AnswerMyQuestion

CS 6340 – Natural Language Processing
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A Rule-Based Framework

• The Framework is written in Java. It runs pretty fast
  o Answers all the questions in the developer set in less than a minute

• 33 rules to classify questions and answers
  o The best rules are for WHO typed questions. 80% Recall - 40% Precision – 52% F Score on test set 1
  o The worst rules are for WHAT typed questions. 62% Recall – 19% Precision – 29% F Score on test set 1

• Named Entity Recognition
  o Location, Person, Organization, Money, Percent, Date, Time
  o Stanford NLP Group

• Part-of-Speech Tagging
  o Penn Treebank tag set
  o Stanford NLP Group

• Stemming
  o University of Washington NLP Group

• Stop words
  o Stanford NLP Group
The Workflow

1. Input data
2. Read Question & Answers
3. Process Questions into Words
4. Process Stories into Sentences & Words
5. Determine Best Sentence with Word Matching

6. Determine Question Type
7. People & Organizations
8. Other

8.1 Time & Location
8.1.1 Who, Whom, Whose
8.1.2 When, Where
8.1.3 Why, How, What, Which

8.2 Use NER to find Proper Names & Organizations
8.3 Use NER to find Dates, Times, & Locations
8.4 Use NER and POS Tagger to Help Find Answer

9. Trim sentence down to Acceptable Answer
10. Output Answer
Question Classification

• 9 defined question types
  o WHO, WHERE, WHEN, WHAT, HOW,
  o WHY, WHICH WHOM, WHOSE and UNKNOWN

• Based on Regular Expression matching
  o Multiple rules to improve the question classification
  o Example: [^How], [?\bhow\b.*?]}
  o If a conflict happens it gets the result which yields the best score
    • “Can you tell me how was the day when she left?”
Base Scores

• Sentence scores are generated using Bag-Of-Words
  o Bag-Of-Words is the set of words in a sentence
  o One Story has multiple BOW’s (one for each sentence)
  o The words are stemmed (eat, ate, eaten) before added to BOW

• Base Score
  o $Q = \text{BOW for the Question}$
  o $S = \text{BOW for the Nth sentence of the Story}$
  o For each word on set $Q$ intersection $S$
    • Increment score
      o If the word is a verb increment the score 2x
Scores Improvement

- Based on Regular Expression matching
  - Increment the sentence score if a rule is matched

- Example of Efficient Rules:
  - How typed Questions
    - Question: How long (.* ) ?
    - Answer: … <NUMBER>42</NUMBER> ...

  - Question: How much (.* ) ?
    - Answer: … <MONEY>$2400</MONEY> ...

  - Question: How many KEYWORD (.* ) ?
    - Answer: … <NUMBER>42</NUMBER> KEYWORD ...
      - How many days are left?
      - There are 3 days left.
Scores Improvement

- Based on Regular Expression matching
  - Increment the sentence score if a rule is matched

- Example of Efficient Rules:
  - Who typed Questions
    - Question: Who is the (.* )?
    - Answer: ... <PERSON> Barack Obama </PERSON> ...
    - Answer: ... <ORGANIZATION> Amazon </ORGANIZATION> ...

  - Who (.* )_VB[A-Z]* (.* )?
  - Answer: ... (.* )_VB[A-Z]* ...
    - Who claimed behavior is controller by enviromental consequences?
    - B. F. Skinner claimed that enviromental consequences control people behavior.
Answer Selection

• How to select an answer within a long sentence
• Based on Regular Expression matching

```java
if (CommonAnswerer.regexMatcher(tagger.tagString(wordsMatched[startingPosition]), "([A ]+)_VB[A-Z]*") { 
    String result = "";
    String[] wordsSentence = bestSentence.split("\s");
    for (int i = 0; i < wordsSentence.length; i++) {
        if (MorphaStemmer.morpha(wordsSentence[i], false).equals(MorphaStemmer.morpha(wordsMatched[startingPosition], false))) {
            if (!MorphaStemmer.morpha(wordsSentence[i], false).equals("be") { 
                startingPosition++;
            } else {
                if (startingPosition != 0) {
                    break;
                }
                result += wordsSentence[i] + " ";
            }
        }
    }
    if (startingPosition > 0) {
        bestSentence = result;
    }
```
QuestionID: 1999-W08-1-5
Question: Who claimed that Clinton tried to get Lewinsky to lie about her affair with the president?
Best Sentence: Republican senators claim Clinton tried to get Lewinsky to lie, but she says it was her own decision to cover up the affair.
Final Answer: Republican senators
Answer Selection

- How to select an answer within a long sentence
- Based on NER

QuestionID: 1999-W33-3-9
Question: Where could a partial eclipse be seen?
Best Sentence: A partial eclipse {where the moon covers part, but not all of the sun} could be seen in <LOCATION>Eastern Canada</LOCATION>
Final Answer: Eastern Canada
Our Scores

Test set 1

- **Who**
  - AVERAGE RECALL = 0.5174 (23.28 / 45)
  - AVERAGE PRECISION = 0.4545 (20.45 / 45)
  - AVERAGE F-MEASURE = 0.4839

- **When**
  - AVERAGE RECALL = 0.6269 (18.81 / 30)
  - AVERAGE PRECISION = 0.3282 (9.85 / 30)
  - AVERAGE F-MEASURE = 0.4309

- **Where**
  - AVERAGE RECALL = 0.5174 (23.28 / 45)
  - AVERAGE PRECISION = 0.4545 (20.45 / 45)
  - AVERAGE F-MEASURE = 0.4839

- **Why**
  - AVERAGE RECALL = 0.6269 (18.81 / 30)
  - AVERAGE PRECISION = 0.3282 (9.85 / 30)
  - AVERAGE F-MEASURE = 0.4309

- **What**
  - AVERAGE RECALL = 0.6260 (57.59 / 92)
  - AVERAGE PRECISION = 0.1936 (17.81 / 92)
  - AVERAGE F-MEASURE = 0.2957

- **How**
  - AVERAGE RECALL = 0.6171 (36.41 / 59)
  - AVERAGE PRECISION = 0.4367 (25.77 / 59)
  - AVERAGE F-MEASURE = 0.5115

- **Which**
  - AVERAGE RECALL = 0.6333 (1.90 / 3)
  - AVERAGE PRECISION = 0.3833 (1.15 / 3)
  - AVERAGE F-MEASURE = 0.4776
Questions?