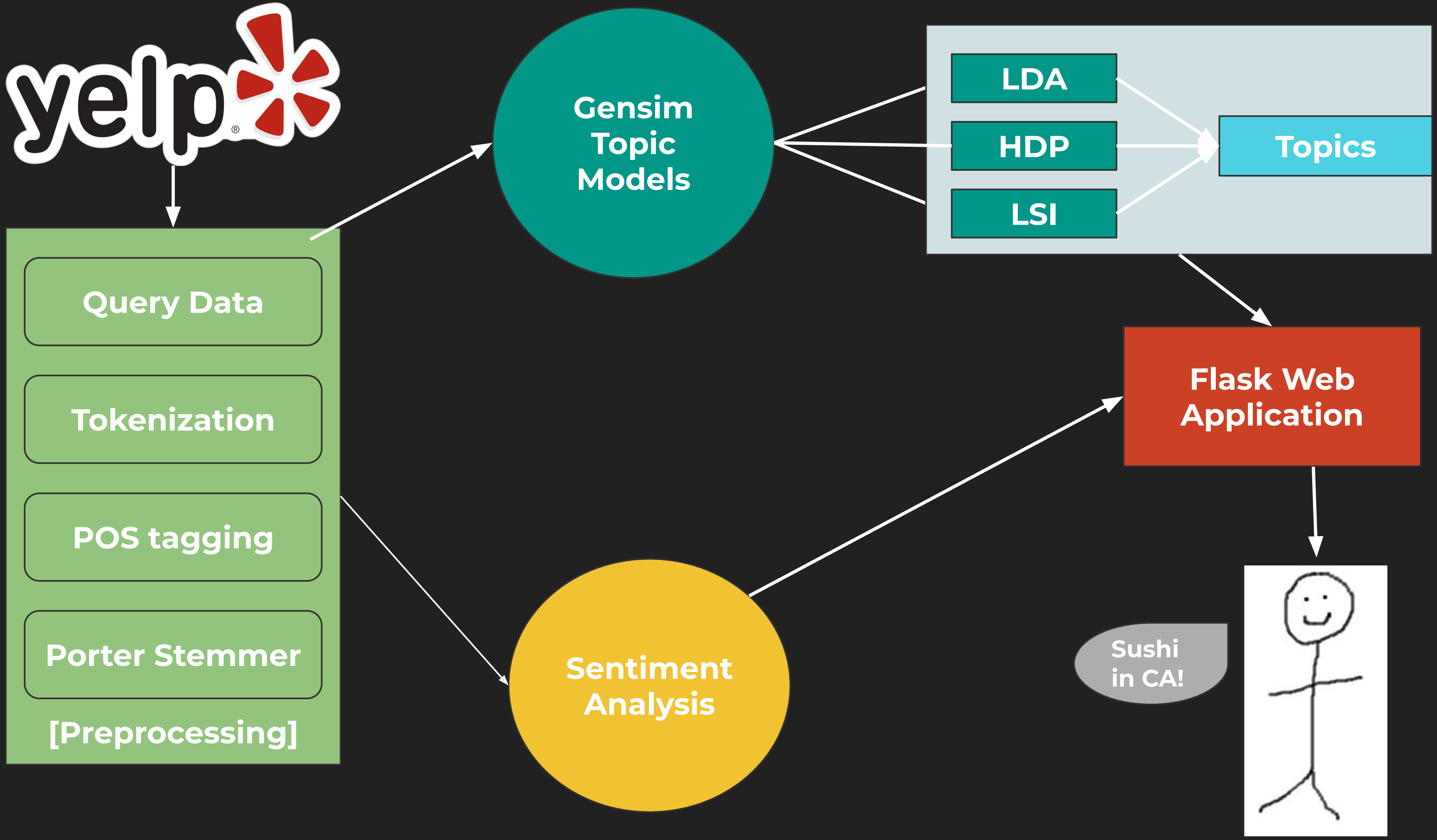
WHAT IS TOPIC MODELING?

- Traditional recommendation engines rely on defined categories

- Defined categories can be misleading, wrong, or uninformative

- Potential to uncover hidden similarities between reviews





Query Data

Tokenization

POS tagging

Porter Stemmer

[Preprocessing]

Gensim Topic Models

LDA

HDP

LSI

Topics

Sentiment Analysis

Flask Web Application

TOPIC MODELS

LDA (Latent Dirichlet Allocation)

HDP (Hierarchical Dirichlet Process)

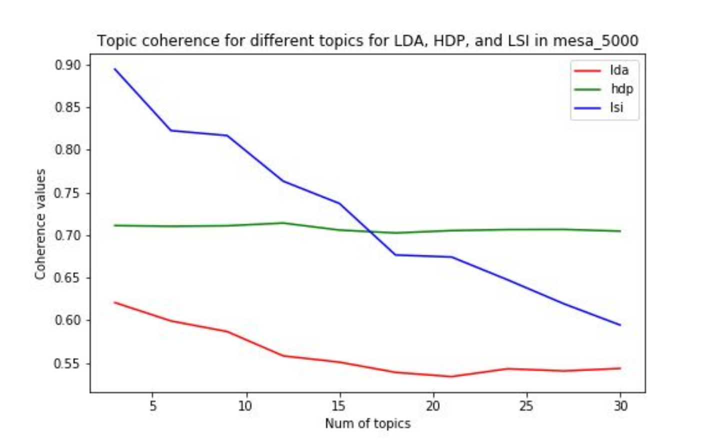
LSI (Latent Semantic Indexing)

TOPIC MODELS

- Parameter tuning
  - Number of topics
  - Number of words
  - Number of passes and iterations
- Trade-off: LSI and HDP outperforms LDA in topic coherence score BUT LDA is easier to visualize and interpret
- Similarity between two restaurants
  - KL divergence

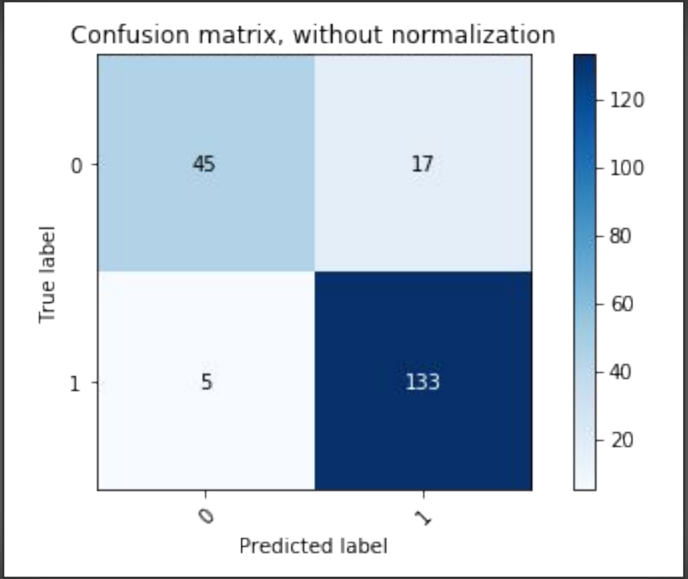
TOPIC MODELS

- Performance Metrics for topic models
    - Topic coherence score
    - Visualization
    - Manually compare results



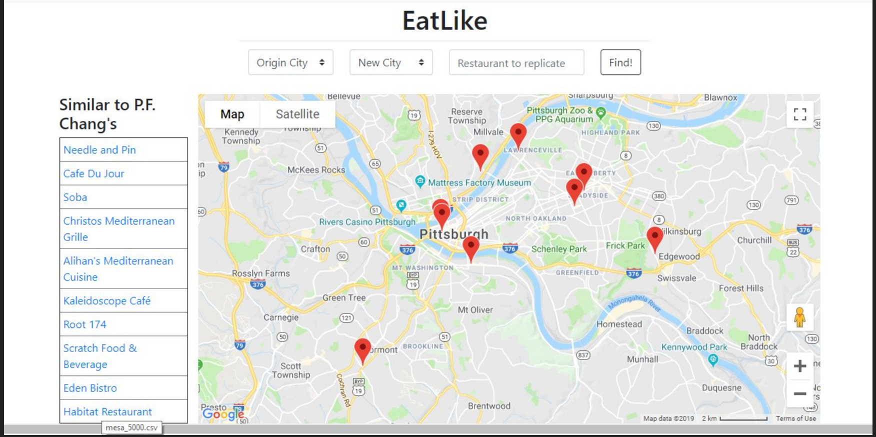
SENTIMENT ANALYSIS

- Sentence-level sentiment classification
- Uses Vader sentiment analyzer
- Extracts positive and negative sentences



RESULTS

- Topic Models
  - LDA model: 0.55 coherence score when num of topics = 6
  - HDP model: 0.7 coherence score when num of topics = 12
- Applied Sentiment Analysis
  - Precision: 88.6%
  - Recall: 96.4%
  - Accuracy: 89.0%
- Successful web app development



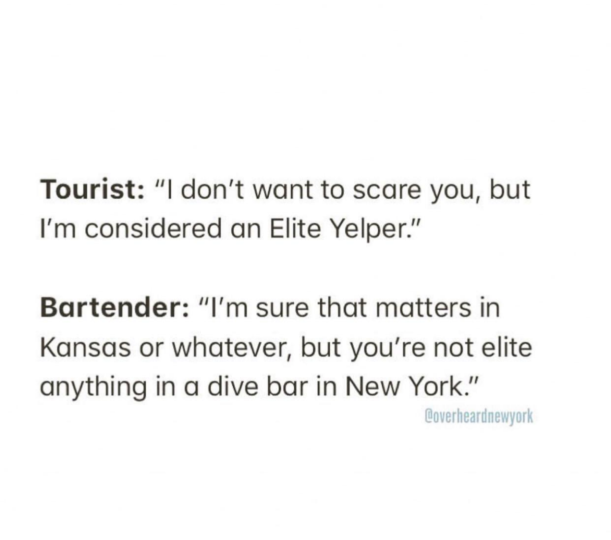
EatLike

Similar to P.F. Chang's

- Needle and Pin
- Cafe Du Jour
- Soba
- Christos Mediterranean Grille
- Alihan's Mediterranean Cuisine
- Kaleidoscope Café
- Root 174
- Scratch Food & Beverage
- Eden Bistro
- Habitat Restaurant

CHALLENGES

- Using an unsupervised model
- No real metric to evaluate results → deploy model
- Subject to human interpretation
- Finding good Yelp jokes and other words that rhyme with Yelp (besides “help”)



Tourist: “I don’t want to scare you, but I’m considered an Elite Yelper.”

Bartender: “I’m sure that matters in Kansas or whatever, but you’re not elite anything in a dive bar in New York.”

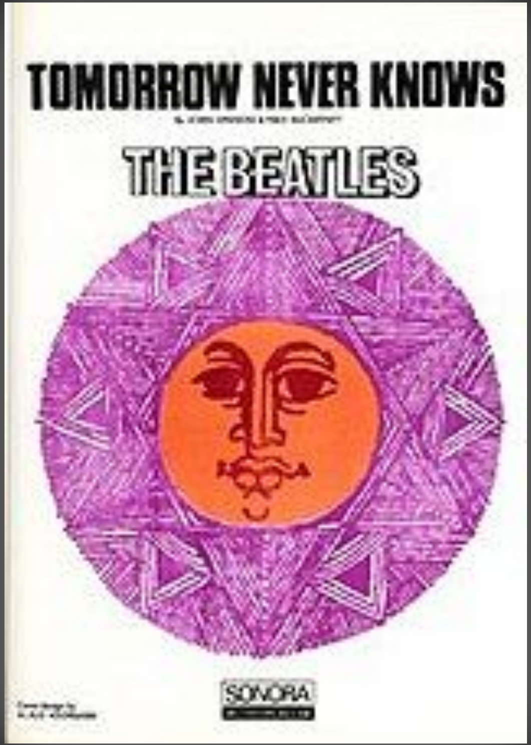
@overheardnewyork

ETHICS

- **Selection bias (non-response)**
  - Unbalanced representation of a restaurant’s ratings due to location
- **Implicit bias**
  - Linguistics (non-universal slang and/or phrases)
- **Group Attribution Bias**
  - Viewing ratings from friends or neighbors
  - Skewed inside/outside cultural preferences
- **Reporting Bias**
  - People only writing if they *really* did not like/liked a restaurant

NEXT STEPS AND FUTURE WORK

- Measure neighborhood development via restaurants
- Create a mobile app version
- Use more learning tools
  - Word cloud
- Use a database
- Deploy A/B testing
  - Showing variations of a page



THANK YOU!

yelp®

RESOURCES

SLDC Models- an overview: https://medium.com/existek/sdlc-models-explained-agile-waterfall-v-shaped-iterative-spiral-e3f012f390c5

What are Review Highlights?: https://www.yelp-support.com/article/What-are-Review-Highlights?l=en_US

An Exploratory Data Analysis (EDA) for Text Data:https://towardsdatascience.com/a-complete-exploratory-data-analysis-and-visualization-for-text-data-29fb1b96fb6a

Topic Modeling: https://www.machinelearningplus.com/nlp/topic-modeling-gensim-python/
https://www.analyticsvidhya.com/blog/2016/08/beginners-guide-to-topic-modeling-in-python/
https://www.kdnuggets.com/2016/07/text-mining-101-topic-modeling.html

Yelp Dataset Challenge Winner (sample):
https://www.yelp.com/html/pdf/YelpDatasetChallengeWinner_PersonalizingRatings.pdf?fbclid=IwAR292yTyZ4CV3zp3YVBEDeGzJ6RMszoBfGmiabGAM16JDirmBLA3vtKb_zw

Yelp Dataset Examples: https://github.com/Yelp/dataset-examples

Relevant Papers:
https://www.yelp.com/html/pdf/YelpDatasetChallengeWinner_PersonalizingRatings.pdf?fbclid=IwAR0ef70_Bn1qgoO7vCQhokeBrM8w1_6Vbqm5-7OMQOiek6-XS0p6504ZVI8

Interesting read on how Yelp data can impact others: https://www.hbs.edu/faculty/Publication%20Files/18-077_a0e9e3c7-eceb-4685-8d72-21e0f518b3f3.pdf

LDA and Document Similarity: https://www.kaggle.com/ktattan/lda-and-document-similarity

LDA Building a Missing Feature with Bars: https://towardsdatascience.com/using-lda-to-build-a-missing-yelp-feature-43436e575d65
Preprocessed Text: https://orange3-text.readthedocs.io/en/latest/widgets/preprocesstext.html

Sentiment Analysis and Applications: https://towardsdatascience.com/sentiment-analysis-concept-analysis-and-applications-6c94d6f58c17

Topic Modeling and Latent Dirichlet Allocation: https://towardsdatascience.com/topic-modeling-and-latent-dirichlet-allocation-in-python-9bf156893c24

Beatles font: https://fontmeme.com/the-beatles-font/

QUESTIONS?

- Team
- Timeline
- Machine Learning Diagram
- Why topic models
- Topic Models 1 2 3 4
- Sentiment Analysis
- Demo
- Results
- Challenges
- Ethics
- Next Steps & Future Work

We got by with a little yelp from our friends- the Scripps AMLI squad, Josh, Ju, David S., David B., Liza, Sidnie, Winston, Abel, and Shu. Thank you!!