Washington University in St. Louis
College of Arts & Sciences

Day 1 - Introduction

Introduction to Text Analysis in Python
TRIADS Training Series

Ishita Gopal

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Today

- Introduction
- Course Logistics
- Overview - Text Analysis
- Lab - String Manipulation

Software

- We will be using Python.
- Python materials will be in notebooks and is provided through Google Colab.
- Google Colab allows you to modify and run copies of the notebooks without worrying about installations on your own machines.
- FYI, Google Colab provides free access to GPU and TPU computing, although it is overkill for this course, and we will not be using it.

What we will cover

- Day 1: Overview of the goals and methods in text analysis, introduction to string manipulation.
- Day 2: NLP “pipelines”. General concepts and practical application of NLP labeling tasks like part-of-speech tagging, named entity recognition, Basics of bag-of-words (with emphasis on CountVectorizer).
- Day 3: Dictionary-based analysis (using tools like VADER), introduction to topic modeling methods (such as Latent Dirichlet Allocation or LDA)
- Day 4: Text classification (using Naïve Bayes)

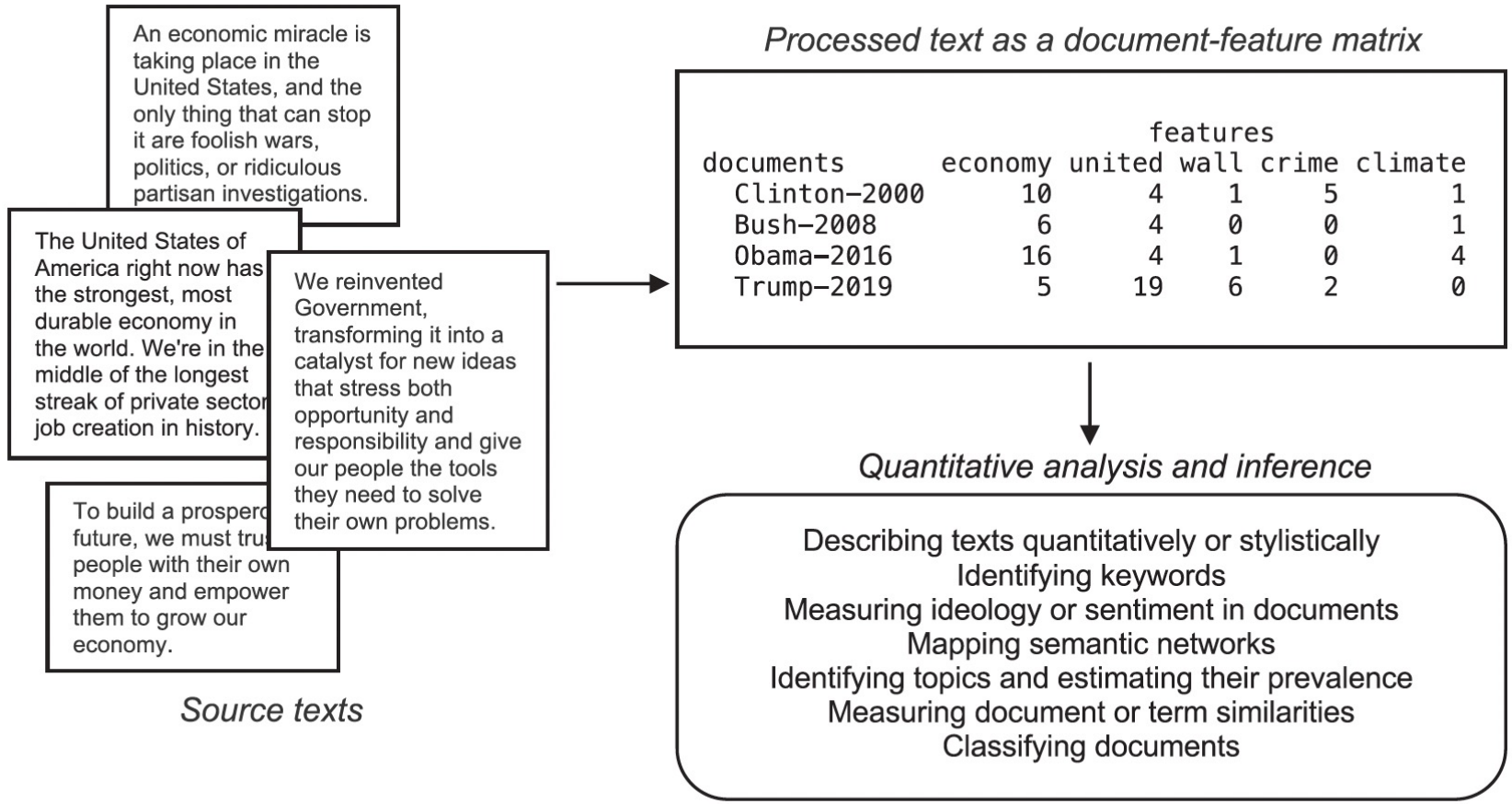


Figure 26.1 From text to data to data analysis

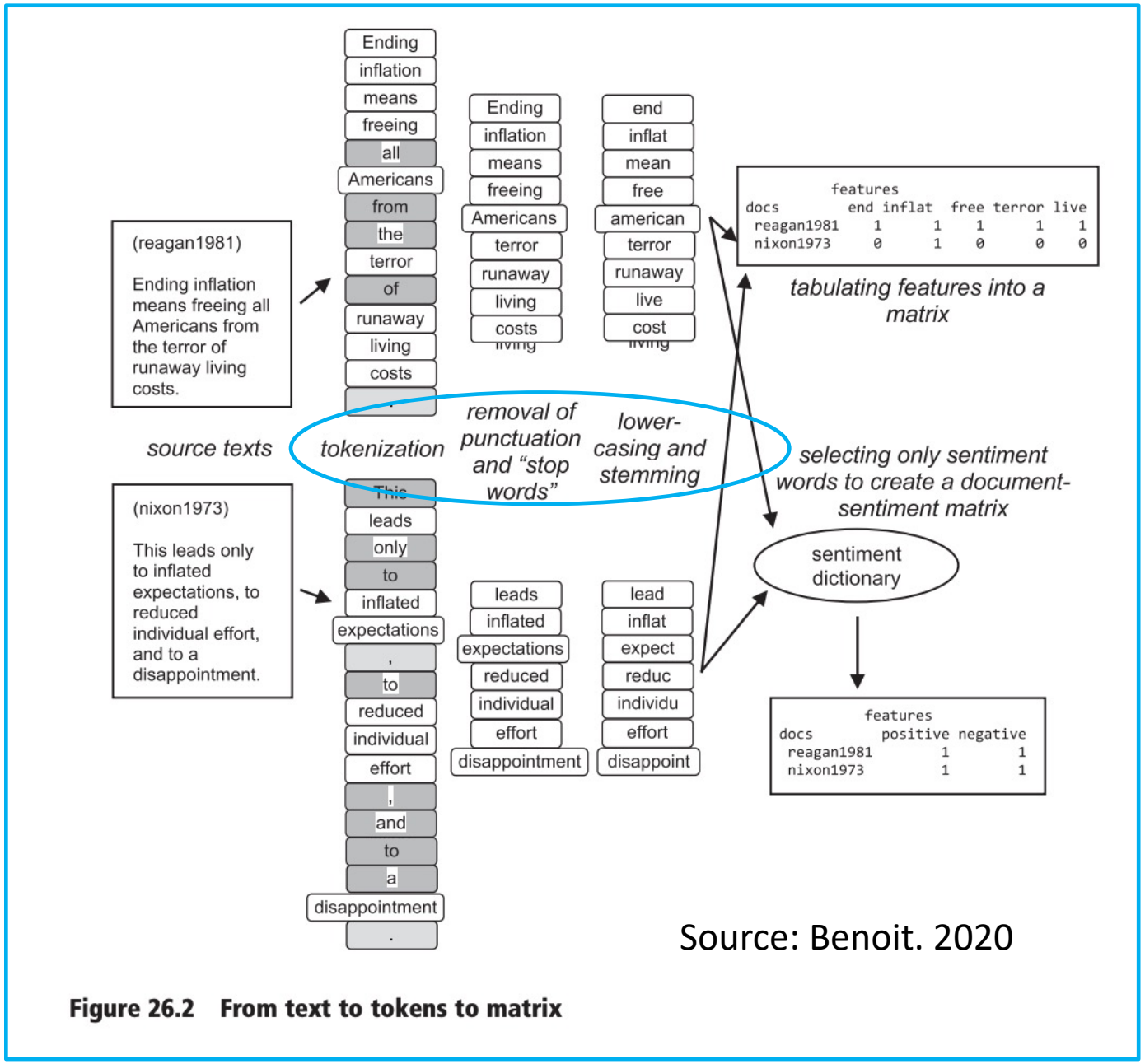
Source: Benoit. 2020

Typical text-as-data pipeline

(1) divides the text into the units we might care about,

(2) throws out some we're pretty sure we don't care about, and

(3) combines units that we're pretty sure should count as the same thing.



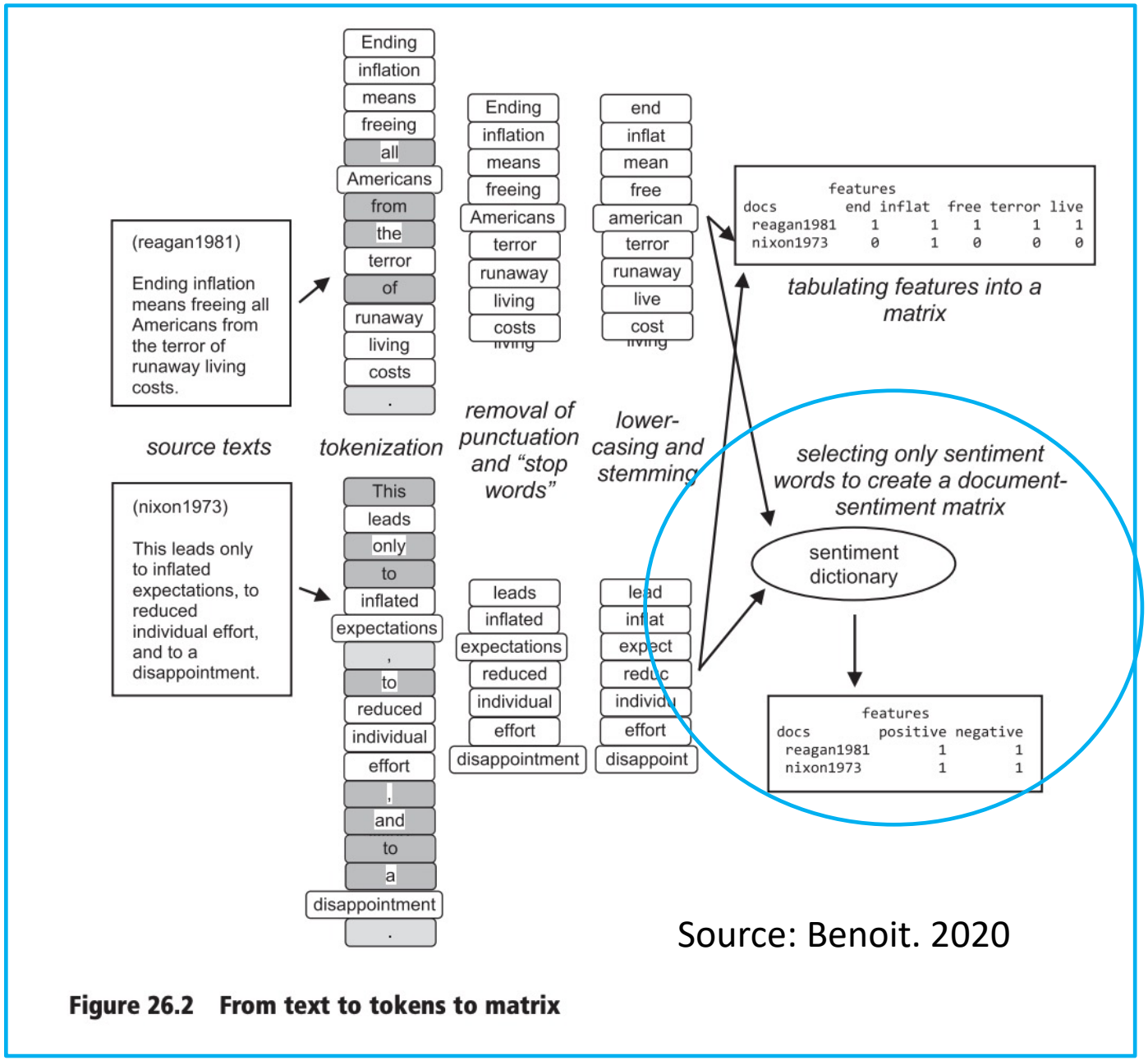
Source: Benoit. 2020

Figure 26.2 From text to tokens to matrix

Dictionary Methods

- Most basic - you have a list of words → have a dictionary that maps a predetermined category/score for each word → you have the computer count/add them up.

- Very popular approach to sentiment analysis.
  - VADER
  - LIWC
  - Lexicoder



Source: Benoit. 2020

Figure 26.2 From text to tokens to matrix

LIWC category	Example words
Positive emotions	Happy, pretty, good
Optimism	Ease, trust, hope
Negative emotions	Hate, worthless, enemy
Anxiety	Nervous, afraid, tense
Anger	Hate, kill, pissed
Sadness	Grief, cry, sad

Source: Settanni and Marengo. 2015

Supervised Learning - Classification

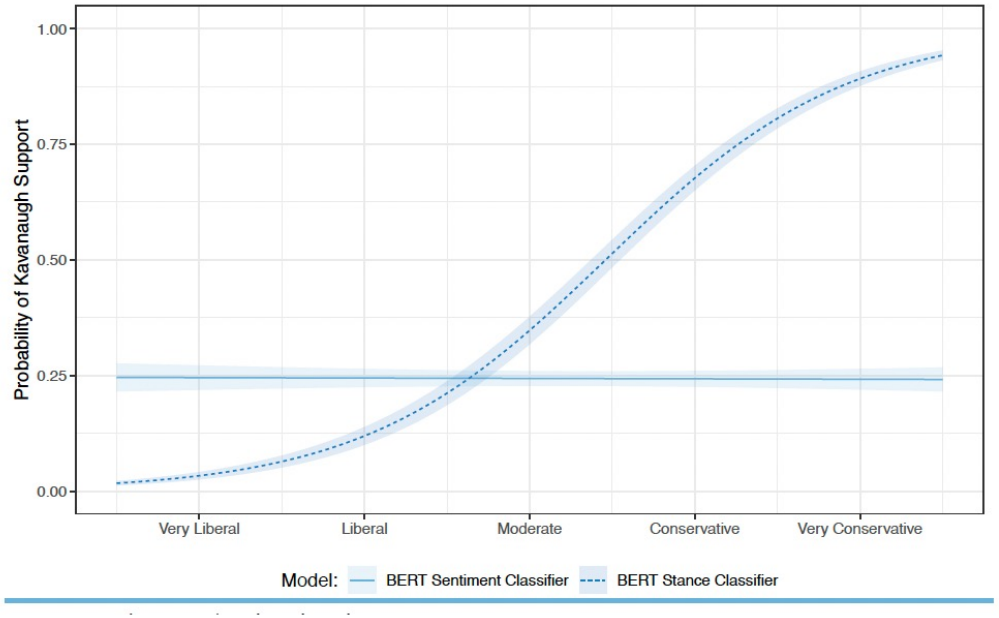
- We have labeled examples (documents) - training data.
- Input text (which can be a speech, tweet, email etc.) is paired with corresponding output labels (negative sentiment, mentions of COVID, identification as spam email).
- The task is to assign predefined categories or labels to input data.
- Much more flexible than dictionaries.

Table 6. Classifier Performance: Kavanaugh Tweets

Classifier	F1 Score (Predicting Sentiment)	F1 Score (Predicting Stance)
Lexicoder	0.788 (0.005)	0.572 (0.014)
VADER	0.754 (0.005)	0.514 (0.011)
SVM (sentiment-trained)	0.943 (0.003)	0.514 (0.012)
BERT (sentiment-trained)	0.954 (0.002)	0.582 (0.005)
SVM (stance-trained)		0.935 (0.006)
BERT (stance-trained)		0.938 (0.002)

Reported figures are the average F1 score over 5-fold cross validation
Standard Errors in parentheses

Figure 5. Predicting Kavanaugh Support from Ideology



Source: Bestvater and Monroe, 2020.

Sentiment refers to the emotional tone in a piece of text.
Stance relates to the author's position a topic.

In the article above, the authors classify 1) if the tweet was positive or negative 2) if the tweet supports or opposes Kavanaugh's confirmation.

	Positive sentiment	Negative sentiment
Approving stance	• #ConfirmKavanaugh this is a great man he will make a great Supreme Court judge • POWERFUL TESTIMONY of women that stand behind Brett Kavanaugh. Calling him Honorable with High Integrity, Family man, great friend and boss!	• The Republicans can certainly kiss the midterms goodbye if they blow this Kavanaugh confirmation • The sinister left will do absolutely anything to maintain power and attack conservatives ….Lie, cheat, delay. Whatever it takes. We absolutely cannot allow them to win. Confirm Kavanaugh!
	$N = 521$	$N = 1,467$
Opposing stance	• I hope she feels the love and support and the heartache that women feel in standing in solidarity with her • DR. FORD IS AN AMERICAN HERO	• Kavanaugh and the GOP have no idea of the power and anger they are unleashing • @SenateGOP withdraw Kavanaugh, you are just dragging yourselves, this country and Dr. Ford through the mud
	$N = 391$	$N = 1,281$
Total	$N = 3,660$	$r = 0.03$

Source: Bestvater and Monroe. 2020

Unsupervised Learning

- We don’t have labeled examples (documents) - no training data.
- This is often used as an exploratory / discovery exercise or for theory testing.
- Some of the main variants:
  - Clustering
  - Topic modeling
  - Word embeddings

Unsupervised Learning - Topic Modeling

- Unlike a classification problem, you don't have pre-defined categories.
- But one main output of a topic model is a measure of how words are associated with the topic.
- When a topic model really works well, the appropriate label is obvious.
- A model of speeches in the US Senate contained the topic to the right … what label would you give it?

school
teacher
educ
student
children
test
local
learn
district
class
account
classroom
achiev
teach
better

Table 4: *Key Words on* [redacted]

Today

Basics of String Manipulation in Python:

1. Define a string
2. Strings and lists
3. String Manipulation
   - Concatenate
   - Format
   - Split
4. Substring Matching
5. Regular Expressions (if there is time!)

- Google Colab notebook linked below: https://colab.research.google.com/drive/1RxcNLqLsAxl25CBdaRcdBtTFUKorCF1T?usp=sharing

- Workshop folder is here: https://github.com/IshitaGopal/TRIADS_workshops