About Us

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What is ShallowQA?

• Question/Answer System
  ○ Takes question posed in natural language as input.
  ○ Output is a hypothesis (potential answer)

• Inspired by IBM Watson/DeepQA
  ○ Big
  ○ Expensive

• ShallowQA doesn't rely on internal documents
  ○ Little storage needed
What's an algorithm?

Merriam-Webster says: a procedure for solving a mathematical problem (as of finding the greatest common divisor) in a finite number of steps that frequently involves repetition of an operation; broadly : a step-by-step procedure for solving a problem or accomplishing some end especially by a computer

Put Simply: a set of specific instructions to achieve a desired result
What is "Natural Language?"

- The language that we as humans use to communicate
- Unstructured
- Ambiguous
- Many interpretations for the same thing
Consider the following...

"I shot an elephant wearing my pajamas"

- NLP's favorite phrase
- Who was wearing the pajamas?
- What'd you shoot with? A camera?
- Can YOU write an algorithm to answer these questions given the above sentence?
  - You can come to F.I.T. and find out!
Knowing all the challenges... how does ShallowQA work?
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PROPRIETARY
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(KIDDING)
Knowing all the challenges... how does ShallowQA work?

- Three Basic Steps (Highest Level)
  - Question Analysis
    - What is the type of question? (Who/What/Where/When)
    - Do we even know how to answer this kind of question? Should we even try.
    - What is the question asking?
  - Hypothesis Generation
    - Analyze Evidence
    - Generate hypotheses from evidence
    - "Hypothesis" ~= Educated Guess
  - Ranking and Merging
    - Take all of the generated hypotheses, rank them.
    - The "most correct" answer should be the highest ranked.
Toolbox

● Current
  ○ Java7 JDK
  ○ Stanford CoreNLP Library
    ■ Natural Language Parsing library
    ■ We abandoned the bigger project and raided smaller bits for performance reasons
  ○ Princeton Wordnet
    ■ Lexicographical database

● Incoming
  ○ Google Guava
    ■ Cool utility functions that are tedious to otherwise build and test
  ○ Wordnet Blast
    ■ Ultra-fast access to the WordNet database
Step one: Question Analysis

Question:
"When was the original Macintosh Introduced?"
Question Analysis

Answer: Before I was born
Question Analysis

Also accepted: 1984.
Question Analysis: What do we need to know?

- What type of question is this?
"When was the original Macintosh Introduced?"
"When was the original Macintosh Introduced?"
Question Analysis: What do we need to know?

- What type of question is this?
  - "When"
Question Analysis: What do we need to know?

- What type of question is this?
  - "When"
- What's the question asking about
"When was the original Macintosh Introduced?"
When was the original Macintosh Introduced?
Question Analysis: What do we need to know.

- What type of question is this?
  - "When"
- What's the question asking about?
  - "Macintosh"
Question Analysis: What do we need to know.

- What type of question is this?
  - "When"
- What's the question asking about?
  - "Macintosh"
- What about the Macintosh?
Question Analysis

"When was the original Macintosh Introduced?"
Question Analysis: What do we need to know.

- What type of question is this?
  - "When"
- What's the question asking about?
  - "Macintosh"
- What about the Macintosh?
  - "Introduced"
Question Analysis: What do we need to know.

- What type of question is this?
  - "When"
- What's the question asking about?
  - "Macintosh"
- What about the Macintosh?
  - "Introduced"
- Anything else?
Question Analysis

"When was the original Macintosh Introduced?"
"When was the original Macintosh Introduced?"
Question Analysis: What do we need to know.

- What type of question is this?
  - "When"
- What's the question asking about?
  - "Macintosh"
- What about the Macintosh?
  - "Introduced"
- Anything else?
  - The original macintosh
"When was the original Macintosh Introduced?"
"When was the original Macintosh Introduced?"
Question Analysis

"When was the original Macintosh Introduced?"
Question Analysis

"When was the original Macintosh Introduced?"

(Remember sentence diagramming)
"When was the original Macintosh Introduced?"
Interestingly Enough...
Evidence Analysis

Consider this hypothetical sentence from Wikipedia:

"The original Macintosh was introduced in 1984."
Evidence Analysis

"The original Macintosh was introduced in 1984."
"The original Macintosh was introduced in 1984."
"When was the original Macintosh Introduced?"

"The original Macintosh was introduced in 1984."
But what if...

Instead of:

"The original Macintosh was introduced in 1984."
But what if...

The evidence says:

"The first Macintosh was unveiled in 1984."
But what if...

The evidence says:

"The first Macintosh was unveiled in 1984."

We have steps 2 & 3, and Joey to tell you about them
Step 2: Hypothesis Generation

- Identify potentially millions of possible answers

- Why is hypothesis generation important?
  - If the correct answer to the question isn't in the set of candidate hypotheses, then it will be impossible for ShallowQA to provide the correct answer.
Step 2: Hypothesis Generation

- So far we've
  - Parsed the question
  - Identified the question as a "when" question
  - Downloaded and parsed the corresponding Wikipedia page

- Because it's a "when" question, the answer will be a date
  - Identify evidence with supporting dates
  - Discard the remaining set
Step 2: Hypothesis Generation

- Example set of candidate hypotheses
  - In 1991 Apple released the PowerBook line.
  - Apple Inc.'s then-chairman Steve Jobs introduced the first Macintosh on January 24, 1984.

Actual data from "Macintosh" Wikipedia Article
Step 2: Hypothesis Generation

- Example set of candidate hypotheses
  - In 1991 Apple released the PowerBook line.
  - Apple Inc.'s then-chairman Steve Jobs introduced the first Macintosh on January 24, 1984.

Actual data from "Macintosh" Wikipedia Article
Step 3: Ranking

- The process of sorting through all possible answers and ordering them in order of likelihood of being the correct answer.

- If the correct answer isn't at the top of the list, ShallowQA provides the wrong answer.

- Current development stage
Step 3: Ranking

- So far we've
  - Parsed the question
  - Identified the question as a "when" question
  - Downloaded and parsed the corresponding Wikipedia page
  - Generated a list of possible answers (candidate hypotheses)
Step 3: Ranking

● Consider our question
  ○ When was the original Macintosh Introduced?

● Consider this candidate hypothesis
  ○ In 1991 Apple released the PowerBook line.
Step 3: Ranking

When was the original Macintosh Introduced?

In 1991 Apple released the PowerBook line.
Step 3: Ranking

When was the original Macintosh Introduced?

In 1991 Apple released the PowerBook line.
Step 3: Ranking

When was the original Macintosh Introduced?

Steve Jobs introduced the first Macintosh on January 24, 1984.
Step 3: Ranking

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Step 3: Ranking

When was the original Macintosh Introduced?

Steve Jobs introduced the first Macintosh on January 24, 1984.

VERY Close Match
Final Remarks

- Unstructured data accounts for 70-80% of the world's information
- World's data doubles every ~2 years\(^1\)
- QA technology is part of an emerging technology area
  - Everyone's heard the "big data" buzzword.
- Uses beyond Siri
  - Medical (IBM)
  - Financial data
  - Research tools

\(^1\) [http://www.dailytech.com/Worlds+Data+to+Reach+18+Zettabytes+by+2011/article11055.htm](http://www.dailytech.com/Worlds+Data+to+Reach+18+Zettabytes+by+2011/article11055.htm)
Thank You!

Live Demo

Questions?