Language Processing and Python

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What is this course about?

- Natural Language Processing (and the Python Toolkit)
- Computational Linguistics
- Dealing with language (which is messy)

What will you learn?

- How simple programs can help you manipulate and analyze language data, and how to write these programs
- How key concepts from text mining and linguistics are used to describe and analyze language
- How data structures and algorithms are used in text mining and NLP
- How language data is stored in standard formats, and how data can be used to evaluate the performance of NLP techniques

Syllabus

- You should read the syllabus for course policies and other important information.
- You will use Moodle for all course related activities.
- Let's check those things out now.

Writing

- You will be expected to write reports with code and text embedded.
- You will want to embed or otherwise cite your sources for material you are referencing.
- Please use APA style on how to citations (search Purdue OWL for tips).

What is NLP?

- Natural language processing
- Roots in computer science, artificial intelligence, and linguistics
- Focuses on human language and how to analyze language data
- What is language? How do we deal with such a messy construct?

Origins of NLP

- Turing Test - Intelligence (1950)
  - Chinese Room Thought Experiment by Searle (1980)
- Georgetown Experiment - Machine Translation (1954)
- NLP Systems (1960s)
  - SHRDLU
  - ELIZA
- Explosion in research given computational power increases, corpus linguistics, and machine learning

Why Study NLP?

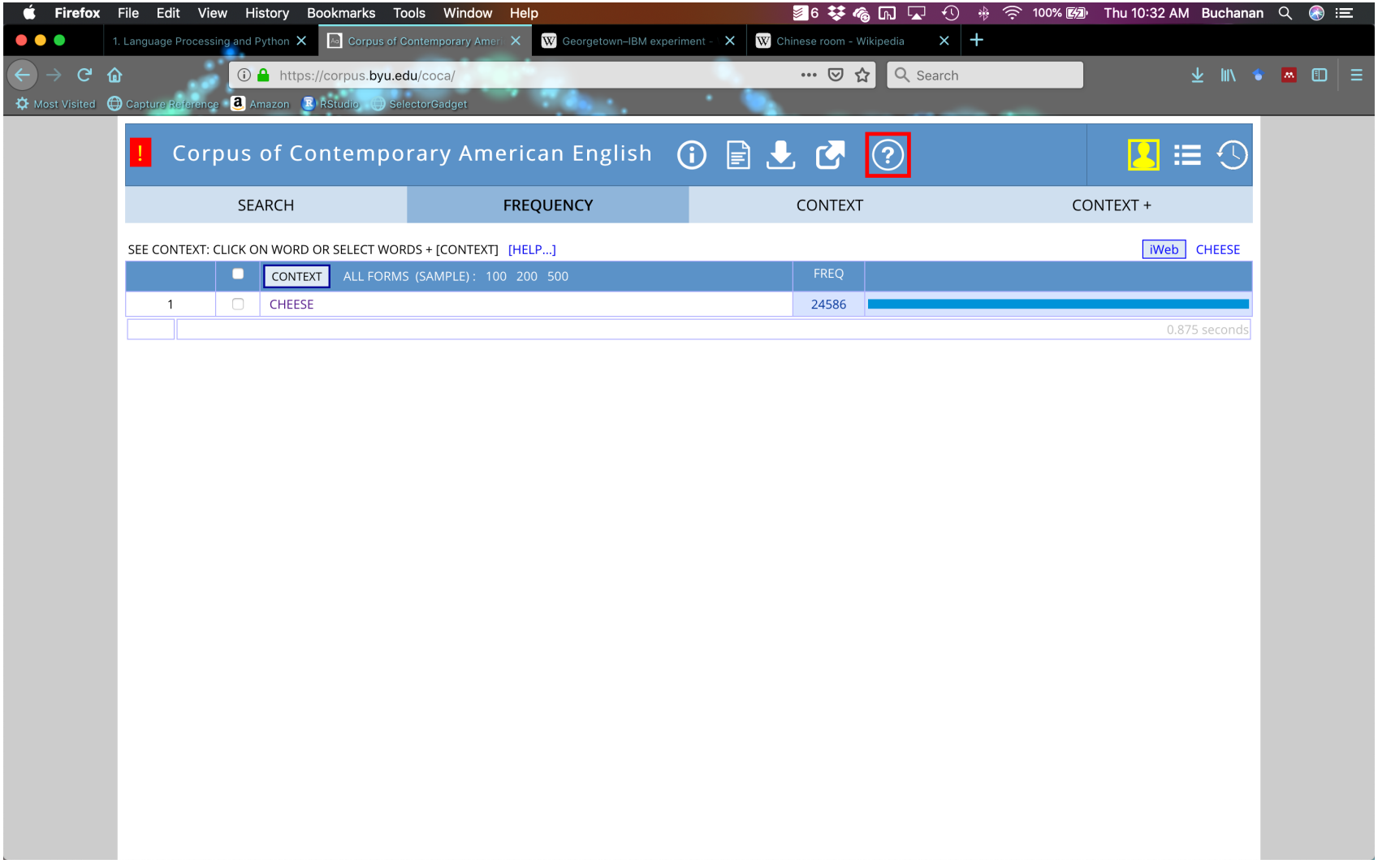
- 80% of "big data" is unstructured data
  - Images
  - Videos
  - Human language (text, recordings)
- Text Mining (text analytics, sentiment analysis, etc.)
  - Linguistic, statistical, and machine learning techniques used to derive high-quality information from text

Traditional Approaches to Text Analytics

- Semantics
  - Readability
  - Student interest indices
  - Vocabulary
- Frequency, frequency, frequency
  - Factor/cluster analysis
  - Word clouds
  - Pages, chapters, etc.

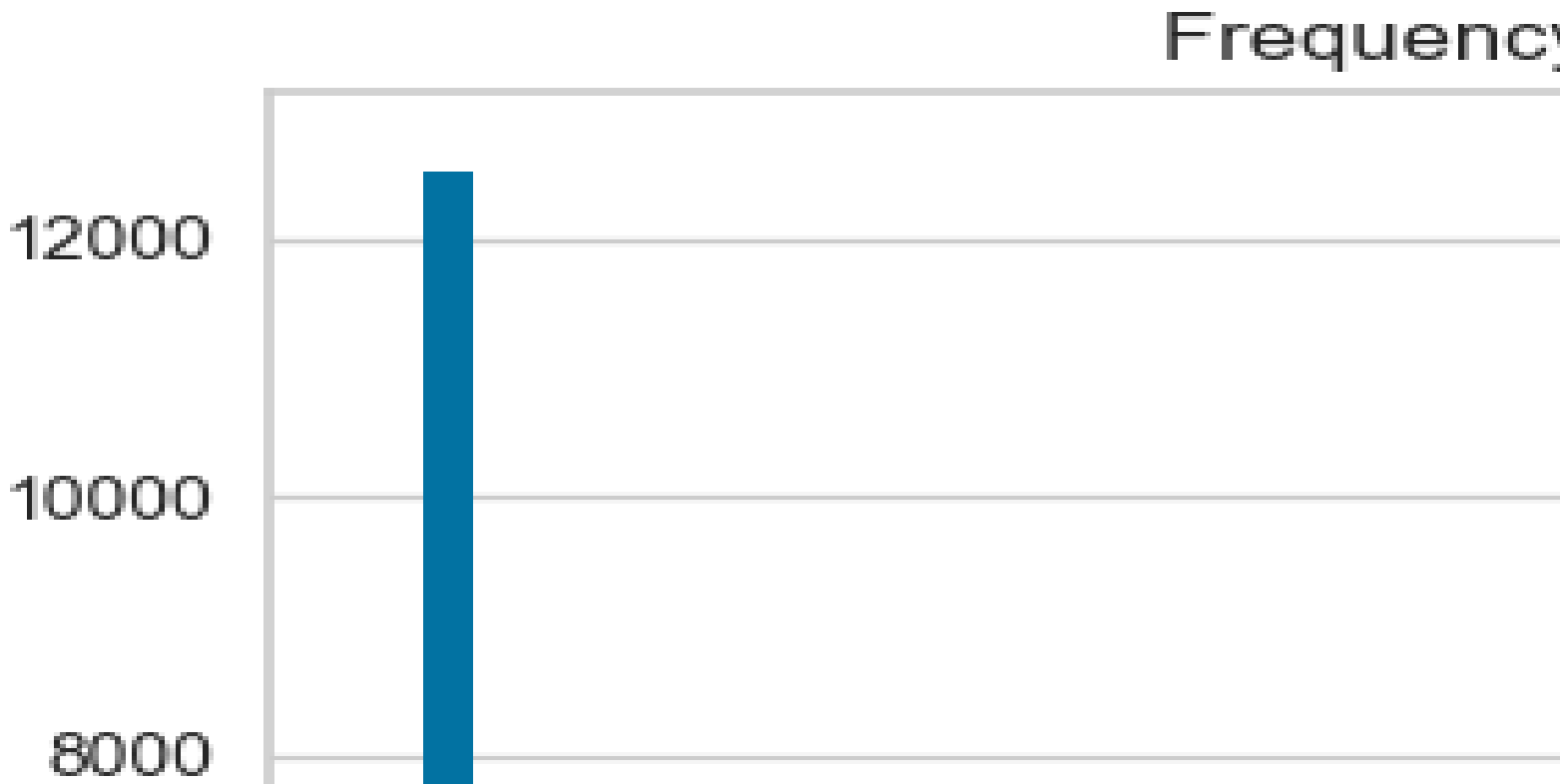
Terms to Know

- Corpus: a body of linguistic data
  - Corpus of Contemporary American English



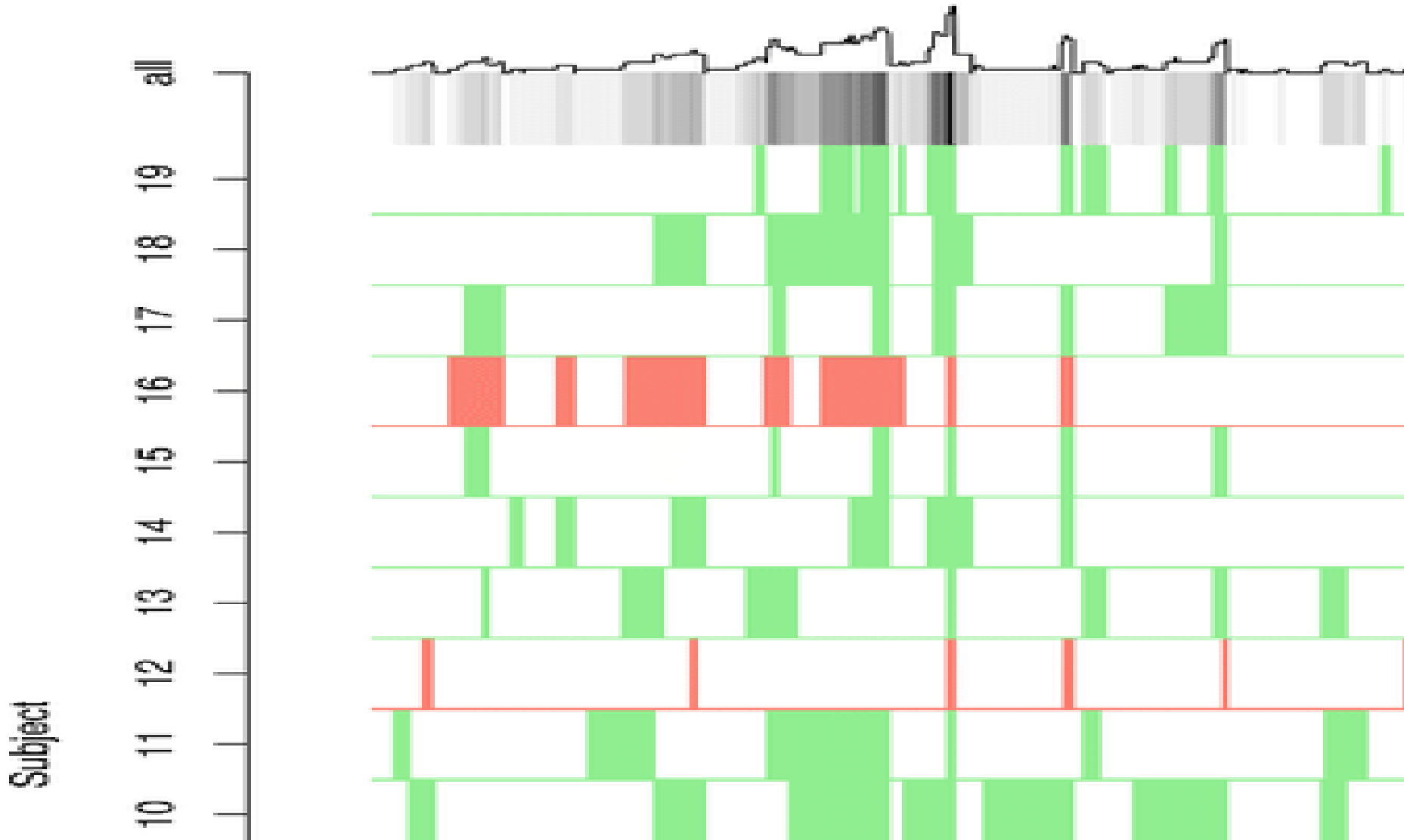
Terms to Know

- Token: total number of words in a text
- Types: number of distinct words
- Frequency distribution: a list of all the unique tokens (types) and count of how many times they appear



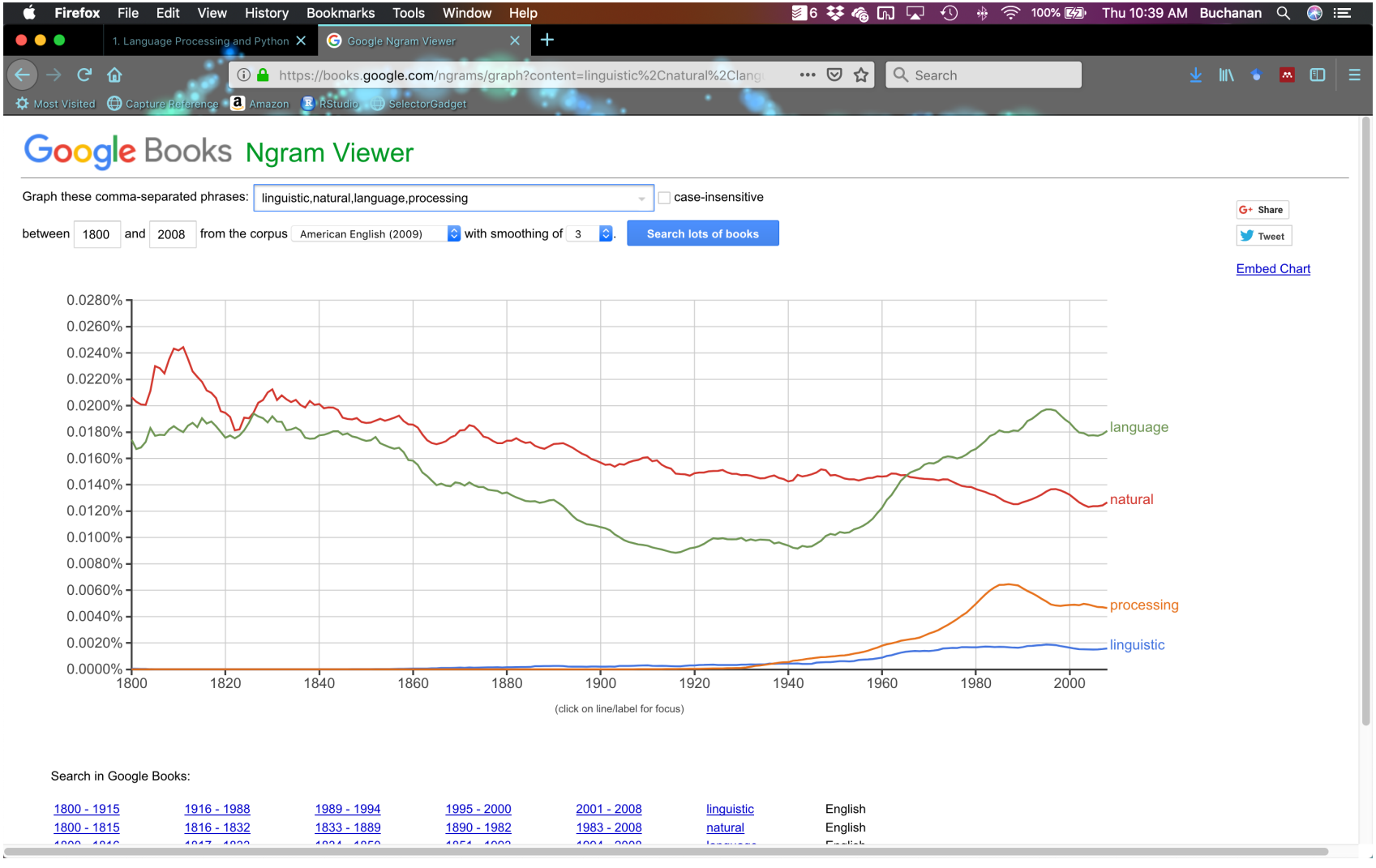
Terms to Know

- Dispersion plot: a graphical representation of the location of tokens in a text



Terms to Know

- Collocation: a sequence of words that occur together often
- n-Gram: n words that occur together



How to Compute Language

- Basic Statistics
  - Frequency: Counts of characters, words, sentences
  - Lexical Diversity: percentage of unique word tokens
  - Lexical Dispersion: position of word tokens in the text

How to Compute Language

- Word Sense Disambiguation
  - Determine which word was intended in a given context
    - serve: help with food or drink; hold an office; put ball into play
    - dish: plate; course of a meal; communications device
  - Contextual clues:
    - The lost children were found by the searchers (agentive)
    - The lost children were found by the mountain (locative)
    - The lost children were found by the afternoon (temporal)

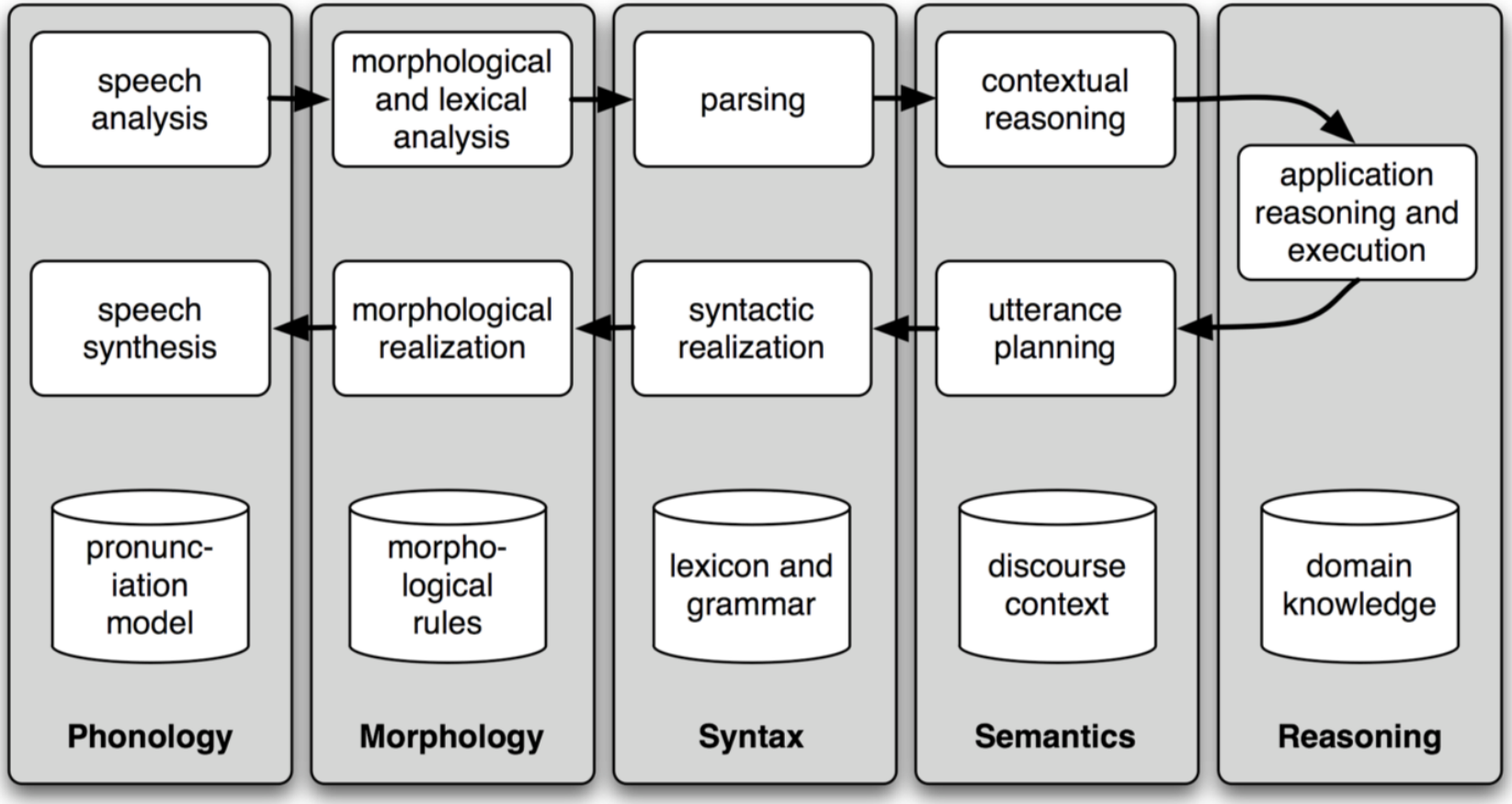
How to Compute Language

- Pronoun Resolution
  - Pronouns refers to a noun - like I/you/this
  - The noun it refers to is called the antecedent
- Examples
  - The thieves stole the paintings. They were subsequently sold.
  - The thieves stole the paintings. They were subsequently caught.
  - The thieves stole the paintings. They were subsequently found.

How to Compute Language

- Generating Language Output
  - Question Answering
    - For example, who sold the paintings?
  - Machine Translation
    - Being able to translate from one language to another
    - Search for google translate fails
  - Spoken Dialog Systems
    - Siri, Ok Google, etc.

How to Compute Language



How to Compute Language

- Textual Entailment: determining if a statement is true from a set of text input
  - Text: David Golinkin is the editor or author of eighteen books, and over 150 responsa, articles, sermons and books
  - Hypothesis: Golinkin has written eighteen books

Break

- Learn some Python!
- Do the first assignment together with others
- As you read the first chapter of the book, there's more Python tutorial

Getting Started with the NLTK

- Let's hop over to the Jupyter Notebook for Python
- Class will generally consist of:
  - Lecture notes - explaining key concepts
  - Notebooks/scripts - active use of key concepts