Doesn’t Google know everything?

What animal does a cat eat?

What animal does a cat eat

About 10,700,000 results (0.24 seconds)

What wild animal would eat a domestic cat or dog? - Yahoo!7 Answers
Aug 21, 2008 ... I went outside to get my kitty in a few minutes ago and couldn't ... I hope it's not what you think, I really do. But there are wild animals ... au.answers.yahoo.com › Pets › Cats - Cached - Similar

What If my cat eats rawhide? - 2 answers - Aug 14, 2010

More results from au.answers.yahoo.com »

WikiAnswers - What animal eats cat
Wild Animals question: What animal eats cat? Mountain lions do, as will coyotes. I've heard of bobcats eating cats too, but i'm not sure it's true.
wiki.answers.com/Q/What_animal_eats_cat - Cached - Similar
Even Key Word Queries

- Paris Hilton -- not easy to book! (vs. Boston Hilton)
Ambiguity

Where can I spot a snow leopard?

Where can I spot a snow leopard
About 27,400,000 results (0.19 seconds)

Apple - Mac OS X Snow Leopard - The world's most advanced OS
To advance Mac OS X Leopard, Apple engineers went deep into the code to streamline, secure, and add new core technologies.
Buy Mac OS X Snow Leopard now. - Compatibility - Desktop
www.apple.com/macosx/ - Cached - Similar

Snow Leopard - Wikipedia, the free encyclopedia
The snow leopard (Uncia uncia) is a moderately large cat native to the ... their body with small spots of the same color on their heads and larger spots on ...
Taxonomy - Etymology - Distribution - Ecology and behaviour
en.wikipedia.org/wiki/Snow_Leopard - Cached - Similar

Mac OS X Snow Leopard - Wikipedia, the free encyclopedia
Mac OS X Snow Leopard (version 10.6) is the seventh and current major release of Mac OS X, Apple's desktop and server certified Unix operating system. ...
en.wikipedia.org/wiki/Mac_OS_X_Snow_Leopard - Cached - Similar
More about Ambiguities

• to middle school kids: what does this sentence mean?

I saw her duck.

Aravind Joshi
to middle school kids: what does this sentence mean?

I saw her duck.

Aravind Joshi
More about Ambiguities

- to middle school kids: what does this sentence mean?

I saw her duck.

Aravind Joshi

lexical ambiguity (word-sense)
More about Ambiguities

- to middle school kids: what does this sentence mean?

I eat sushi with tuna.

Aravind Joshi
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structural ambiguity (PP-attachment)
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lexical ambiguity (word-sense)
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- to middle school kids: what does this sentence mean?

Everybody loves somebody.

???
More about Ambiguities

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Everybody loves somebody.

???

structural ambiguity
(quantifier scope)
More about Ambiguities

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Buffalo buffalo Buffalo buffalo buffalo buffalo Buffalo buffalo

Aravind Joshi
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http://www.cse.buffalo.edu/~rapaport/BuffaloBuffalo/buffalobuffalo.html
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Dogs dogs dog dog dogs.

Police police police police police police

Aravind Joshi

http://www.cse.buffalo.edu/~rapaport/BuffaloBuffalo/buffalobuffalo.html
Ambiguities in Translation

self help terminal device
Ambiguities in Translation

Slip carefully
Ambiguities in Translation
Ambiguities in Translation

- 小心滑落
  Slip carefully
- 安全出口
  The safety export
- 注意安全!
  TAKE CARE!
- 小心落水!
  FALL INTO WATER CAREFULLY!
Ambiguities in Translation

-小心滑落 (Slip carefully)
-安全出口 (The safety export)
-有毒有害垃圾 (Poisonous & Evil Rubbish)
-小心落水 (Fall into water carefully)
-注意安全! (TAKE CARE!)

Images show signs with potentially misleading translations.
If you are stolen...

一旦失窃要报警，切莫姑息养奸
If you are stolen, call the police at once.
or even...
or even...

clear evidence that NLP is used in real life!
Grammar

SBARQ

WHNP

What animal

SINV

VBZ NP VP

does a cat VB NP

eat t
PP Attachment Ambiguity
One morning in Africa,
I shot an elephant in my pajamas;
One morning in Africa,
I shot an elephant in my pajamas;
how he got into my pajamas I’ll never know.
PP Attachment Ambiguity

One morning in Africa,
I shot an elephant in my pajamas;
how he got into my pajamas I’ll never know.
I saw her duck.
I saw her duck.

- how about...
  - I saw her duck with a telescope.
  - I saw her duck with a telescope in the garden...
Ambiguity Explosion

- exponential explosion of the search space

- Q1: how to represent ambiguities (compactly)?

- Q2: how to search over this space (efficiently)?

- Q3: how to rank different hypotheses?

\[
\begin{align*}
S & \rightarrow NP \\
NP & \rightarrow PRP \\
NP & \rightarrow VBD NP \\
VBD & \rightarrow IN NP \\
IN & \rightarrow PP NP \\
PP & \rightarrow PRP$ \rightarrow NN IN DT NN \\
& \rightarrow saw her duck with a telescope
\end{align*}
\]
Answers...

- **Q1:** how to represent ambiguities?
  - context-free grammar (unit 2)
  - finite-state automata (unit 1)

- **Q2:** how to search in this space?
  - dynamic programming (units 1&2)

- **Q3:** how to rank these hypotheses?
  - weighted grammar (units 1-3)
  - weights learned from data
    - (saw, with, telescope) seen more often in texts
Why Learning?

learning is better than hand-written rules, because:

- less work; easily adapts to new languages/domains
  - Powerset (now bing.com): 15 years for English grammar!
  - now they are writing their Chinese grammar...
  - and languages constantly change!

learning can work, and often works better!

- machine translation: used to be dominated by rule-based
  - now statistical methods are better: google vs. systran
  - google learns from the web, and translates 40+ langs
Example - Rosetta Stone

- the most famous (tri-)parallel text
- machines can do the same job! (if given parallel text)
  - UN/EU/Ca proceedings, News, tech manuals, ...
Take Home Message

• languages are *beyond* just bags of words!
  • ambiguity is everywhere, and NLP is all about that
• we’ll teach machines how to read and translate...
  • and how to *learn* to read and translate from data
• have fun in this class! :)