LING 581: Advanced Computational Linguistics

Lecture Notes

April 9th
WordNet Homework

• **Reminder:**
  - has everyone submit some code and their results for the three quizzes?
Question-Answering (QA)

• **NL or semantic search: a marketplace failure**
  - Ask Jeeves
  - now ask.com (no more NL searches)
  - Powerset (subsumed into Bing)
    - in a Search Refinement, a Chance to Rival Google
    - (2007) **Powerset** using (Xerox) PARC NL parsers

• **Quotes:**
  - “For a lot of things, keyword search works well”, said Barney Pell, chief executive of Powerset. “But I think we are going to look back in 10 years and say, remember when we used to search using keywords.”
  - Researchers have predicted breakthrough applications for natural languages for years, but the technology has proved usable in only limited contexts, turning many experts into skeptics about its potential, at least in the short term.
  - In a November interview, Marissa Mayer, Google’s vice president for search and user experience, said: “**Natural language is really hard. I don't think it will happen in the next five years.**”
Question-Answering (QA)

• Powerset Debuts With Search of Wikipedia
  – (May 2008)
  – Powerset created an index of Wikipedia by studying the meaning of entire sentences rather than
    the relationship between words. Similarly, it allows users to type queries as fully formed
    questions. That allows it to do certain things that many search engines cannot do.

Ask “Who did Henry VIII marry?” or “What did the F.D.A. ban?” or “What did Bill Clinton sign?” and Powerset will come up with remarkably good answers.
(Incidentally, Google does a decent job of answering the first of these questions but not the other two.)

Powerset Debuts With Search of Wikipedia
By MIGUEL HELFT

Powerset is undoubtedly among the most ballyhooed start-ups in Silicon Valley. The company’s mission is as improbable as it is daring: just as Google did a decade ago, Powerset wants to come up with a better way to search.
Question-Answering (QA)
Question-Answering (QA)

Who did Henry VIII marry?

Including results for who did henry vii marry.
Do you want results for Who did Henry VIII marry??

Henry VIII of England - Wikipedia, the free encyclopedia
Early years: 1491–1509 · Early reign: 1509–1525 · Power and authority
Henry VIII (28 June 1491 – 28 Jun 1547) was an authority. Henry VIII was a paternalistic ruler who did ... by the descendants of Henry VIII's deceased younger sister, Mary
on.wikipedia.org/wiki/Henry_VIII_of_England

Mary Boleyn - Wikipedia, the free encyclopedia
Early life · Royal affair in France · Royal mistress · Sister's rise to power
Mary was one of the Mistresses of Henry VIII. It has been alleged that she bore two of the King's children, though Henry did not acknowledge either of them as he did with ... on.wikipedia.org/wiki/Mary_Boleyn

Answers.com - What happens to King Henry VIII's daughter Mary
Did King Henry VIII have a daughter? Yes he had 2 daughters born on the proper side of the blanket. Princess Mary by his first wife Katherine of Aragon, and Princess ... wiki.answers.com/Q/What_happens_to_King_Henry_VIII%27s_daughter_Mary

Images of Who did Henry VIII marry?
Question-Answering (QA)
TREC 9 QA data (2000)

- The Text REtrieval Conference (TREC), co-sponsored by the National Institute of Standards and Technology (NIST) and U.S. Department of Defense, was started in 1992 as part of the TIPSTER Text program.

- Its purpose was to support research within the information retrieval community by providing the infrastructure necessary for large-scale evaluation of text retrieval methodologies.

- **Question Answering Track**
  - A track designed to take a step closer to information retrieval rather than document retrieval.
  - URL: [http://trec.nist.gov/tracks.html](http://trec.nist.gov/tracks.html)

- **Data (from Year 2000)**
  - URL: [http://trec.nist.gov/data/qa/T9_QAdata/variants.key](http://trec.nist.gov/data/qa/T9_QAdata/variants.key)
Orig: 408. What kind of animal was Winnie the Pooh?
701. Winnie the Pooh is what kind of animal?
702. What species was Winnie the Pooh?
703. Winnie the Pooh is an imitation of which animal?
704. What was the species of Winnie the Pooh?

Orig: 409. What's another name for aspartame?
705. Aspartame if also known as what?
706. What is a synonym for aspartame?
707. Aspartame is known by what other name?
708. Aspartame is also called what?

Orig: 410. What does hazmat stand for?
709. Hazmat stands for what?
710. What is the definition of hazmat?

Orig: 411. What tourist attractions are there in Reims?
711. What are the names of the tourist attractions in Reims?
712. What do most tourists visit in Reims?
713. What attracts tourists to Reims?
714. What are tourist attractions in Reims?
715. What could I see in Reims?
716. What is worth seeing in Reims?
717. What can one see in Reims?

Orig: 412. Name a film in which Jude Law acted.
718. Jude Law was in what movie?
719. Jude Law acted in which film?
720. What is a film starring Jude Law?
721. What film was Jude Law in?
722. What film or films has Jude Law appeared in?

Orig: 413. Where are the U.S. headquarters for Procter & Gamble?
723. What city houses the U.S. headquarters of Procter and Gamble?
724. Where is Procter & Gamble headquartered in the U.S.?
725. What is the U.S. location of Procter & Gamble corporate offices?
726. Procter & Gamble is headquartered in which U.S. city?
727. Where is Procter & Gamble based in the U.S.?

Orig: 203. How much folic acid should an expectant mother get daily?
728. What is the recommended daily requirement for folic acid for pregnant women?
729. How much folic acid should a pregnant woman get each day?
730. What is the daily requirement of folic acid for an expectant mother?
731. What amount of folic acid should an expectant mother take daily?

Orig: 415. What does CNN stand for?
732. Name the first Russian astronaut to do a spacewalk.
733. Who was the first Russian astronaut to walk in space?
734. Who was the first Russian to do a spacewalk?

Orig: 416. When was CNN's first broadcast?
735. CNN is the abbreviation for what?
736. CNN is an acronym for what?
737. What was the date of CNN's first broadcast?
738. CNN began broadcasting in what year?
739. CNN's first broadcast occurred on what date?
740. When did CNN begin broadcasting?
741. When did CNN go on the air?
Orig: 417. Who owns CNN?
742. Who is the owner of CNN?
743. CNN is owned by whom?

Orig: 418. What is the name of a Salt Lake City newspaper?
744. What newspaper serves Salt Lake City?
745. Name a Salt Lake City newspaper.

Orig: 419. Who was Jane Goodall?
746. What is Jane Goodall famous for?
747. What is Jane Goodall known for?
748. Why is Jane Goodall famous?
749. What made Jane Goodall famous?

Orig: 421. What is thalassemia?
750. Define thalassemia.
751. What is the meaning of thalassemia?
752. How is thalassemia defined?

Orig: 423. What soft drink contains the largest amount of caffeine?
753. What soft drink is most heavily caffeinated?
754. What is the most heavily caffeinated soft drink?
755. To get the most caffeine, what soda should I drink?
756. Which type of soda has the greatest amount of caffeine?
757. What soft drink would provide me with the biggest intake of caffeine?

Orig: 424. What do you call a group of geese?
758. What is the collective term for geese?
759. What is the collective noun for geese?
760. What is the term for a group of geese?
761. What is the name given to a group of geese?

Orig: 425. How many months does a normal human pregnancy last?
762. What is the gestation period for human pregnancies?
763. How long is human gestation?
764. What is the gestation period for humans?
765. A normal human pregnancy lasts how many months?

Orig: 426. What format was VHS's main competition?
766. What was the alternate to VHS?
767. What video format was an alternative to VHS?
768. What format was the major competition of VHS?

Orig: 427. What culture developed the idea of potlatch?
769. What ethnic group introduced the idea of potlatch?
770. What is the cultural origin of the ceremony of potlatch?
771. Who developed potlatch?

Orig: 428. Where is Logan International located?
772. Where is Logan Airport?
773. What city is Logan Airport in?
774. Logan International serves what city?
775. Logan International is located in what city?
776. What city's airport is named Logan International?
777. What city is served by Logan International Airport?

Orig: 429. What university was Woodrow Wilson president of?
778. Woodrow Wilson was president of which university?
779. Name the university of which Woodrow Wilson was president.
780. Woodrow Wilson served as president of what university?
Orig: 431. What does CPR stand for?
781. What does the acronym CPR mean?
782. What do the initials CPR stand for?
783. CPR is the abbreviation for what?
784. What is the meaning of “CPR”?

Orig: 433. Who was Darth Vader’s son?
785. What was the name of Darth Vader’s son?
786. What was Darth Vader’s son named?

Orig: 435. How did Bob Marley die?
787. What caused the death of Bob Marley?
788. What killed Bob Marley?
789. What was the cause of Bob Marley’s death?

Orig: 436. What instrument is Ray Charles best known for playing?
790. What instrument does Ray Charles play?
791. Musician Ray Charles plays what instrument?
792. Ray Charles plays which instrument?
793. Ray Charles is best known for playing what instrument?

Orig: 437. What is Dick Clark’s birthday?
794. When was Dick Clark born?
795. When is Dick Clark’s birthday?
796. What is Dick Clark’s date of birth?

Orig: 440. Where was Poe born?
797. What was Poe’s birthplace?
798. What was the birthplace of Edgar Allen Poe?
799. Where is Poe’s birthplace?

Orig: 441. What king was forced to agree to the Magna Carta?
800. What monarch signed the Magna Carta?
801. Which king signed the Magna Carta?
802. Who was the king who was forced to agree to the Magna Carta?
803. What king signed the Magna Carta?
804. Who was the king who signed the Magna Carta?

Orig: 393. Where is your corpus callosum?
805. Where is one’s corpus callosum found?
806. What part of your body contains the corpus callosum?
807. The corpus callosum is in what part of the body?

Orig: 394. What is the longest word in the English language?
808. What English word has the most letters?
809. What English word contains the most letters?
810. What is the longest English word?

Orig: 396. Who invented silly putty?
811. What is the name of the inventor of silly putty?
812. Silly putty was invented by whom?
813. Who was the inventor of silly putty?

Orig: 397. When was the Brandenburg Gate in Berlin built?
814. When was Berlin’s Brandenburg gate erected?

Orig: 398. When is Boxing Day?
815. What is the date of Boxing Day?
816. What date is Boxing Day?
817. Boxing Day is celebrated on what date?

etc...
Homework

• Steps:
  1. Pick 3 query groups
  2. Simulate (programmatically) factoid QA
  3. use a parser of your choice and WordNet to find answers to the queries
  4. submit report
Example

• Question group
  What kind of animal was Winnie the Pooh?
  Winnie the Pooh is what kind of animal?
  What species was Winnie the Pooh?
  Winnie the Pooh is an imitation of which animal?
  What was the species of Winnie the Pooh?

• MXPOST
  • ./mxpost tagger.project/ < t9.txt
  9 Winnie NNP the DT Pooh NNP is VBZ what WP kind NN of IN animal NN ? .
  7 What WP species VBZ was VBD Winnie NNP the DT Pooh NNP ? .
  10 Winnie NNP the DT Pooh NNP is VBZ an DT imitation NN of IN which WDT animal NN ? .
  9 What WP was VBD the DT species NNS of IN Winnie NNP the DT Pooh NNP ? .

then Collins (model 3)

• gunzip -c models/model3/events.gz | code/parser t9.txt models/model3/grammar 10000 1 1 1 1 > t9.output

(TOP (S (NP (NP (NNP Winnie)) (NP (DT the) (NNP Pooh))) (VP (VBZ is) (NP (NP (WDT what) (NN kind)) (PP (IN of) (NP (NN animal) (. ?)))))))

(TOP (SINV (SBARQ (WHNP (WP What)) (SQ (VP (VBZ species)))) (VP (VBD was) (NP (NNP Winnie))) (NP (DT the) (NNP Pooh) (. ?))))

(TOP (S (NP (NP (NNP Winnie)) (NP (DT the) (NNP Pooh))) (VP (VBZ is) (NP (NP (DT an) (NN imitation)) (PP (IN of) (NP (WDT which) (NN animal) (. ?))))))

(TOP (SBARQ (WHNP (WP What)) (SQ (VBD was) (NP (NP (DT the) (NNS species)) (PP (IN of) (NP (NP (NNP Winnie)) (NP (DT the) (NNP Pooh) (. ?))))))))
Example

• trees

• reformulate Qs into declarative sentences with missing wh-phrase
  – ____ (kind of animal) is winnie the pooh
  – winnie the pooh is ____ (species)
  – winnie the pooh is an imitation of ____ (animal)
  – the species of winnie the pooh is ____
Auto-complete

• Digression:
  – **Auto-complete** (not switchable): *as you type in the search box, you can find information quickly by seeing search predictions that might be similar to the search terms you're typing.*
Auto-complete
Example

• **Answers:**
  • Winnie the Pooh is such a popular character in Poland
  • Winnie-the-Pooh Is My Co-worker
  • Winnie the Pooh is a little, adorable and cute bear obsessed by honey.
  • Winnie-the-Pooh is so fat.
  • Winnie the Pooh is one of the things most closest to my heart
  • Winnie the Pooh is his usual befuddled self

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Owl (Winnie the Pooh) - Wikipedia, the free encyclopedia
From Wikipedia, the free encyclopedia. Jump to: navigation, search. Disney's interpretation of Owl. Disney's interpretation of Ow ... en.wikipedia.org/wiki/Owl_(Winnie_the_Pooh) - 18k - Cached - Similar pages

Winnie-the-Pooh - Wikipedia, the free encyclopedia
Winnie the Pooh is such a popular character in Poland that a Warsaw street is ... Possibly the strongest incarnation of Winnie the Pooh in Peter David's ... en.wikipedia.org/wiki/Winnie_the_Pooh - 62k - Cached - Similar pages

[ More results from en.wikipedia.org ]

McSweeney's Internet Tendency: Winnie-the-Pooh Is My Co-worker
OTHER McSWEENEY'S FEATURES: ----- Winnie-the-Pooh Is My Co-worker By John Moe Favorite Gerund Movie Titles, Un-gerunded By Ian Carey ...
www.mcsweeney.net/2004/6/11moe.html - 54k - Cached - Similar pages

Penny Arcade - Further Deviations
Equal parts comics and commentary, Penny Arcade features Tycho and Gabe, the alter egos of creators Mike Krahulik and Jerry Holkins.
www.penny-arcade.com/comic/2006/03/31 - 6k - Cached - Similar pages

The Many Adventures of Winnie the Pooh (1977)
Winnie the Pooh is a little, adorable and cute bear obsessed by honey. He loves honey so much that he exaggerates and eats so many pots of honey until he ...
www.imdb.com/title/tt0070143/ - 43k - Cached - Similar pages

What gender is Winnie-the-Pooh?
Dear Yahoo!: What gender is Winnie-the-Pooh? Janice Langley, Canada. Dear Janice:... According to the Winnie-the-Pooh FAQ, "...every character in ...
ask.yahoo.com/20020506.html - 13k -Cached - Similar pages

Winnie-the-Pooh Character Guide - Jokes and Riddles
Winnie-the-Pooh is so fat... How fat is he? Winnie-the-Pooh is so fat that when he stepped on the scales it said "To be continued..." ...
www.lavasurfer.com/pooh-jokes.html - 21k - Cached - Similar pages

Winnie The Pooh and Pals
As you probably realise Winnie the Pooh is one of the things most closest to my heart, and by making this I hope everyone realises how special Winnie the ...
www.winniethepooh.co.uk/index.shtml - 6k - Cached - Similar pages

Amazon.com: Winnie the Pooh Preschool: Software
Winnie the Pooh is his usual befuddled self and just can't remember what it is that he's
Example

• **MXPOST**

11 Winnie NNP the DT Pooh NNP is VBZ such PDT a DT popular JJ character NN in IN Poland NNP . .
5 Winnie-the-Pooh NNP Is VBZ My PRP$ Co-worker NN . .
14 Winnie NNP the DT Pooh NNP is VBZ a DT little, NN adorable JJ and CC cute JJ bear NN obsessed VBN by IN honey NN . .
5 Winnie-the-Pooh NNP is VBZ so RB fat JJ . .
14 Winnie NNP the DT Pooh NNP is VBZ one CD of IN the DT things NNS most RBS closest JJ to TO my PRP$ heart NN . .
9 Winnie NNP the DT Pooh NNP is VBZ his PRP$ usual JJ befuddled JJ self NN . .

• **Pick out head of object**

- (TOP~is~1~1 (S~is~2~2 (NP-A~Winnie~2~1 (NPB~Winnie~1~1 Winnie/NNP ) (NPB~Pooh~2~2 the/DT Pooh/NNP ) ) (VP~is~2~1 is/VBZ (NP-A~character~2~1 (NPB~character~4~4 such/PDT a/DT popular/JJ character/NN ) (PP~in~2~1 in/IN (NPB~Poland~1~1 Poland/NNP ./PUNC. ) ) ) ) ) )

[Diagram of sentence structure]
Example

- (TOP~Is~1~1 (S~Is~2~2 (NPB~Winnie-the-Pooh~1~1 Winnie-the-Pooh/NNP ) (VP~Is~2~1 Is/VBZ (NPB~Co-worker~2~2 My/PRP$ Co-worker/NN ./ PUNC. ) ) ) )

- (TOP~is~1~1 (S~is~3~1 (S~is~2~2 (NP~A~Winnie~2~1 (NPB~Winnie~1~1 Winnie/NNP ) (NPB~Pooh~2~2 the/DT Pooh/NNP ) ) (VP~is~3~1 is/VBZ (NPB~little~2~2 a/DT little,/NN ) (ADJP~adorable~1~1 adorable/JJ ) ) ) and/CC (S~obsessed~2~2 (NPB~bear~2~2 cute/JJ bear/NN ) (VP~obsessed~2~1 obsessed/VBN (PP~by~2~1 by/IN (NPB~honey~1~1 honey/NN ./ PUNC. ) ) ) ) ) )

bad parse!
Example

- (TOP~is~1~1 (S~is~2~2 (NP-A~Winnie~2~1 (NPB~Winnie~1~1 Winnie/NNP ) (NPB~Pooh~2~2 the/DT Pooh/NNP ) ) (VP~is~3~1 is/VBZ (NP-A~one~2~1 (NPB~one~1~1 one/CD ) (PP~of~2~1 of/IN (NPB~things~2~2 the/DT things/NNS ) ) ) (ADJP~closest~3~2 most/RBS closest/ JJ (PP~to~2~1 to/TO (NPB~heart~2~2 my/PRP$ heart/NN ./PUNC. ) ) ) ) )

- (TOP~is~1~1 (S~is~2~2 (NPB~Winnie-the-Pooh~1~1 Winnie-the-Pooh/NNP ) (VP~is~2~1 is/VBZ (ADJP~fat~2~2 so/RB fat/JJ ./PUNC. ) ) ) )

- (TOP~is~1~1 (S~is~2~2 (NP-A~Winnie~2~1 (NPB~Winnie~1~1 Winnie/NNP ) (NPB~Pooh~2~2 the/DT Pooh/ NNP ) ) (VP~is~2~1 is/VBZ (NPB~self~4~4 his/PRP$ usual/JJ befuddled/JJ self/NN ./PUNC. ) ) ) )

- (TOP~is~1~1 (S~is~2~2 (NP-A~Winnie~2~1 (NPB~Winnie~1~1 Winnie/NNP ) (NPB~Pooh~2~2 the/DT Pooh/ NNP ) ) (VP~is~2~1 is/VBZ (NPB~self~4~4 his/PRP$ usual/JJ befuddled/JJ self/NN ./PUNC. ) ) ) )
Example

• Original declarative form:
  – winnie the pooh is ____ (species)

• Check semantic relatedness of extracted head words using WordNet:
  – character
  – co-worker
  – little
  – one
  – self

• Here, look at shortest paths

• bear (not found)
  1. bear/n is in [bear]
  2. [bear] is a member holonym of [Ursidae,family_Ursidae]
  3. [Ursidae,family_Ursidae] is an instance of [mammal_family]
  4. [mammal_family] is an instance of [family]
  5. [family] is an instance of [taxonomic_group,taxon]
  6. [species] is an instance of [taxonomic_group,taxon]
  – Number of nodes visited: 9258
Example

• character
  1. character/n is in [quality,character,lineament]
  2. [quality,character,lineament] is an instance of [property,attribute,dimension]
  3. [property,attribute,dimension] is an instance of [concept,conception,construct]
  4. [category] is an instance of [concept,conception,construct]
  5. [kind,sort,form,variety] is an instance of [category]
  6. [species] is an instance of [kind,sort,form,variety]
  – Number of nodes visited: 10072

• co-worker
  1. co-worker/n is in [colleague,co-worker,fellow_worker,workfellow]
  2. [colleague,co-worker,fellow_worker,workfellow] is an instance of [associate]
  3. [associate] is a member holonym of [association]
  4. [club,society,guild,gild,lodge,order] is an instance of [association]
  5. order and order/n related by noun.group
  6. [order] is an instance of [taxonomic_group,taxon]
  7. [species] is an instance of [taxonomic_group,taxon]
  – Number of nodes visited: 6488
Example

- **little**
  1. little/n is in [little]
  2. [little] is an instance of [small_indefinite_quantity, small_indefinite_amount]
  3. [helping, portion, serving] is an instance of [small_indefinite_quantity, small_indefinite_amount]
  4. [drumstick] is an instance of [helping, portion, serving]
  5. [drumstick] is a part holonym of [bird, fowl]
  6. [bird, fowl] is a part holonym of [bird]
  7. [bird] is a member holonym of [Aves, class_Aves]
  8. [Aves, class_Aves] is an instance of [class]
  9. [class] is an instance of [taxonomic_group, taxon]
  10. [species] is an instance of [taxonomic_group, taxon]

- **one**
  1. one/n is in [one]
  2. [one] is an instance of [unit]
  3. [unit] is an instance of [whole]
  4. [whole] is an instance of [concept, conception, construct]
  5. [category] is an instance of [concept, conception, construct]
  6. [kind, sort, form, variety] is an instance of [category]
  7. [species] is an instance of [kind, sort, form, variety]

– Number of nodes visited: 734

– Number of nodes visited: 28706
Example

- `self`
  1. `self/n` is in `[self]`
  2. `[self]` is an instance of `[person,individual,someone,somebody,mortal,human,soul]`
  3. `[person,individual,someone,somebody,mortal,human,soul]` is a member holonym of `[people]`
  4. `[people]` is an instance of `[group,grouping]`
  5. `[biological_group]` is an instance of `[group,grouping]`
  6. `[taxonomic_group,taxon]` is an instance of `[biological_group]`
  7. `[species]` is an instance of `[taxonomic_group,taxon]`

- Number of nodes visited: 14456

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<th>Summary</th>
<th>Headword</th>
<th>Length</th>
<th>#nodes</th>
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<td>–little</td>
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Constraints:
- `length < #nodes`
Example 2

Google search for "winnie the pooh is"

About 292,000 results (0.48 seconds)

Milne named the character Winnie-the-Pooh for a teddy bear owned by his son, Christopher Robin Milne, who was the basis for the character Christopher Robin.

Winnie-the-Pooh - Wikipedia, the free encyclopedia

Winnie-the-Pooh - Wikipedia, the free encyclopedia
Example 2

Stanford Parser

Please enter a sentence to be parsed:
Winnie-the-Pooh, also called Pooh Bear, is a fictional anthropomorphic teddy bear created by A. A. Milne.

Language: English  Sample Sentence  Parse

Your query

Winnie-the-Pooh, also called Pooh Bear, is a fictional anthropomorphic teddy bear created by A. A. Milne.

Tagging

Winnie-the-Pooh/NNP ,/, also/IN called/VBN Pooh/NNP bear/NNP ,/, is/VBZ a/DT fictional/JJ anthropomorphic/JJ teddy/NN bear/NN created/VBN by/IN A./NNP A./NNP Milne/NNP ./.
Example 2

Parse

(ROOT
  (S
    (NP
      (NP (NNP Winnie-the-Pooh))
      (, ,)
      (VP
        (ADVP (RB also))
        (VBN called)
        (S
          (NP (NNP Pooh) (NNP Bear)))
        (, ,))
      (VP (VBZ is)
        (NP
          (NP (DT a) (JJ fictional) (JJ anthropomorphinc) (NN teddy) (NN bear))
          (VP (VBN created)
            (PP (IN by)
              (NP (NNP A.) (NNP A.) (NNP Milne)))
            (, .))))
    (, .)
  ))
)
Example 2

Winnie-the-Pooh, also called Pooh Bear, is a fictional anthropomorphic teddy bear created by A. A. Milne.