NLP

Introduction to NLP

Evaluation of QA

The TREC Q&A evaluation

- Run by NIST
  - Voorhees and Tice 1999, 2000
  - 2GB of input
  - AQUAINT corpus
  - 200 questions in 1999
  - 693 questions in 2000
- Essentially fact extraction
  - Who was Lincoln's secretary of state?
  - What does the Peugeot company manufacture?
- Assumptions
  - Questions are based on text
  - Answers are assumed to be present
  - Systems return five passages of 50 or 250 bytes
  - After 2002, only a single passage of 50 bytes + confidence score + NIL
  - No inference needed

TREC 1999

- What date in 1989 did East Germany open the Berlin Wall?
  - Nov 9
- Who was Johnny Mathis' high school track coach?
  - Lou Vasquez
- What is the shape of a porpoises' tooth?
  - spade–shaped
- What is the number of buffaloes thought to have been living in North America when Columbus landed in 1492?
  - 60 million
- The Faroes are a part of what northern European country?
  - Denmark

- The symptoms of Parkinson's disease are linked to the demise of cells in what area of the brain?
  - substantia nigra
- What was the date of the Chelsea flower show in 1992?
  - May 18
- What hotel was used for a setting of the Agatha Christie novel, "And Then There Were None"?
  - Burgh Island Hotel
- What year was the Magna Carta signed?
  - 1215
- Who was Lincoln's Secretary of State?
  - William Seward
- How long does it take to fly from Paris to New York in a Concorde?
  - 3 1/2 hours

TREC 1999 – Test Questions

- Who is the author of the book, "The Iron Lady: A Biography of Margaret Thatcher"?
- What was the monetary value of the Nobel Peace Prize in 1989?
- What does the Peugeot company manufacture?
- How much did Mercury spend on advertising in 1993?
- What is the name of the managing director of Apricot Computer?
- Why did David Koresh ask the FBI for a word processor?
- What debts did Qintex group leave?
- What is the name of the rare neurological disease with symptoms such as: involuntary movements (tics), swearing, and incoherent vocalizations (grunts, shouts, etc.)?
- How far is Yaroslavl from Moscow?
- Name the designer of the shoe that spawned millions of plastic imitations, known as "jellies".
- Who was President Cleveland's wife?

- How much did Manchester United spend on players in 1993?
- How much could you rent a Volkswagen bug for in 1966?
- What country is the biggest producer of tungsten?
- When was London's Docklands Light Railway constructed?
- What two US biochemists won the Nobel Prize in medicine in 1992?
- How long did the Charles Manson murder trial last?
- Who was the first Taiwanese President?
- Who was the leader of the Branch Davidian Cult confronted by the FBI in Waco, Texas in 1993?
- Where is Inoco based?
- Who was the first American in space?
- When did the Jurassic Period end?
- When did Spain and Korea start ambassadorial relations?
- When did Nixon visit China?
- Who was the lead actress in the movie "Sleepless in Seattle"?
- What is the name of the "female" counterpart to El Nino, which results in cooling temperatures and very dry weather?
- What is the brightest star visible from Earth?
- What are the Valdez Principles?

Evaluation

- MRR
  - Mean Reciprocal Rank
  - Introduced by TREC in 1999

$$\mathbf{MRR} = \frac{1}{n}\left(\sum_{i=1}^{n} \frac{1}{rank_i} \right)$$

- Example
  - What is the capital of Canada?
  - 1.Toronto, 2.Ottawa, 3.Albany, 4.Philadelphia, 5.Ottawa
  - Correct answer ranks = 2, 5 (highest rank = 2)
  - MRR = 1/2 = 0.5
  - TRR = 1/2 + 1/5 = 0.7 = total reciprocal rank

- Later years
  - Confidence–weighted score

Performance

- 1999
  - Cymphony, SMY, AT&T, IBM, XRCE, Umd
- 2000
  - SMU, ISI, Waterloo, IBM, CUNY–QC
- 2001
  - InsightSoft, LCC, Oracle, ISI
- 2002
  - LCC, InsightSoft, NUS
- 2003
  - LCC, NUS, LexiClone, ISI
- 2004
  - LCC, NUS, Uwales, IBM
- 2005
  - LCC, NUS, IBM, Albany

Other Types of Questions

- Definitional
  - What is a boll weevil?
- List
  - Which states signed the US Declaration of Independence?
- Crosslingual
  - E.g., questions in Spanish, documents in English
- Series
  - Next slide

TREC Series Questions

- What are prions made of?
- Who discovered prions?
- What researchers have worked with prions?
- Who is the lead singer/ musician in Nirvana?
- Who are the band members?
- When was the band formed?
- What is their biggest hit?

- What are their albums?
- What style of music do they play?
- What industry is Rohm and Haas in?
- Where is the company located?
- What is their annual revenue?
- How many employees does it have?
- What kind of insect is a boll weevil?
- What type of plant does it damage?
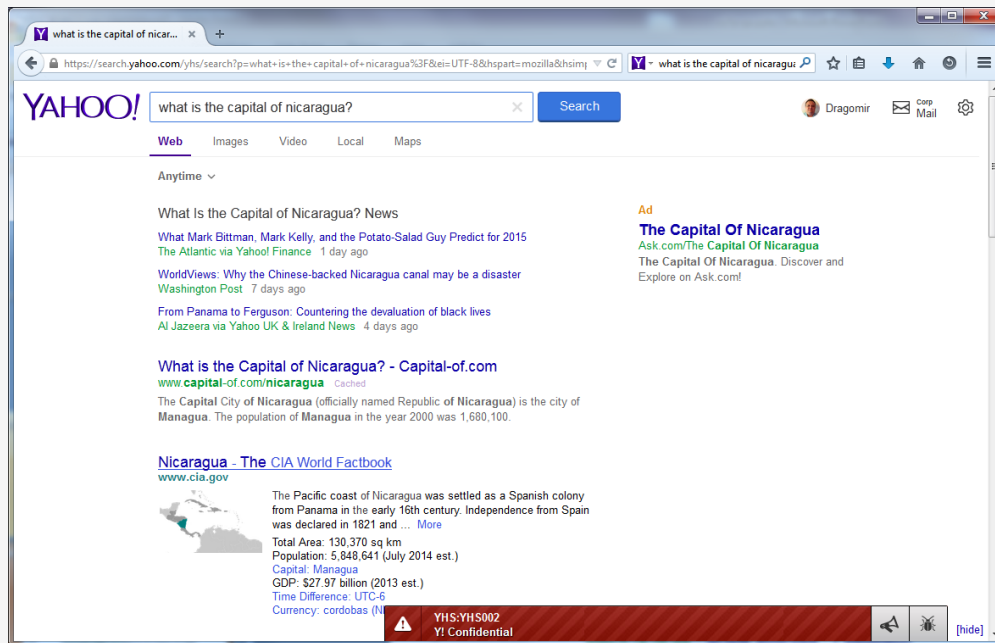- What states have had problems with boll weevils?

NLP

Introduction to NLP

System Architecture

System Architecture

- Many questions can be answered by traditional search engines

What is the Largest City in Northern Afghanistan?

... Afghanistan, Kabul, 2,450 **...** Administrative capital and **largest city** (1997 est **...** Undetermined. Panama, Panama **City**, 450,668. **...** of the Gauteng, **Northern** Province, Mpumalanga **...**
www.infoplease.com/cgi-bin/id/A0855603

... died in Kano, **northern** Nigeria's **largest city**, during two days of anti-American riots led by Muslims protesting the US-led bombing of **Afghanistan**, according to **...**
www.washingtonpost.com/wp-dyn/print/world/

... air strikes on the **city**. **...** the Taliban militia in **northern Afghanistan** in a significant blow **...** defection would be the **largest** since the United States **...**
www.afgha.com/index.php - 60k

... Kabul is the capital and **largest city** of **Afghanistan**. . **...** met. area pop. 2,029,889), is the **largest city** in Uttar Pradesh, a state in **northern** India. . **...**
school.discovery.com/homeworkhelp/worldbook/atozgeography/ k/k1menu.html

... Gudermes, Chechnya's second largest town. The attack **...** location in **Afghanistan's** outlying regions **...** in the **city** of Mazar-i-Sharif, a **Northern** Alliance-affiliated **...**
english.pravda.ru/hotspots/2001/09/17/

... Get Worse By RICK BRAGG Pakistan's **largest city** is getting a jump on the **...** Region: Education Offers Women in **Northern Afghanistan** a Ray of Hope. **...**
www.nytimes.com/pages/world/asia/

... within three miles of the airport at Mazar-e-Sharif, the **largest city** in **northern Afghanistan**, held since 1998 by the Taliban. There was no immediate comment **...**
uk.fc.yahoo.com/photos/a/afghanistan.html

System Components

- Source identification
  - semi-structured vs. text sources
- Query modulation
  - best paraphrase of a NL question given the syntax of a search engine
  - Example: Who wrote Hamlet → author | wrote Hamlet
- Document retrieval
- Sentence ranking
  - n-gram matching, Okapi
- Answer extraction
  - question type classification
  - phrase chunking
- Answer ranking
  - question type, proximity to query words, frequency

What is the largest city in Northern Afghanistan?

Query modulation

(largest OR biggest) city "Northern Afghanistan"

Document retrieval

www.infoplease.com/cgi-bin/id/A0855603
www.washingtonpost.com/wp-dyn/print/world/

Sentence ranking

Gudermes, Chechnya's second **largest** town ... location in **Afghanistan's** outlying regions
within three miles of the airport at Mazar-e-Sharif, the **largest city** in **northern Afghanistan**

Answer extraction

Gudermes
Mazer-e-Sharif

Answer ranking

Mazer-e-Sharif
Gudermes

Question Type Classification

- Can help find the right answers in the text
- Example
  - Who wrote Anna Karenina?
  - Looking for a PERSON/INDIVIDUAL/WRITER

SYN-classes (IBM AnSel)

QA-token	Question type	Example
PLACE	Where?	In the Rocky Mountains
COUNTRY	Where? What country?	United Kingdom
STATE	Where? What state?	Massachusetts
PERSON	Who?	Albert Einstein
ROLE	Who?	Doctor
NAME	Who? What? Which?	The Shakespeare Festival
ORG	Who? What?	The U.S. Post Office
DURATION	How long?	For 5 centuries
AGE	How old?	30 years old
YEAR	When? What year?	1999
TIME	When? What time?	In the afternoon
DATE	When? What date?	July 4th, 1776
VOLUME	How big? How large?	3 gallons
AREA	How big? How large?	4 square inches
LENGTH	How long? How big?	3 miles
WEIGHT	How heavy? How big?	25 tons
NUMBER	How many?	1,134.5
RATE	How much? What percentage?	50 per cent
MONEY	How much?	4 million dollars

UIUC Question Types

- **ENTITY**: entities
-   animal: animals
-   body: organs of body
-   color: colors
-   creative: inventions, books and other creative pieces
-   currency: currency names
-   dis.med.: diseases and medicine
-   event: events
-   food: food
-   instrument: musical instrument
-   lang: languages
-   letter: letters like a–z
-   other: other entities
-   plant: plants
-   product: products
-   religion: religions
-   sport: sports
-   substance: elements and substances
-   symbol: symbols and signs
-   technique: techniques and methods
-   term: equivalent terms
-   vehicle: vehicles
-   word: words with a special property

- **ABBREVIATION**: abbreviation
-   abb   abbreviation
-   exp   expression abbreviated
- **DESCRIPTION**: description and abstract concepts
-   definition: definition of sth.
-   description: description of sth.
-   manner: manner of an action
-   reason: reasons
- **HUMAN**: human beings
-   group: a group or organization of persons
-   ind: an individual
-   title: title of a person
-   description: description of a person
- **LOCATION**: locations
-   city: cities
-   country: countries
-   mountain: mountains
-   other: other locations
-   state: states

- **NUMERIC**: numeric values
-   code: postcodes or other codes
-   count: number of sth.
-   date: dates
-   distance: linear measures
-   money: prices
-   order: ranks
-   other: other numbers
-   period: the lasting time of sth.
-   percent: fractions
-   speed: speed
-   temp: temperature
-   size: size, area and volume
-   weight: weight

UIUC Examples

- **NUM:date**
  - When did Rococo painting and architecture flourish ?
- **LOC:country**
  - What country 's national passenger rail system is called Via ?
- **HUM:ind**
  - Who invented Make–up ?
- **DESC:desc**
  - What is the origin of the word `` attic '' ?
- **DESC:desc**
  - What did Delilah do to Samson 's hair ?
- **ENTY:animal**
  - What kind of animals were in the Paleozoic era ?
- **HUM:ind**
  - Which of the following was Rhodes Scholar ?

- **HUM:ind**
  - Who comprised the now–defunct comic book team known as the Champions ?
- **DESC:**
  - **manner** How do you make a paintball ?
- **LOC:**
  - **state** What U.S. state is Fort Knox in ?
- **ENTY:**
  - **animal** What is a female rabbit called ?
- **LOC:mount**
  - Where is the highest point in Japan ?
- **DESC:desc**
  - Where do chihuahuas come from ?
- **LOC:other**
  - Where does Barney Rubble go to work after he drops Fred off in the `` Flintstones '' cartoon series?

UIUC Papers On Question Classification

- Xin Li and Dan Roth. Experimental Data for Question Classification
  - http://l2r.cs.uiuc.edu/~cogcomp/Data/QA/QC/

- Xin Li, Dan Roth. Learning Question Classifiers: The Role of Semantic Information
  - http://l2r.cs.uiuc.edu/~danr/Papers/LiRo05a.pdf
  - http://l2r.cs.uiuc.edu/~cogcomp/asoftware.php?skey=LBJ

- Data set
  - training (http://l2r.cs.uiuc.edu/~cogcomp/Data/QA/QC/train_5500.label)
  - test (http://l2r.cs.uiuc.edu/~cogcomp/Data/QA/QC/TREC_10.label)

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