Objects in Python

Methods in Computational Linguistics I
October 15, 2010

Last Time

- List Comprehensions and Dictionaries

Today

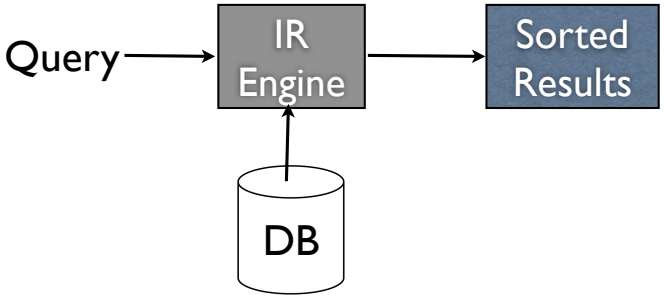
- Information Retrieval
  - Advertisement delivery
- Objects in Python

Information Retrieval

- Searching for documents, or information within documents.
- Search Engines -- Google, Yahoo, Bing, etc.
- Library search products
- Travel sites -- Orbitz, Expedia, Kayak, etc.
- Job search -- Monster, Careers.com

IR framework

- The user requests information via a **query**
- The system delivers a set of documents, typically ordered by **relevance**.



Inverted Index

- How can we determine which documents contain the words that we are interested in?
- A - “Cars need gasoline.”
- B - “Gasoline prices rising.”
- C - “Click for prices.”

- cars - {A}
- need - {A}
- gasoline - {A,B}
- prices - {B,C}
- rising - {B}
- click - {C}
- for - {C}

Near misses

- “cars” doesn’t match “car” in an inverted index.
- “running” doesn’t match “run”.
- “running” doesn’t match “marathon”.

Morphological Analysis

- Morphological analysis that converts "cars" to "car +plural", and "running" to "run +gerund"
- Only store the stem (or lemma) of every word in the index.
- At query time, stem the query.
- CON: This eliminates valuable information from the query.

Query Expansion

- Augment the query with related words, including stems, synonyms, etc.
- similar("running") = {"run", "runs", "ran", "marathon", "race", ...}
- Identifying similar words is an open research question.

Calculating Relevance

- How is relevance calculated?
- A - "Cars need gasoline."
- B - "Gasoline prices rising."
- C - "Click for prices."
- *query - "price of gasoline"*

- Count the number of hits.
- Count the number of close hits.
- Scale the value of matching a word based on the rarity of the word. Matching "the" is less important than matching "centennial".

PageRank

- Core of Google's success in search ~15 years ago.
- Trust a page that people trust. "Crowdsourcing"
- The PageRank of a page is the sum of the PageRank of every page that links to it (divided by the number of links from that page).

$$PR(u) = \sum_{v \in B_u} \frac{PR(v)}{L(v)}$$

Advertisement Delivery

- Placing a relevant ad on a page can be viewed as an Information Retrieval task.
- Treat the page as the **query**.
- Treat the set of available ads as **documents**.
- Relevance needs to involve the price that advertisers will per impression (CPI) or expected payment per click.
- Often, threshold candidate ads based on relevance, then hold an auction to determine the ad to show.

Objects in Python

- Object-Oriented Programming.
- "Objects" are ways of organizing data and the ways that data can be processed.
- **Objects** have:
  - Variables -- Containing data
  - Methods -- Defining how to access and manipulate that data

Objects in NLTK

- We've already seen some objects.
- **FreqDist** is an object defined in NLTK.
  - It is a specification of a dictionary, which has some additional functionality.
  - plotting, incrementing the value of elements
- **nltk.Text** is an object

Objects vs. Types

- str and int are special objects.
- They have methods that are defined specifically for them.
- However, these are called **types** because they are built-in to the python language.
- This distinction gets quite blurry.

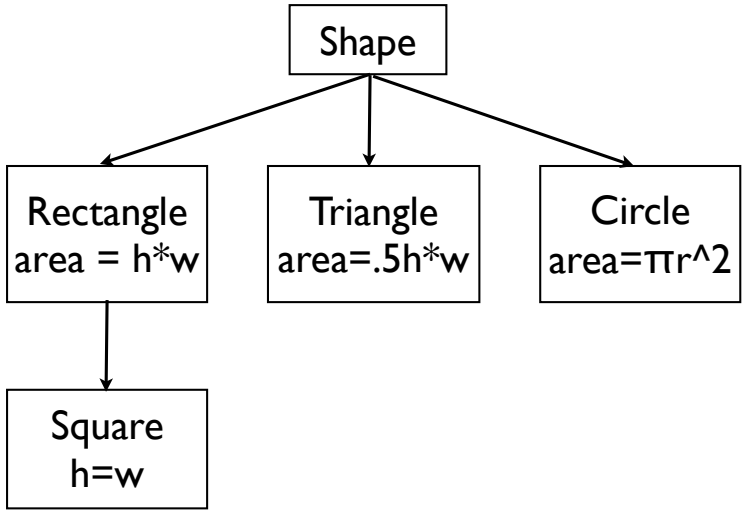
Example Objects

- Demo time.
- Basic Objects
- Initializing data in an object.
- Objects that can be iterated over.

Inheritance

- Objects can define relationships between objects.
- Through member variables, we can incorporate “has-one” and “has-many” relationships.
- Through **inheritance** we can support “is-a” relationships.

Shape Example



Next Time

- Regular Expressions in Python