Natural Language Processing
SoSe 2015

Hasso Plattner Institut
IT Systems Engineering | Universität Potsdam

Introduction to Language Technology

Dr. Mariana Neves

April 13th, 2015

(based on the slides of Dr. Saeedeh Momtazi)

Outline

- Introduction to NLP
- NLP Applications
- NLP Techniques
- Linguistic Knowledge
- Challenges
- NLP course

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- NLP Applications
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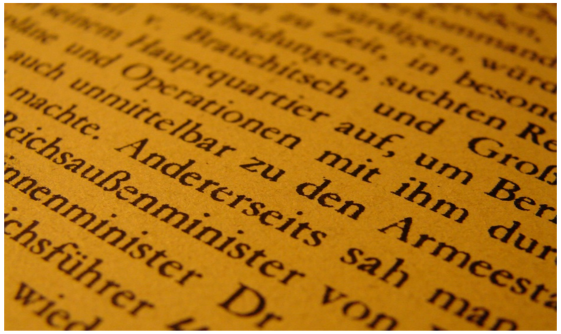
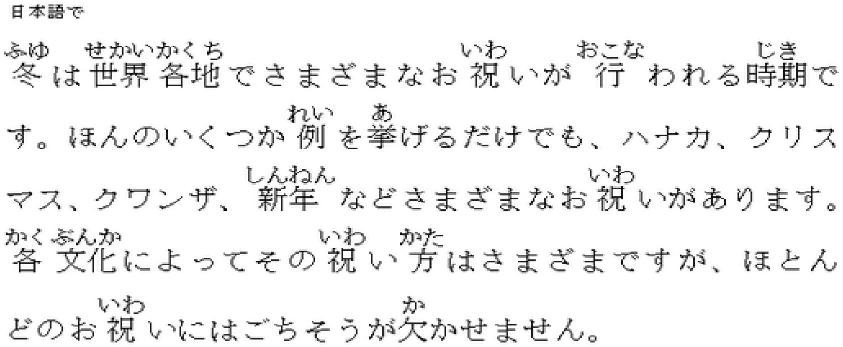
Types of Language

- Natural languages


zu Zeit, in besond
würdigen, würd
v. Brauchitsch und Groß
Hauptquartier auf, um Ber
und Operationen mit ihm dur
auch unmittelbar zu den Armeesta
machte. Andererseits sah man
Reichsaußenminister von
nnenminister
chsführer Dr
wied

(http://expertenough.com/2392/german-language-hacks)

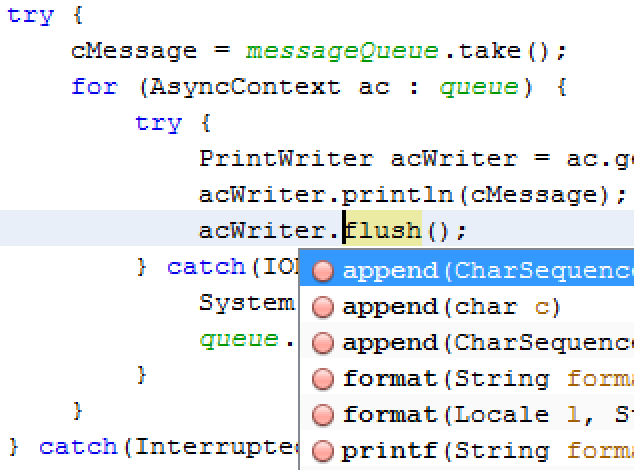


日本語で

冬は世界各地でさまざまなお祝いが行われる時期です。ほんのいくつか例を挙げるだけでも、ハナカ、クリスマス、クワンザ、新年などさまざまなお祝いがあります。各文化によってその祝い方はさまざまですが、ほとんどのお祝いにはごちそうが欠かせません。

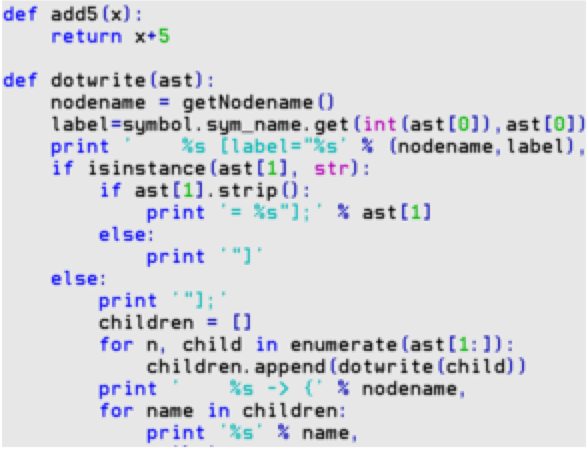
(http://www.transparent.com/learn-japanese/articles/dec_99.html)

- Programming languages



```
try {
    cMessage = messageQueue.take();
    for (AsyncContext ac : queue) {
        try {
            PrintWriter acWriter = ac.g
            acWriter.println(cMessage);
            acWriter.flush();
        } catch(IO
            System
            queue.
        }
    }
} catch(Interrupte
```

(https://netbeans.org/features/java/)



```
def add5(x):
    return x+5

def dotwrite(ast):
    nodename = getNodename()
    label=symbol.sym_name.get(int(ast[0]),ast[0])
    print '    %s [label="%s' % (nodename, label),
    if isinstance(ast[1], str):
        if ast[1].strip():
            print '= %s"];' % ast[1]
        else:
            print '"]'
    else:
        print '"];'
        children = []
        for n, child in enumerate(ast[1:]):
            children.append(dotwrite(child))
        print '    %s -> {' % nodename,
        for name in children:
            print '%s' % name,
```

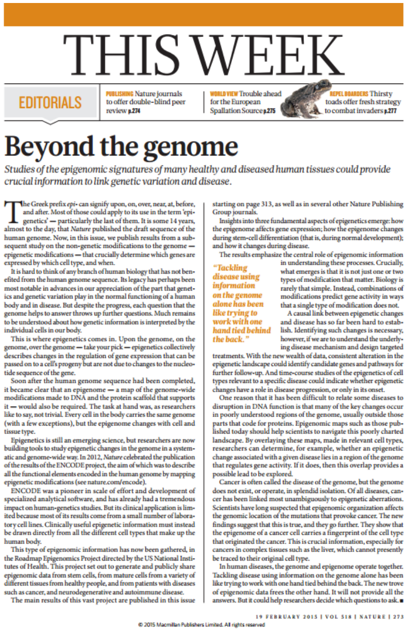
(http://noobite.com/learn-programming-start-with-python/)

Natural Language

A vocabulary consists of a set of words (w_i)

(http://learnenglish.britishcouncil.org/en/vocabulary-games)

A text is composed of a sequence of words from a vocabulary



THIS WEEK

EDITORIALS

PUBLISHING Nature journals to offer double-blind peer review p.274

WORLD VIEW Trouble ahead for the European Spallation Source p.275

REPEL BOARDERS Thirsty toads offer fresh strategy to combat invaders p.277

Beyond the genome

Studies of the epigenomic signatures of many healthy and diseased human tissues could provide crucial information to link genetic variation and disease.

The Greek prefix *epi-* can signify upon, on, over, near, at, before, and after. Most of those could apply to its use in the term 'epigenetics' — particularly the last of them. It is some 14 years, almost to the day, that *Nature* published the draft sequence of the human genome. Now, in this issue, we publish results from a subsequent study on the non-genetic modifications to the genome — epigenetic modifications — that crucially determine which genes are expressed by which cell type, and when.

It is hard to think of any branch of human biology that has not benefited from the human genome sequence. Its legacy has perhaps been most notable in advances in our appreciation of the part that genetics and genetic variation play in the normal functioning of a human body and in disease. But despite the progress, each question that the genome helps to answer throws up further questions. Much remains to be understood about how genetic information is interpreted by the individual cells in our body.

This is where epigenetics comes in. Upon the genome, on the genome, over the genome — take your pick — epigenetics collectively describes changes in the regulation of gene expression that can be passed on to a cell's progeny but are not due to changes to the nucleotide sequence of the gene.

Soon after the human genome sequence had been completed, it became clear that an epigenome — a map of the genome-wide modifications made to DNA and the protein scaffold that supports it — would also be required. The task at hand was, as researchers like to say, not trivial. Every cell in the body carries the same genome (with a few exceptions), but the epigenome changes with cell and tissue type.

Epigenetics is still an emerging science, but researchers are now building tools to study epigenetic changes in the genome in a systematic and genome-wide way. In 2012, *Nature* celebrated the publication of the results of the ENCODE project, the aim of which was to describe all the functional elements encoded in the human genome by mapping epigenetic modifications (see nature.com/encode).

ENCODE was a pioneer in scale of effort and development of specialized analytical software, and has already had a tremendous impact on human-genetics studies. But its clinical application is limited because most of its results come from a small number of laboratory cell lines. Clinically useful epigenetic information must instead be drawn directly from all the different cell types that make up the human body.

This type of epigenomic information has now been gathered, in the Roadmap Epigenomics Project directed by the US National Institutes of Health. This project set out to generate and publicly share epigenomic data from stem cells, from mature cells from a variety of different tissues from healthy people, and from patients with diseases such as cancer, and neurodegenerative and autoimmune disease.

The main results of this vast project are published in this issue starting on page 313, as well as in several other Nature Publishing Group journals.

Insights into three fundamental aspects of epigenetics emerge: how the epigenome affects gene expression; how the epigenome changes during stem-cell differentiation (that is, during normal development); and how it changes during disease.

The results emphasize the central role of epigenomic information in understanding these processes. Crucially, what emerges is that it is not just one or two types of modification that matter. Biology is rarely that simple. Instead, combinations of modifications predict gene activity in ways that a single type of modification does not.

"Tackling disease using information on the genome alone has been like trying to work with one hand tied behind the back."

A causal link between epigenetic changes and disease has so far been hard to establish. Identifying such changes is necessary, however, if we are to understand the underlying disease mechanism and design targeted treatments. With the new wealth of data, consistent alteration in the epigenetic landscape could identify candidate genes and pathways for further follow-up. And time-course studies of the epigenetics of cell types relevant to a specific disease could indicate whether epigenetic changes have a role in disease progression, or only in its onset.

One reason that it has been difficult to relate some diseases to disruption in DNA function is that many of the key changes occur in poorly understood regions of the genome, usually outside those parts that code for proteins. Epigenomic maps such as those published today should help scientists to navigate this poorly charted landscape. By overlaying these maps, made in relevant cell types, researchers can determine, for example, whether an epigenetic change associated with a given disease lies in a region of the genome that regulates gene activity. If it does, then this overlap provides a possible lead to be explored.

Cancer is often called the disease of the genome, but the genome does not exist, or operate, in splendid isolation. Of all diseases, cancer has been linked most unambiguously to epigenetic aberrations. Scientists have long suspected that epigenomic organization affects the genomic location of the mutations that provoke cancer. The new findings suggest that this is true, and they go further. They show that the epigenome of a cancer cell carries a fingerprint of the cell type that originated the cancer. This is crucial information, especially for cancers in complex tissues such as the liver, which cannot presently be traced to their original cell type.

In human diseases, the genome and epigenome operate together. Tackling disease using information on the genome alone has been like trying to work with one hand tied behind the back. The new trove of epigenomic data frees the other hand. It will not provide all the answers. But it could help researchers decide which questions to ask. ■

19 FEBRUARY 2015 | VOL 518 | NATURE | 273

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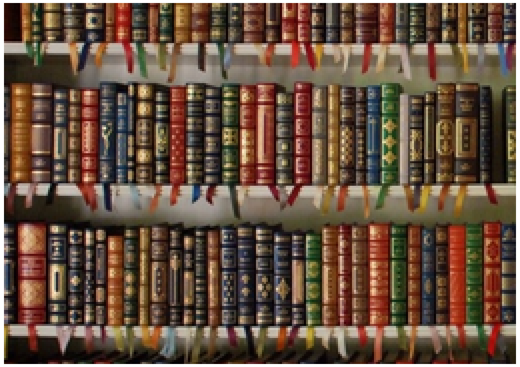
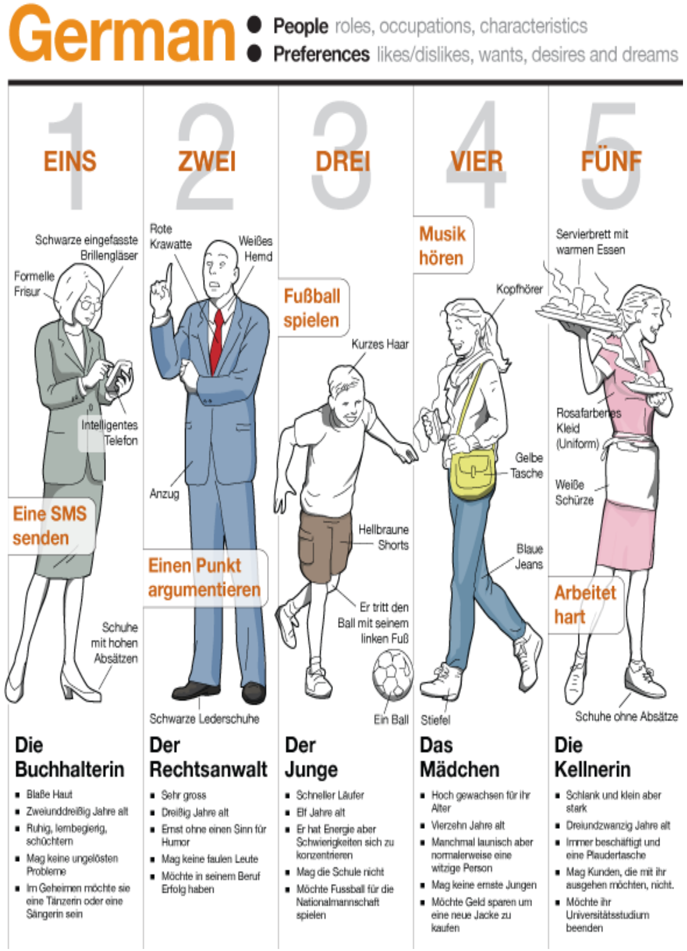
(http://www.nature.com/polopoly_fs/1.16929!/menu/main/topColumns/topLeftColumn/pdf/518273a.pdf)

A language is constructed of a set of all possible texts



(http://www.old-engli.sh/language.php)

Examples of vocabulary



German: ● **People** roles, occupations, characteristics ● **Preferences** likes/dislikes, wants, desires and dreams

Die Buchhalterin

- Blaße Haut
- Zweiunddreißig Jahre alt
- Ruhig, lernbegierig, schüchtern
- Mag keine ungelösten Probleme
- Im Geheimen möchte sie eine Tänzerin oder eine Sängerin sein

Der Rechtsanwalt

- Sehr gross
- Dreißig Jahre alt
- Ernst ohne einen Sinn für Humor
- Mag keine faulen Leute
- Möchte in seinem Beruf Erfolg haben

Der Junge

- Schneller Läufer
- Elf Jahre alt
- Er hat Energie aber Schwierigkeiten sich zu konzentrieren
- Mag die Schule nicht
- Möchte Fussball für die Nationalmannschaft spielen

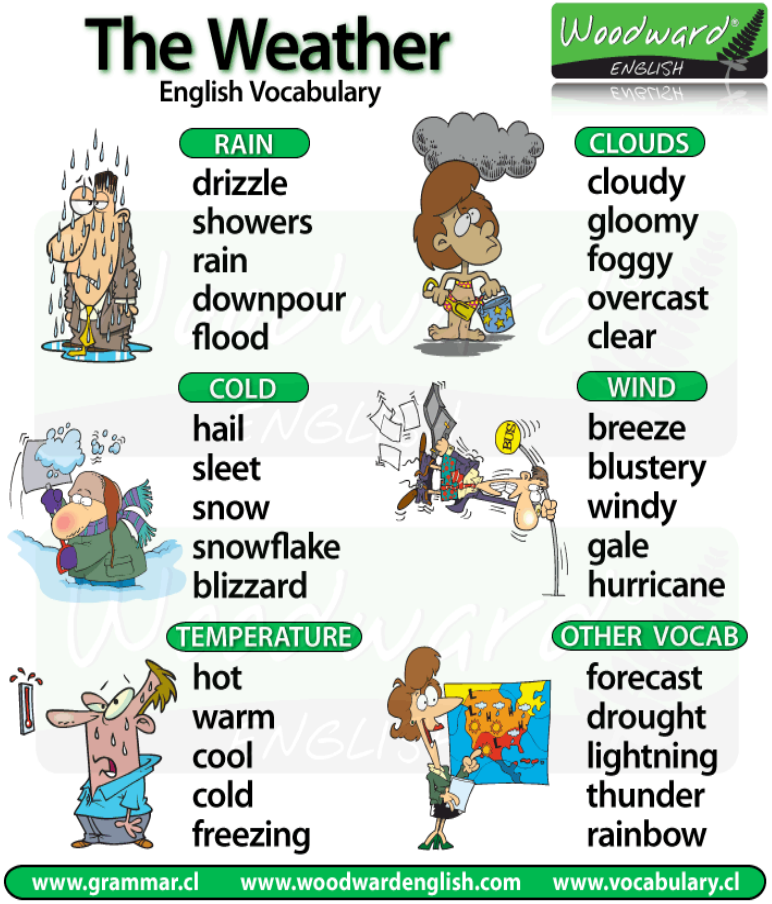
Das Mädchen

- Hoch gewachsen für ihr Alter
- Vierzehn Jahre alt
- Manchmal launisch aber normalerweise eine witzige Person
- Mag keine ernste Jungen
- Möchte Geld sparen um eine neue Jacke zu kaufen

Die Kellnerin

- Schlank und klein aber stark
- Dreiundzwanzig Jahre alt
- Immer beschäftigt und eine Plaudertasche
- Mag Kunden, die mit ihr ausgehen möchten, nicht.
- Möchte ihr Universitätsstudium beenden

(http://linguaposta.com/products/german-people-preferences/)



The Weather
English Vocabulary

RAIN: drizzle, showers, rain, downpour, flood

CLOUDS: cloudy, gloomy, foggy, overcast, clear

COLD: hail, sleet, snow, snowflake, blizzard

WIND: breeze, blustery, windy, gale, hurricane

TEMPERATURE: hot, warm, cool, cold, freezing

OTHER VOCAB: forecast, drought, lightning, thunder, rainbow

www.grammar.cl www.woodwardenglish.com www.vocabulary.cl

(http://www.vocabulary.cl/english/weather.htm)

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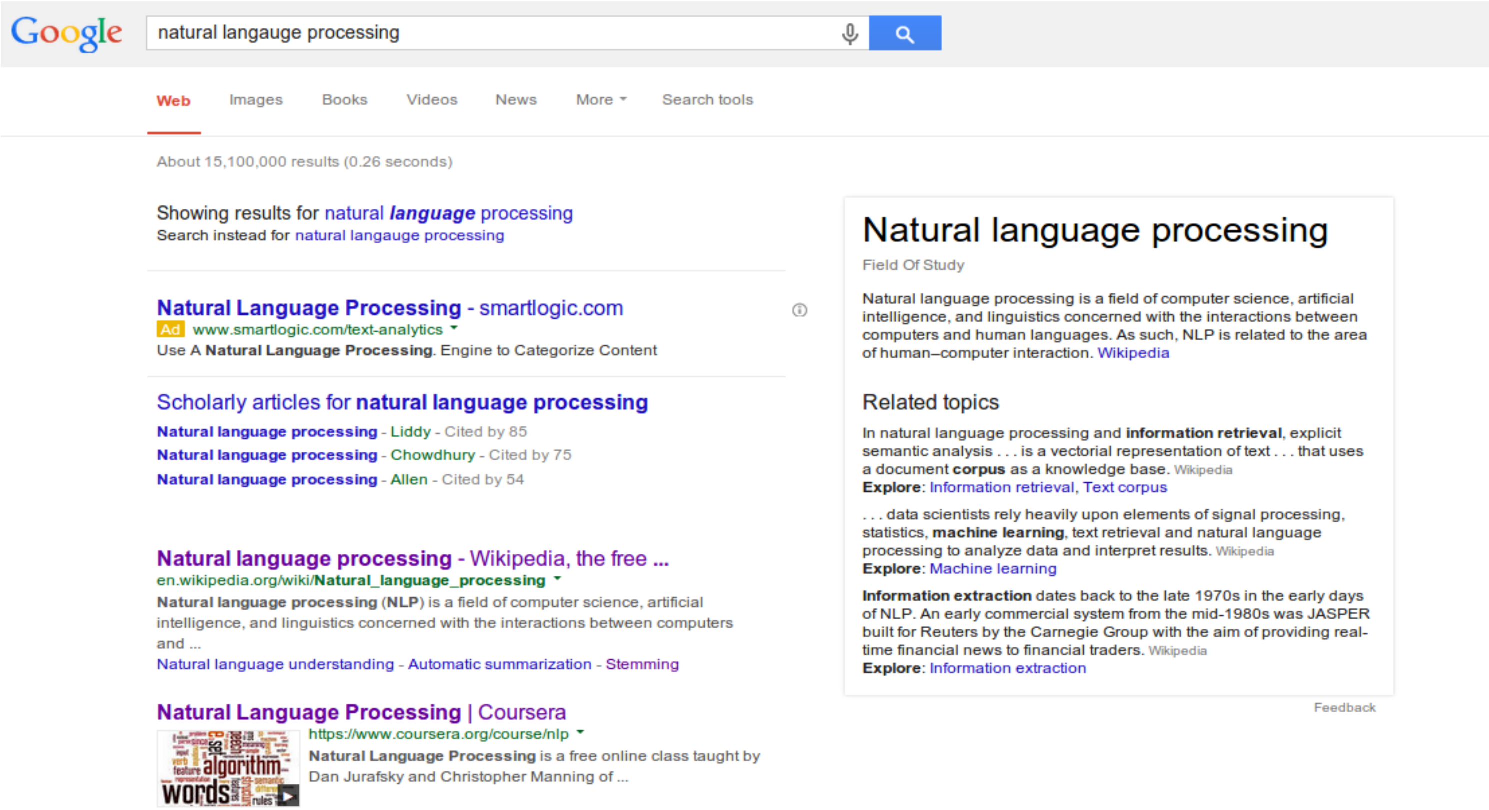
Spell and Grammar Checking

- Checking spelling and grammar of a text
- Suggesting alternatives for the errors



natural langauge processing

About 15,100,000 results (0.26 seconds)

Showing results for natural ***language*** processing
Search instead for natural langauge processing

Natural Language Processing - smartlogic.com
Ad www.smartlogic.com/text-analytics
Use A **Natural Language Processing**. Engine to Categorize Content

Scholarly articles for **natural language processing**
Natural language processing - Liddy - Cited by 85
Natural language processing - Chowdhury - Cited by 75
Natural language processing - Allen - Cited by 54

Natural language processing - Wikipedia, the free ...
en.wikipedia.org/wiki/**Natural_language_processing**
Natural language processing (**NLP**) is a field of computer science, artificial intelligence, and linguistics concerned with the interactions between computers and ...
Natural language understanding - Automatic summarization - Stemming

Natural Language Processing | Coursera
https://www.coursera.org/course/nlp
Natural Language Processing is a free online class taught by Dan Jurafsky and Christopher Manning of ...

Natural language processing
Field Of Study

Natural language processing is a field of computer science, artificial intelligence, and linguistics concerned with the interactions between computers and human languages. As such, NLP is related to the area of human–computer interaction. Wikipedia

Related topics

In natural language processing and **information retrieval**, explicit semantic analysis . . . is a vectorial representation of text . . . that uses a document **corpus** as a knowledge base. Wikipedia
Explore: Information retrieval, Text corpus

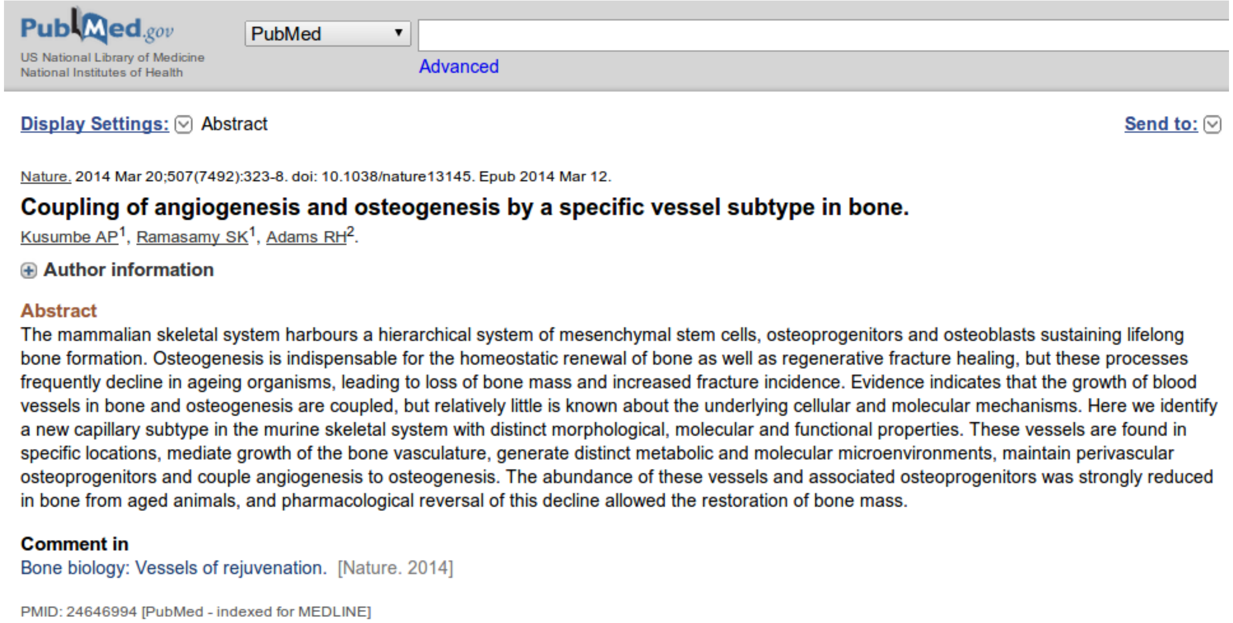
. . . data scientists rely heavily upon elements of signal processing, statistics, **machine learning**, text retrieval and natural language processing to analyze data and interpret results. Wikipedia
Explore: Machine learning

Information extraction dates back to the late 1970s in the early days of NLP. An early commercial system from the mid-1980s was JASPER built for Reuters by the Carnegie Group with the aim of providing real-time financial news to financial traders. Wikipedia
Explore: Information extraction

Feedback

Text Categorization

- Assigning one (or more) pre-defined category to a text



PubMed.gov
US National Library of Medicine
National Institutes of Health
PubMed ▾
Advanced

Display Settings: Abstract

Send to:

Nature. 2014 Mar 20;507(7492):323-8. doi: 10.1038/nature13145. Epub 2014 Mar 12.

Coupling of angiogenesis and osteogenesis by a specific vessel subtype in bone.

Kusumbe AP[1], Ramasamy SK[1], Adams RH[2].

Author information

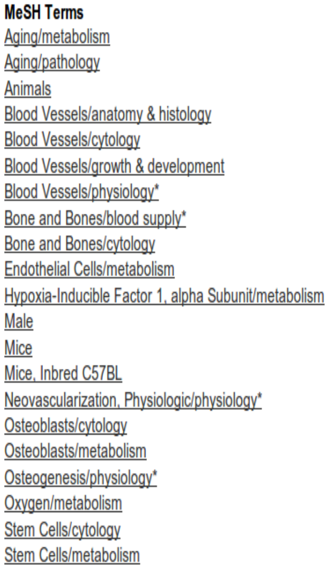
Abstract

The mammalian skeletal system harbours a hierarchical system of mesenchymal stem cells, osteoprogenitors and osteoblasts sustaining lifelong bone formation. Osteogenesis is indispensable for the homeostatic renewal of bone as well as regenerative fracture healing, but these processes frequently decline in ageing organisms, leading to loss of bone mass and increased fracture incidence. Evidence indicates that the growth of blood vessels in bone and osteogenesis are coupled, but relatively little is known about the underlying cellular and molecular mechanisms. Here we identify a new capillary subtype in the murine skeletal system with distinct morphological, molecular and functional properties. These vessels are found in specific locations, mediate growth of the bone vasculature, generate distinct metabolic and molecular microenvironments, maintain perivascular osteoprogenitors and couple angiogenesis to osteogenesis. The abundance of these vessels and associated osteoprogenitors was strongly reduced in bone from aged animals, and pharmacological reversal of this decline allowed the restoration of bone mass.

Comment in

Bone biology: Vessels of rejuvenation. [Nature. 2014]

PMID: 24646994 [PubMed - indexed for MEDLINE]

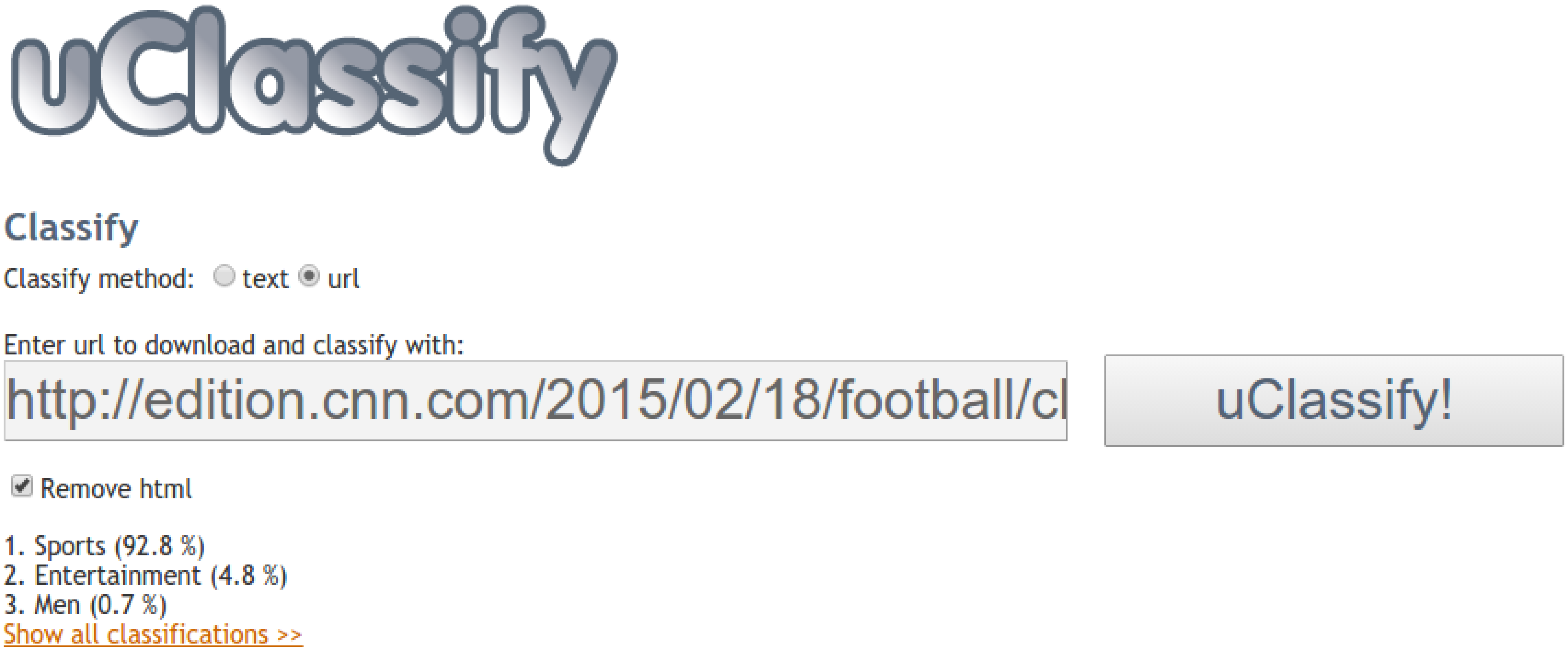


MeSH Terms

- Aging/metabolism
- Aging/pathology
- Animals
- Blood Vessels/anatomy & histology
- Blood Vessels/cytology
- Blood Vessels/growth & development
- Blood Vessels/physiology*
- Bone and Bones/blood supply*
- Bone and Bones/cytology
- Endothelial Cells/metabolism
- Hypoxia-Inducible Factor 1, alpha Subunit/metabolism
- Male
- Mice
- Mice, Inbred C57BL
- Neovascularization, Physiologic/physiology*
- Osteoblasts/cytology
- Osteoblasts/metabolism
- Osteogenesis/physiology*
- Oxygen/metabolism
- Stem Cells/cytology
- Stem Cells/metabolism

Text Categorization

- Assigning one (or more) pre-defined category to a text



Classify

Classify method: ○ text ● url

Enter url to download and classify with:

http://edition.cnn.com/2015/02/18/football/cl

☑ Remove html

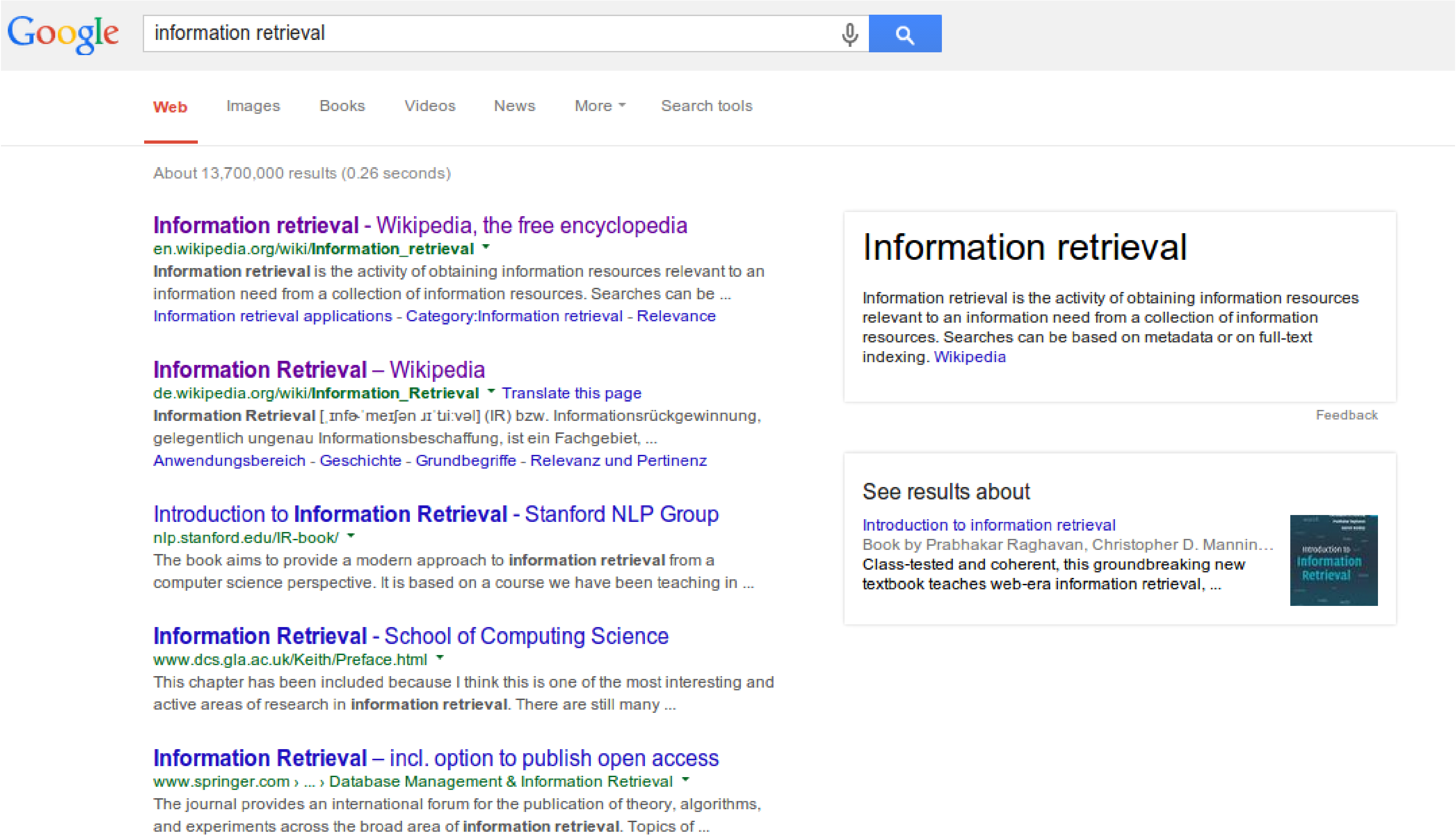
1. Sports (92.8 %)
2. Entertainment (4.8 %)
3. Men (0.7 %)

Show all classifications >>

http://www.uclassify.com/browse/mvazquez/News-Classifier

Information Retrieval

- Finding relevant information to the user’s query



About 13,700,000 results (0.26 seconds)

Information retrieval - Wikipedia, the free encyclopedia
en.wikipedia.org/wiki/**Information_retrieval**
Information retrieval is the activity of obtaining information resources relevant to an information need from a collection of information resources. Searches can be ...
Information retrieval applications - Category:Information retrieval - Relevance

Information Retrieval – Wikipedia
de.wikipedia.org/wiki/**Information_Retrieval** Translate this page
Information Retrieval [ˌɪnfɐˈmeɪʃən ɹɪˈtɹiːvəl] (IR) bzw. Informationsrückgewinnung, gelegentlich ungenau Informationsbeschaffung, ist ein Fachgebiet, ...
Anwendungsbereich - Geschichte - Grundbegriffe - Relevanz und Pertinenz

Introduction to **Information Retrieval** - Stanford NLP Group
nlp.stanford.edu/IR-book/
The book aims to provide a modern approach to **information retrieval** from a computer science perspective. It is based on a course we have been teaching in ...

Information Retrieval - School of Computing Science
www.dcs.gla.ac.uk/Keith/Preface.html
This chapter has been included because I think this is one of the most interesting and active areas of research in **information retrieval**. There are still many ...

Information Retrieval – incl. option to publish open access
www.springer.com › ... › Database Management & Information Retrieval
The journal provides an international forum for the publication of theory, algorithms, and experiments across the broad area of **information retrieval**. Topics of ...

Information retrieval

Information retrieval is the activity of obtaining information resources relevant to an information need from a collection of information resources. Searches can be based on metadata or on full-text indexing. Wikipedia

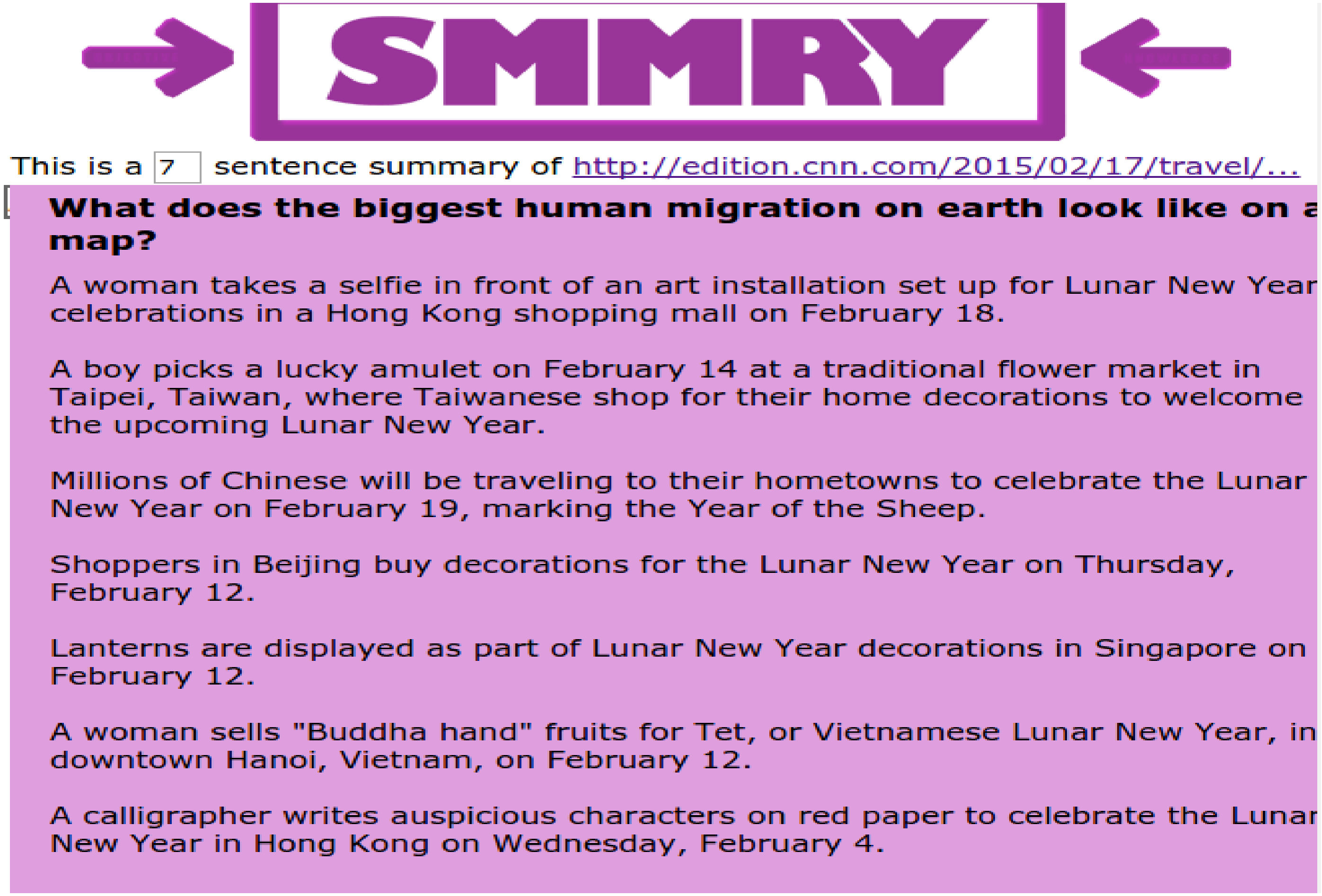
Feedback

See results about

Introduction to information retrieval
Book by Prabhakar Raghavan, Christopher D. Mannin...
Class-tested and coherent, this groundbreaking new textbook teaches web-era information retrieval, ...

Summarization

- Generating a short summary from one or more documents, sometimes based on a given query



This is a 7 sentence summary of http://edition.cnn.com/2015/02/17/travel/...

What does the biggest human migration on earth look like on a map?

A woman takes a selfie in front of an art installation set up for Lunar New Year celebrations in a Hong Kong shopping mall on February 18.

A boy picks a lucky amulet on February 14 at a traditional flower market in Taipei, Taiwan, where Taiwanese shop for their home decorations to welcome the upcoming Lunar New Year.

Millions of Chinese will be traveling to their hometowns to celebrate the Lunar New Year on February 19, marking the Year of the Sheep.

Shoppers in Beijing buy decorations for the Lunar New Year on Thursday, February 12.

Lanterns are displayed as part of Lunar New Year decorations in Singapore on February 12.

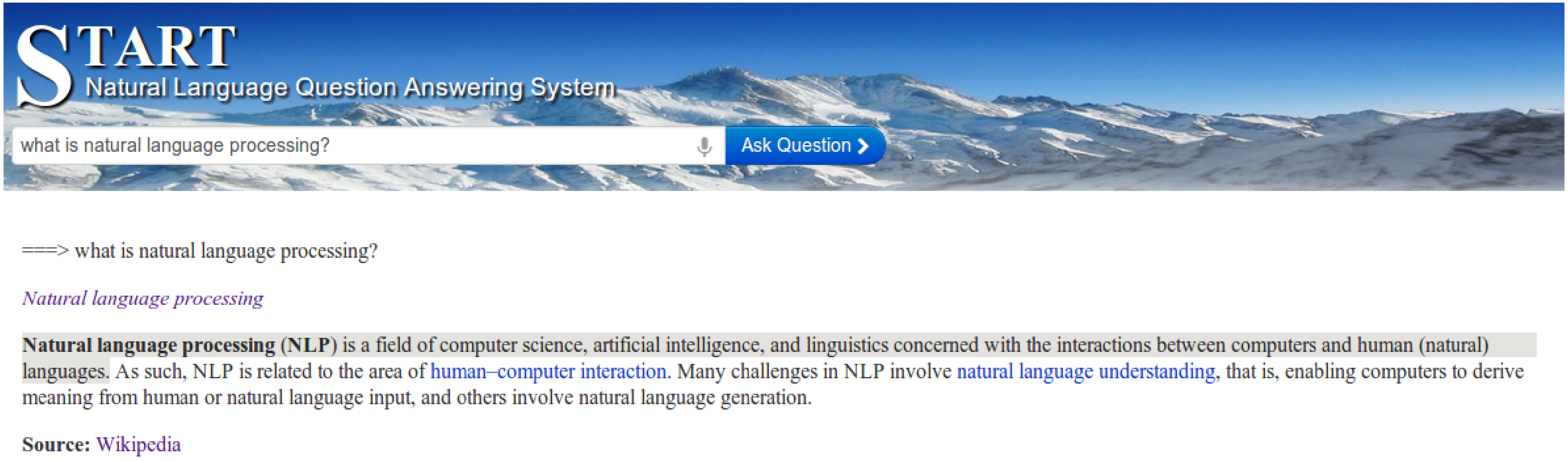
A woman sells "Buddha hand" fruits for Tet, or Vietnamese Lunar New Year, in downtown Hanoi, Vietnam, on February 12.

A calligrapher writes auspicious characters on red paper to celebrate the Lunar New Year in Hong Kong on Wednesday, February 4.

http://smmry.com/ ⭐

Summarization

- Generating a short summary from one or more documents, sometimes based on a given query


START
Natural Language Question Answering System
what is natural language processing?
Ask Question

===> what is natural language processing?

Natural language processing

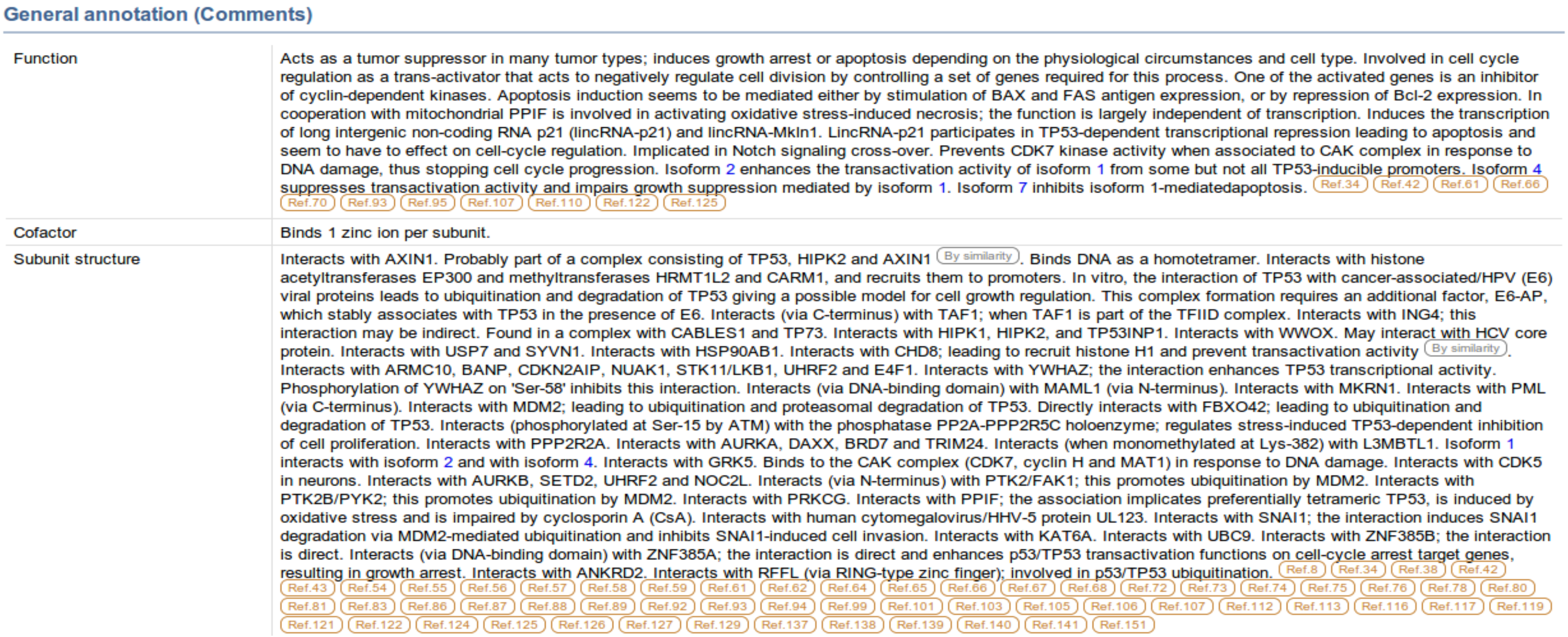
Natural language processing (**NLP**) is a field of computer science, artificial intelligence, and linguistics concerned with the interactions between computers and human (natural) languages. As such, NLP is related to the area of human–computer interaction. Many challenges in NLP involve natural language understanding, that is, enabling computers to derive meaning from human or natural language input, and others involve natural language generation.

Source: Wikipedia

http://start.csail.mit.edu/index.php

Summarization

- Generating a short summary from one or more documents, sometimes based on a given query

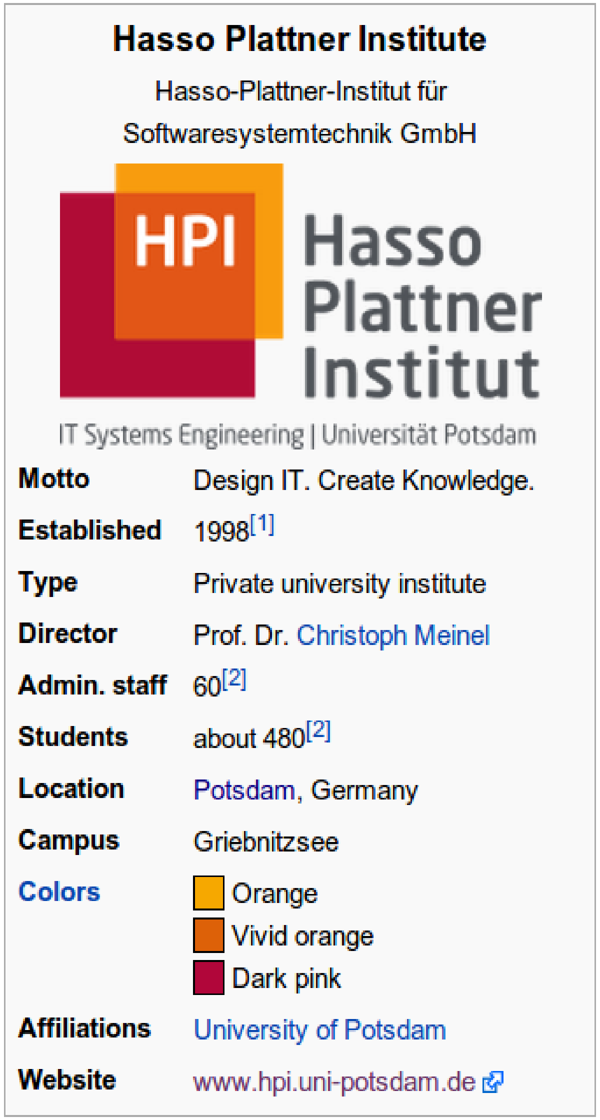


General annotation (Comments)

Function	Acts as a tumor suppressor in many tumor types; induces growth arrest or apoptosis depending on the physiological circumstances and cell type. Involved in cell cycle regulation as a trans-activator that acts to negatively regulate cell division by controlling a set of genes required for this process. One of the activated genes is an inhibitor of cyclin-dependent kinases. Apoptosis induction seems to be mediated either by stimulation of BAX and FAS antigen expression, or by repression of Bcl-2 expression. In cooperation with mitochondrial PPIF is involved in activating oxidative stress-induced necrosis; the function is largely independent of transcription. Induces the transcription of long intergenic non-coding RNA p21 (lincRNA-p21) and lincRNA-MkIn1. LincRNA-p21 participates in TP53-dependent transcriptional repression leading to apoptosis and seem to have to effect on cell-cycle regulation. Implicated in Notch signaling cross-over. Prevents CDK7 kinase activity when associated to CAK complex in response to DNA damage, thus stopping cell cycle progression. Isoform 2 enhances the transactivation activity of isoform 1 from some but not all TP53-inducible promoters. Isoform 4 suppresses transactivation activity and impairs growth suppression mediated by isoform 1. Isoform 7 inhibits isoform 1-mediatedapoptosis. Ref.34 Ref.42 Ref.61 Ref.66 Ref.70 Ref.93 Ref.95 Ref.107 Ref.110 Ref.122 Ref.125
Cofactor	Binds 1 zinc ion per subunit.
Subunit structure	Interacts with AXIN1. Probably part of a complex consisting of TP53, HIPK2 and AXIN1 By similarity. Binds DNA as a homotetramer. Interacts with histone acetyltransferases EP300 and methyltransferases HRMT1L2 and CARM1, and recruits them to promoters. In vitro, the interaction of TP53 with cancer-associated/HPV (E6) viral proteins leads to ubiquitination and degradation of TP53 giving a possible model for cell growth regulation. This complex formation requires an additional factor, E6-AP, which stably associates with TP53 in the presence of E6. Interacts (via C-terminus) with TAF1; when TAF1 is part of the TFIID complex. Interacts with ING4; this interaction may be indirect. Found in a complex with CABLES1 and TP73. Interacts with HIPK1, HIPK2, and TP53INP1. Interacts with WWOX. May interact with HCV core protein. Interacts with USP7 and SYVN1. Interacts with HSP90AB1. Interacts with CHD8; leading to recruit histone H1 and prevent transactivation activity By similarity. Interacts with ARMC10, BANP, CDKN2AIP, NUAK1, STK11/LKB1, UHRF2 and E4F1. Interacts with YWHAZ; the interaction enhances TP53 transcriptional activity. Phosphorylation of YWHAZ on 'Ser-58' inhibits this interaction. Interacts (via DNA-binding domain) with MAML1 (via N-terminus). Interacts with MKRN1. Interacts with PML (via C-terminus). Interacts with MDM2; leading to ubiquitination and proteasomal degradation of TP53. Directly interacts with FBXO42; leading to ubiquitination and degradation of TP53. Interacts (phosphorylated at Ser-15 by ATM) with the phosphatase PP2A-PPP2R5C holoenzyme; regulates stress-induced TP53-dependent inhibition of cell proliferation. Interacts with PPP2R2A. Interacts with AURKA, DAXX, BRD7 and TRIM24. Interacts (when monomethylated at Lys-382) with L3MBTL1. Isoform 1 interacts with isoform 2 and with isoform 4. Interacts with GRK5. Binds to the CAK complex (CDK7, cyclin H and MAT1) in response to DNA damage. Interacts with CDK5 in neurons. Interacts with AURKB, SETD2, UHRF2 and NOC2L. Interacts (via N-terminus) with PTK2/FAK1; this promotes ubiquitination by MDM2. Interacts with PTK2B/PYK2; this promotes ubiquitination by MDM2. Interacts with PRKCG. Interacts with PPIF; the association implicates preferentially tetrameric TP53, is induced by oxidative stress and is impaired by cyclosporin A (CsA). Interacts with human cytomegalovirus/HHV-5 protein UL123. Interacts with SNAI1; the interaction induces SNAI1 degradation via MDM2-mediated ubiquitination and inhibits SNAI1-induced cell invasion. Interacts with KAT6A. Interacts with UBC9. Interacts with ZNF385B; the interaction is direct. Interacts (via DNA-binding domain) with ZNF385A; the interaction is direct and enhances p53/TP53 transactivation functions on cell-cycle arrest target genes, resulting in growth arrest. Interacts with ANKRD2. Interacts with RFFL (via RING-type zinc finger); involved in p53/TP53 ubiquitination. Ref.8 Ref.34 Ref.38 Ref.42 Ref.43 Ref.54 Ref.55 Ref.56 Ref.57 Ref.58 Ref.59 Ref.61 Ref.62 Ref.64 Ref.65 Ref.66 Ref.67 Ref.68 Ref.72 Ref.73 Ref.74 Ref.75 Ref.76 Ref.78 Ref.80 Ref.81 Ref.83 Ref.86 Ref.87 Ref.88 Ref.89 Ref.92 Ref.93 Ref.94 Ref.99 Ref.101 Ref.103 Ref.105 Ref.106 Ref.107 Ref.112 Ref.113 Ref.116 Ref.117 Ref.119 Ref.121 Ref.122 Ref.124 Ref.125 Ref.126 Ref.127 Ref.129 Ref.137 Ref.138 Ref.139 Ref.140 Ref.141 Ref.151

Information Extraction

- Extracting the important items of a text and assigning them a slot in a certain structure



Hasso Plattner Institute

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Motto	Design IT. Create Knowledge.
Established	1998[1]
Type	Private university institute
Director	Prof. Dr. Christoph Meinel
Admin. staff	60[2]
Students	about 480[2]
Location	Potsdam, Germany
Campus	Griebnitzsee
Colors	🟧 Orange 🟧 Vivid orange 🟥 Dark pink
Affiliations	University of Potsdam
Website	www.hpi.uni-potsdam.de

WIKIPEDIA
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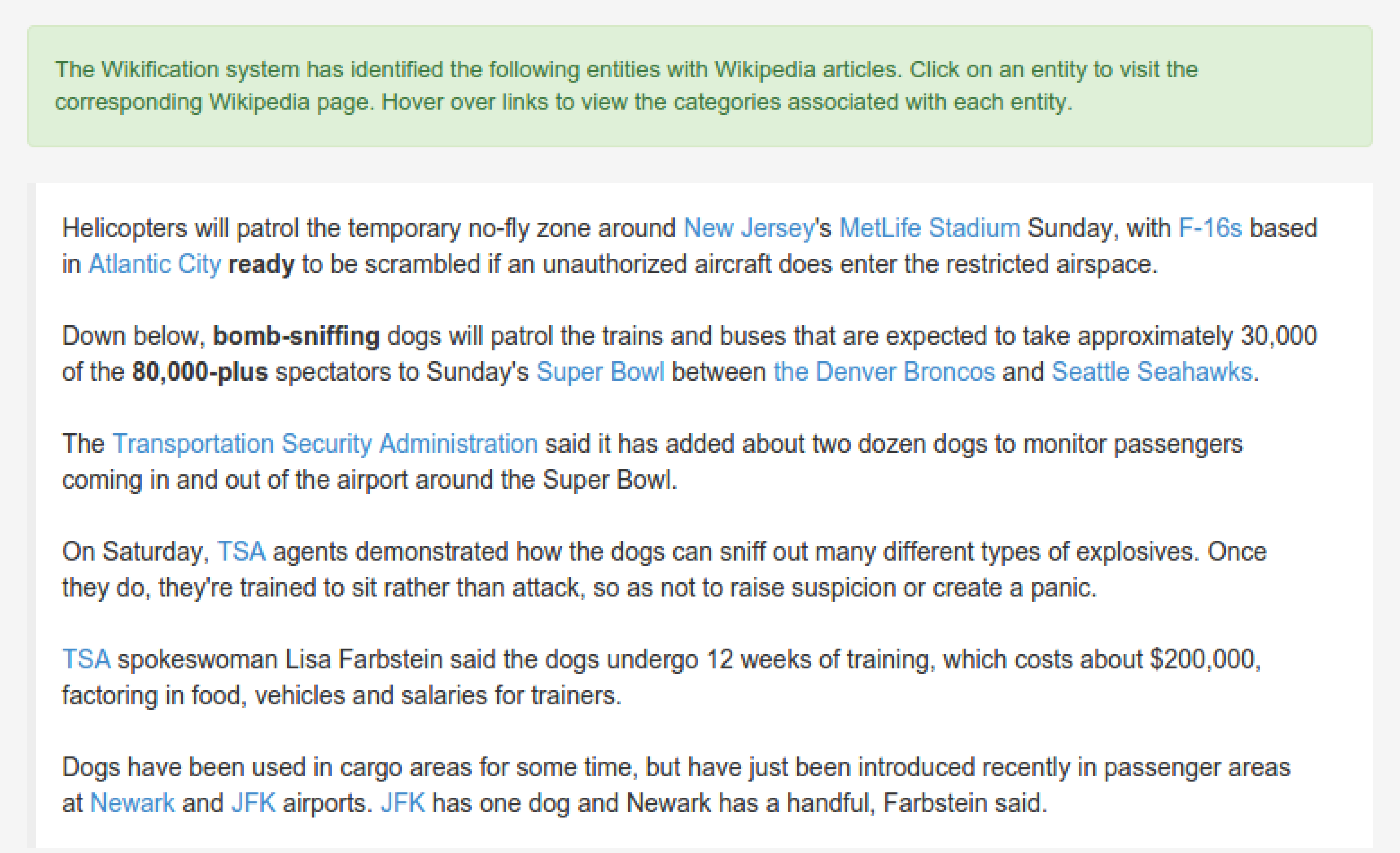
Information Extraction

- Includes named-entity recognition



The Wikification system has identified the following entities with Wikipedia articles. Click on an entity to visit the corresponding Wikipedia page. Hover over links to view the categories associated with each entity.

Helicopters will patrol the temporary no-fly zone around New Jersey's MetLife Stadium Sunday, with F-16s based in Atlantic City **ready** to be scrambled if an unauthorized aircraft does enter the restricted airspace.

Down below, **bomb-sniffing** dogs will patrol the trains and buses that are expected to take approximately 30,000 of the **80,000-plus** spectators to Sunday's Super Bowl between the Denver Broncos and Seattle Seahawks.

The Transportation Security Administration said it has added about two dozen dogs to monitor passengers coming in and out of the airport around the Super Bowl.

On Saturday, TSA agents demonstrated how the dogs can sniff out many different types of explosives. Once they do, they're trained to sit rather than attack, so as not to raise suspicion or create a panic.

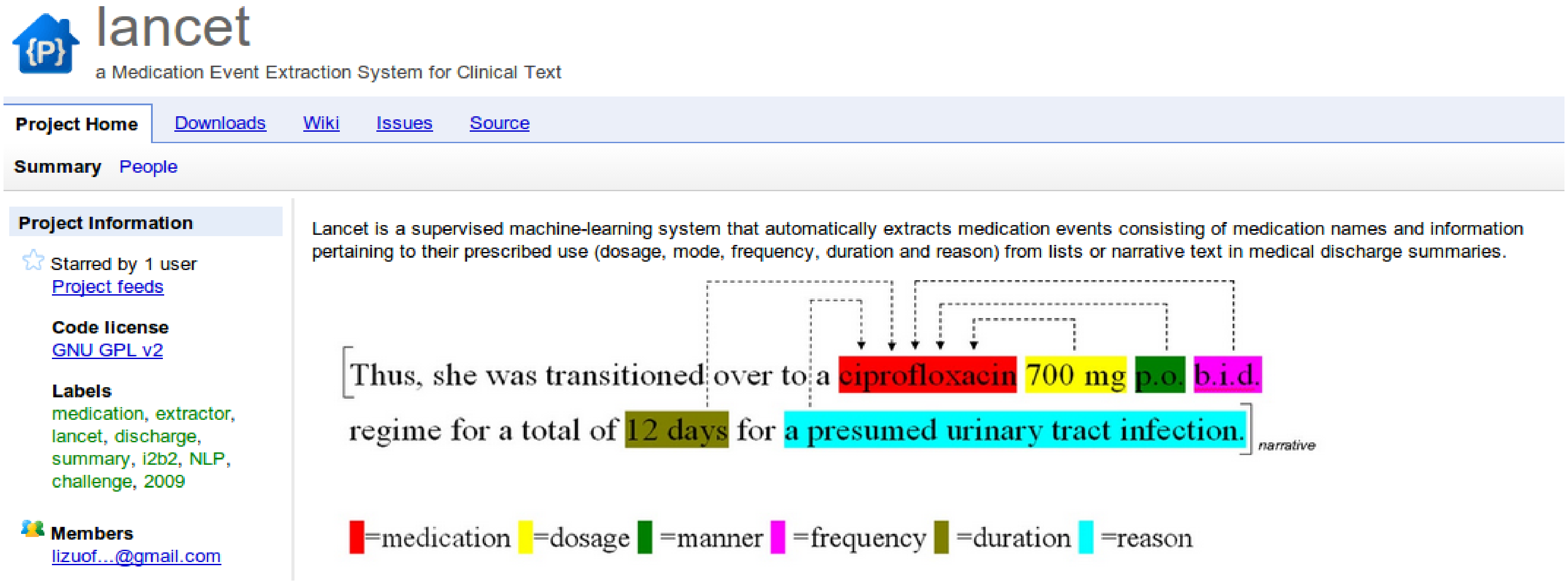
TSA spokeswoman Lisa Farbstein said the dogs undergo 12 weeks of training, which costs about $200,000, factoring in food, vehicles and salaries for trainers.

Dogs have been used in cargo areas for some time, but have just been introduced recently in passenger areas at Newark and JFK airports. JFK has one dog and Newark has a handful, Farbstein said.

http://cogcomp.cs.illinois.edu/page/demo_view/Wikifier

Information Extraction

- Extracting the important items of a text and assigning them a slot in a certain structure



lancet

a Medication Event Extraction System for Clinical Text

Project Information

Starred by 1 user
Project feeds

Code license
GNU GPL v2

Labels
medication, extractor, lancet, discharge, summary, i2b2, NLP, challenge, 2009

Members
lizuof...@gmail.com

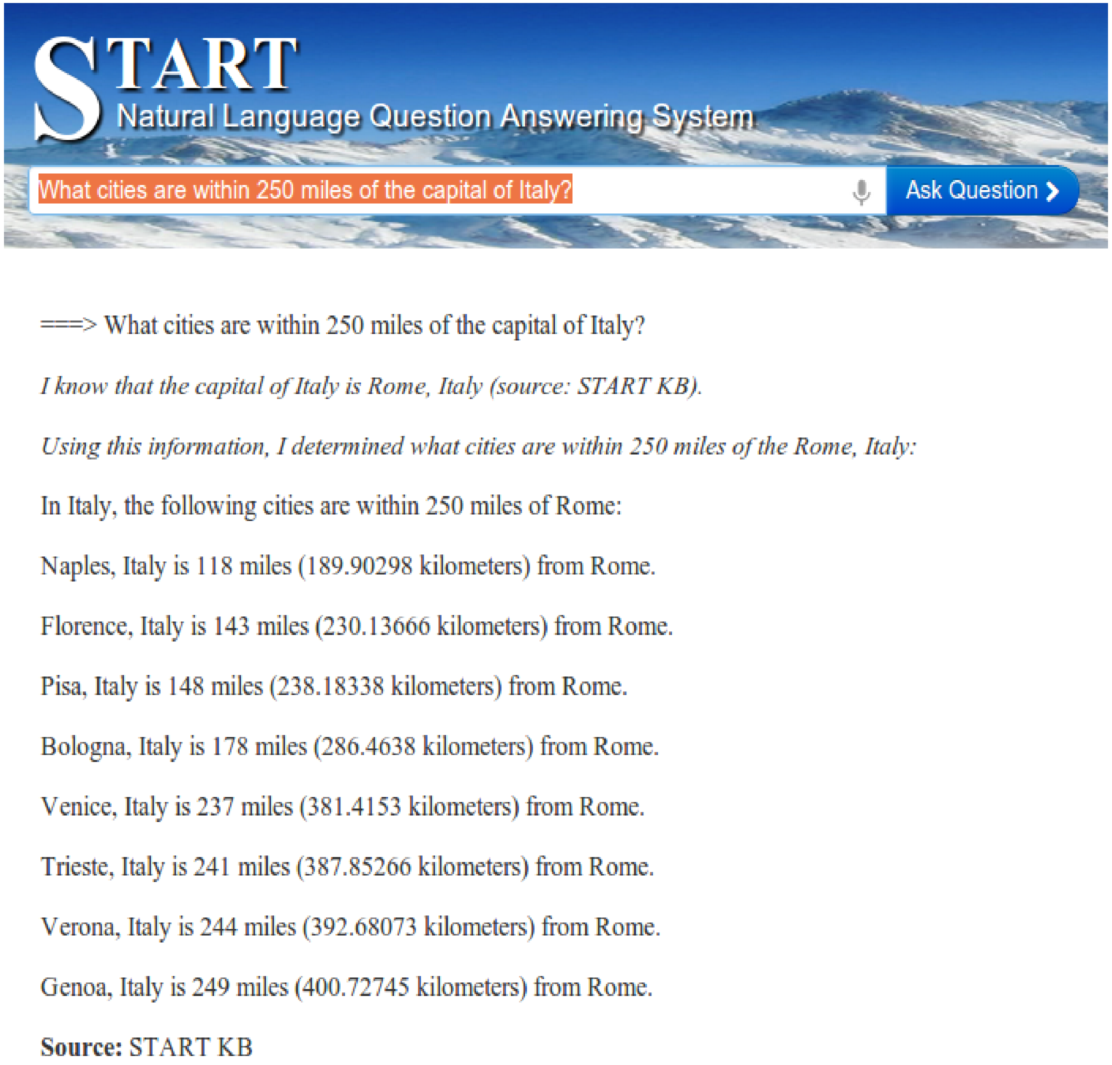
Lancet is a supervised machine-learning system that automatically extracts medication events consisting of medication names and information pertaining to their prescribed use (dosage, mode, frequency, duration and reason) from lists or narrative text in medical discharge summaries.

[Thus, she was transitioned over to a ciprofloxacin 700 mg p.o. b.i.d. regime for a total of 12 days for a presumed urinary tract infection.] *narrative*

🟥=medication 🟨=dosage 🟩=manner 🟪=frequency 🟫=duration 🟦=reason

Question answering

- Answering questions asked by the user with a short answer


START
Natural Language Question Answering System
What cities are within 250 miles of the capital of Italy?
Ask Question

===> What cities are within 250 miles of the capital of Italy?

I know that the capital of Italy is Rome, Italy (source: START KB).

Using this information, I determined what cities are within 250 miles of the Rome, Italy:

In Italy, the following cities are within 250 miles of Rome:

Naples, Italy is 118 miles (189.90298 kilometers) from Rome.

Florence, Italy is 143 miles (230.13666 kilometers) from Rome.

Pisa, Italy is 148 miles (238.18338 kilometers) from Rome.

Bologna, Italy is 178 miles (286.4638 kilometers) from Rome.

Venice, Italy is 237 miles (381.4153 kilometers) from Rome.

Trieste, Italy is 241 miles (387.85266 kilometers) from Rome.

Verona, Italy is 244 miles (392.68073 kilometers) from Rome.

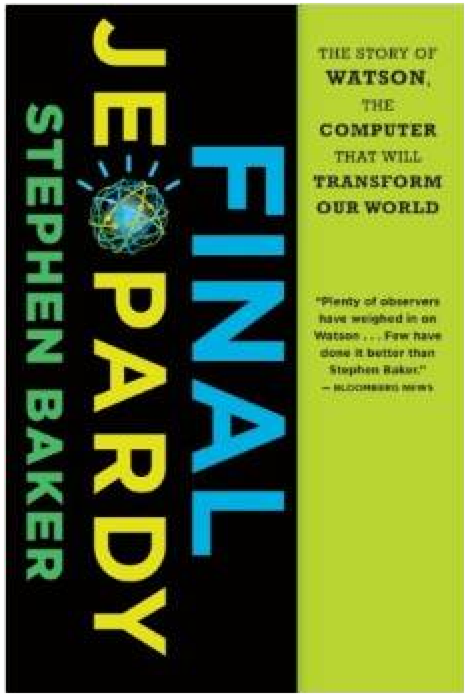
Genoa, Italy is 249 miles (400.72745 kilometers) from Rome.

Source: START KB

http://start.csail.mit.edu/index.php

Question answering

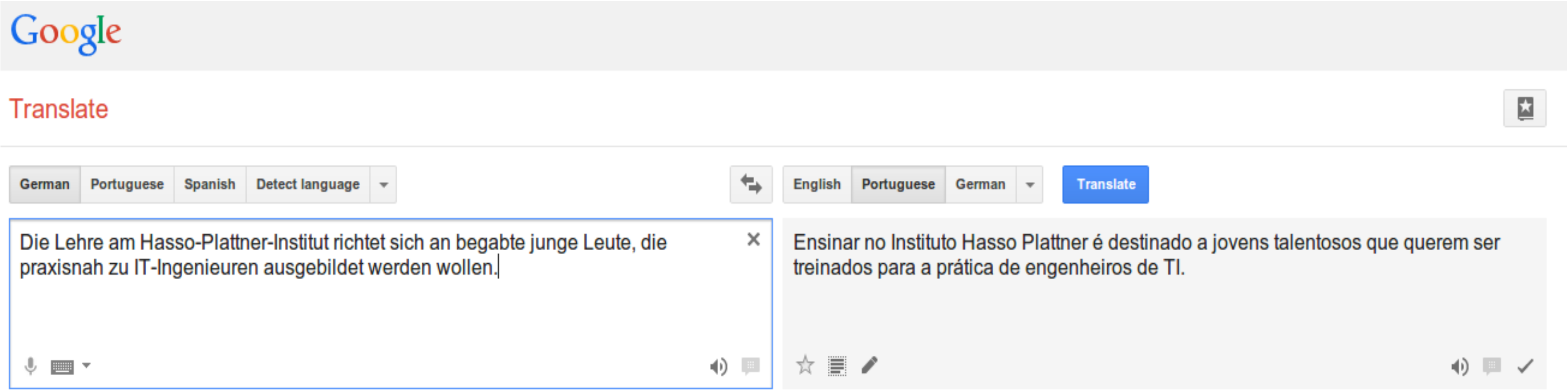
- Answering questions asked by the user with a short answer


FINAL
JEOPARDY
STEPHEN BAKER
THE STORY OF WATSON, THE COMPUTER THAT WILL TRANSFORM OUR WORLD
"Plenty of observers have weighed in on Watson . . . Few have done it better than Stephen Baker."
— BLOOMBERG NEWS

https://www.youtube.com/watch?v=WFR3lOm_xhE

Machine Translation

- Translating a text from one language to another

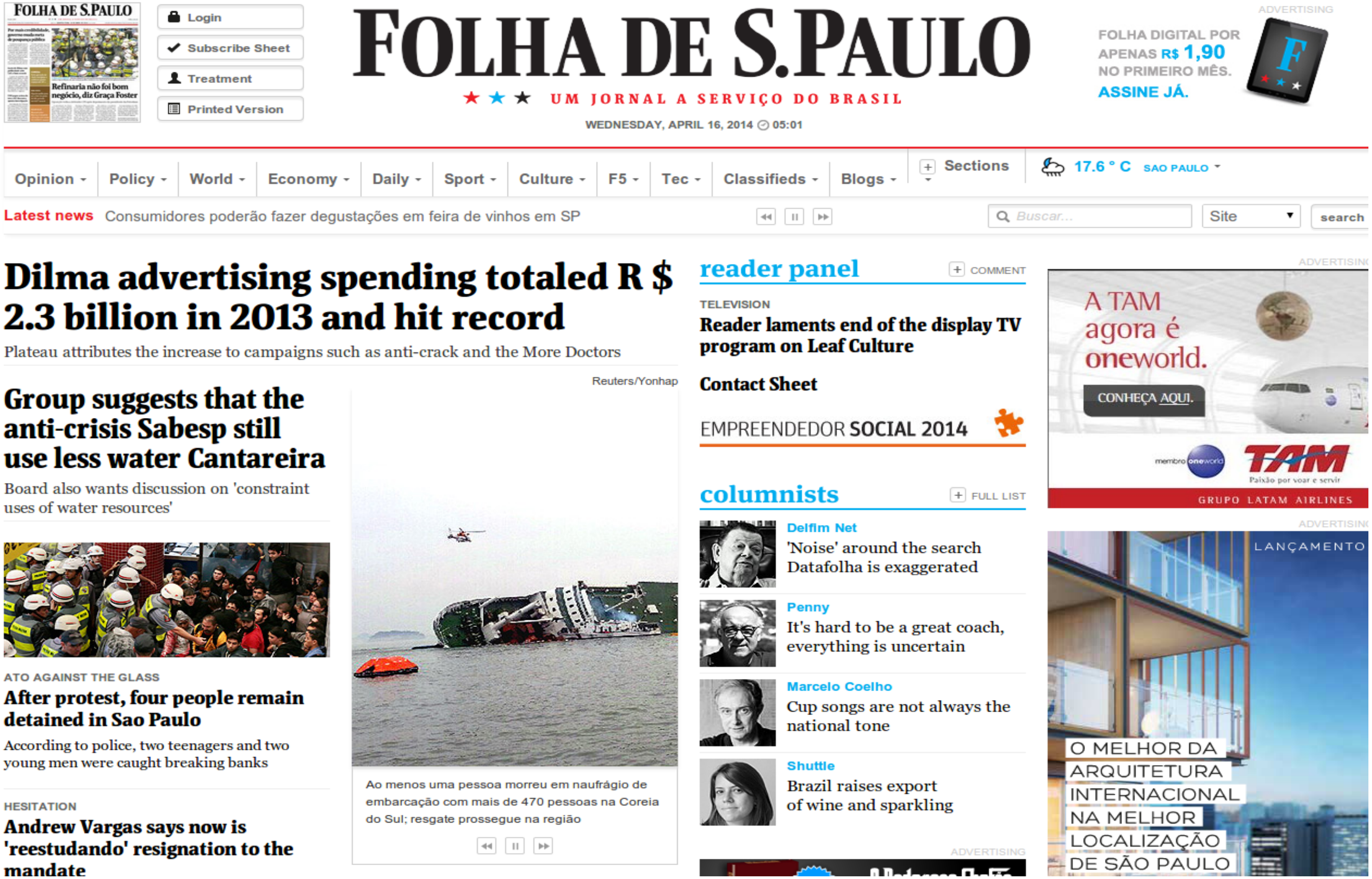


Die Lehre am Hasso-Plattner-Institut richtet sich an begabte junge Leute, die praxisnah zu IT-Ingenieuren ausgebildet werden wollen.

Ensinar no Instituto Hasso Plattner é destinado a jovens talentosos que querem ser treinados para a prática de engenheiros de TI.

Machine Translation

- Translating a text from one language to another



FOLHA DE S.PAULO

Refinaria não foi bom negócio, diz Graça Foster

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Treatment

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FOLHA DE S.PAULO

★ ★ ★ UM JORNAL A SERVIÇO DO BRASIL

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17.6 ° C SAO PAULO

Latest news Consumidores poderão fazer degustações em feira de vinhos em SP

Buscar... | Site | search

Dilma advertising spending totaled R $ 2.3 billion in 2013 and hit record

Plateau attributes the increase to campaigns such as anti-crack and the More Doctors

Reuters/Yonhap

Group suggests that the anti-crisis Sabesp still use less water Cantareira

Board also wants discussion on 'constraint uses of water resources'

ATO AGAINST THE GLASS

After protest, four people remain detained in Sao Paulo

According to police, two teenagers and two young men were caught breaking banks

HESITATION

Andrew Vargas says now is 'reestudando' resignation to the mandate

Ao menos uma pessoa morreu em naufrágio de embarcação com mais de 470 pessoas na Coreia do Sul; resgate prossegue na região

reader panel

COMMENT

TELEVISION

Reader laments end of the display TV program on Leaf Culture

Contact Sheet

EMPREENDEDOR SOCIAL 2014

columnists

FULL LIST

Delfim Net
'Noise' around the search Datafolha is exaggerated

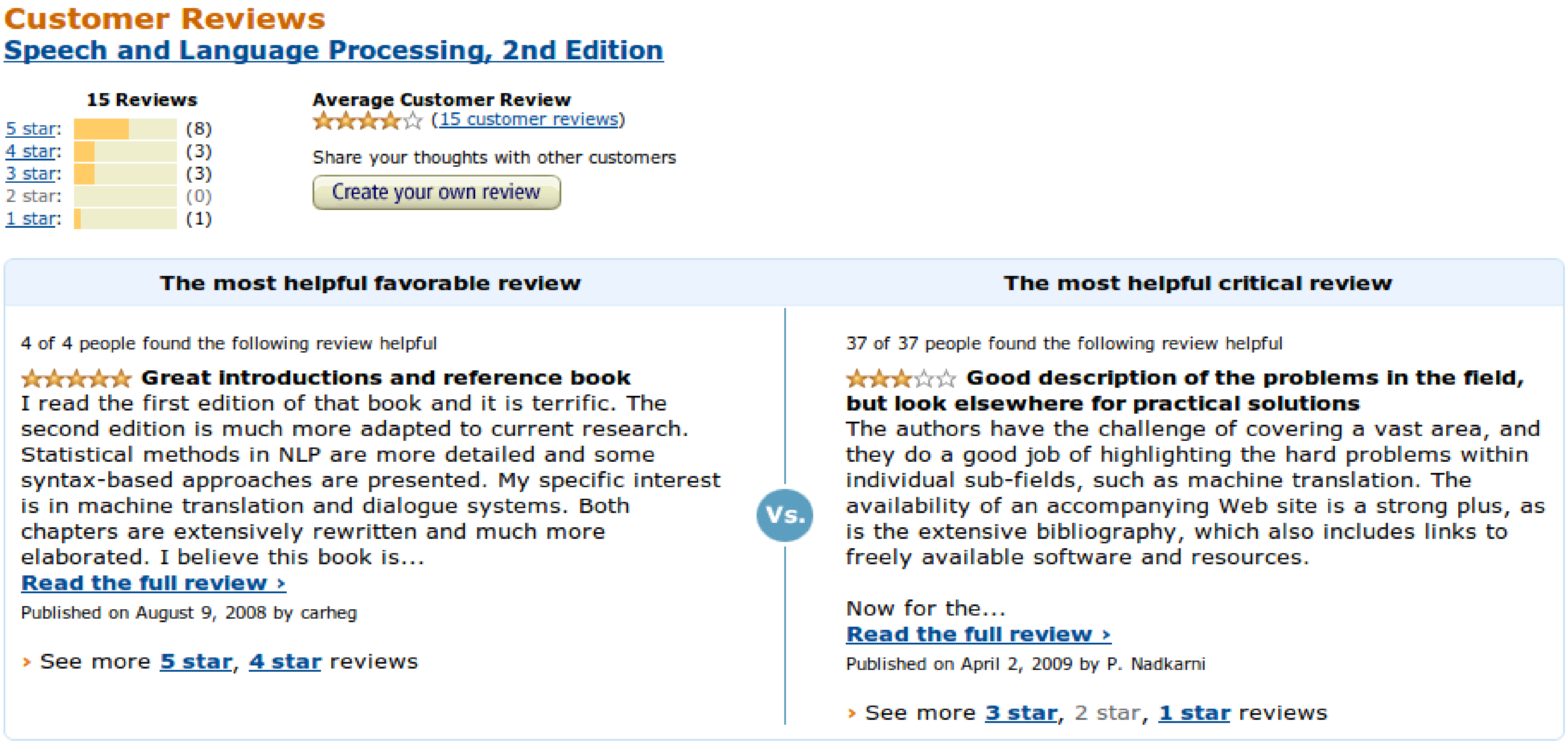
Penny
It's hard to be a great coach, everything is uncertain

Marcelo Coelho
Cup songs are not always the national tone

Shuttle
Brazil raises export of wine and sparkling

Sentiment Analysis

- Identifying sentiments and opinions stated in a text



Customer Reviews

Speech and Language Processing, 2nd Edition

15 Reviews

5 star:	▨	(8)
4 star:	▨	(3)
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2 star:		(0)
1 star:	▨	(1)

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★★★★☆ (15 customer reviews)

Share your thoughts with other customers

Create your own review

The most helpful favorable review

4 of 4 people found the following review helpful

★★★★★ **Great introductions and reference book**

I read the first edition of that book and it is terrific. The second edition is much more adapted to current research. Statistical methods in NLP are more detailed and some syntax-based approaches are presented. My specific interest is in machine translation and dialogue systems. Both chapters are extensively rewritten and much more elaborated. I believe this book is...

Read the full review ›

Published on August 9, 2008 by carheg

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The most helpful critical review

37 of 37 people found the following review helpful

★★★☆☆ **Good description of the problems in the field, but look elsewhere for practical solutions**

The authors have the challenge of covering a vast area, and they do a good job of highlighting the hard problems within individual sub-fields, such as machine translation. The availability of an accompanying Web site is a strong plus, as is the extensive bibliography, which also includes links to freely available software and resources.

Now for the...

Read the full review ›

Published on April 2, 2009 by P. Nadkarni

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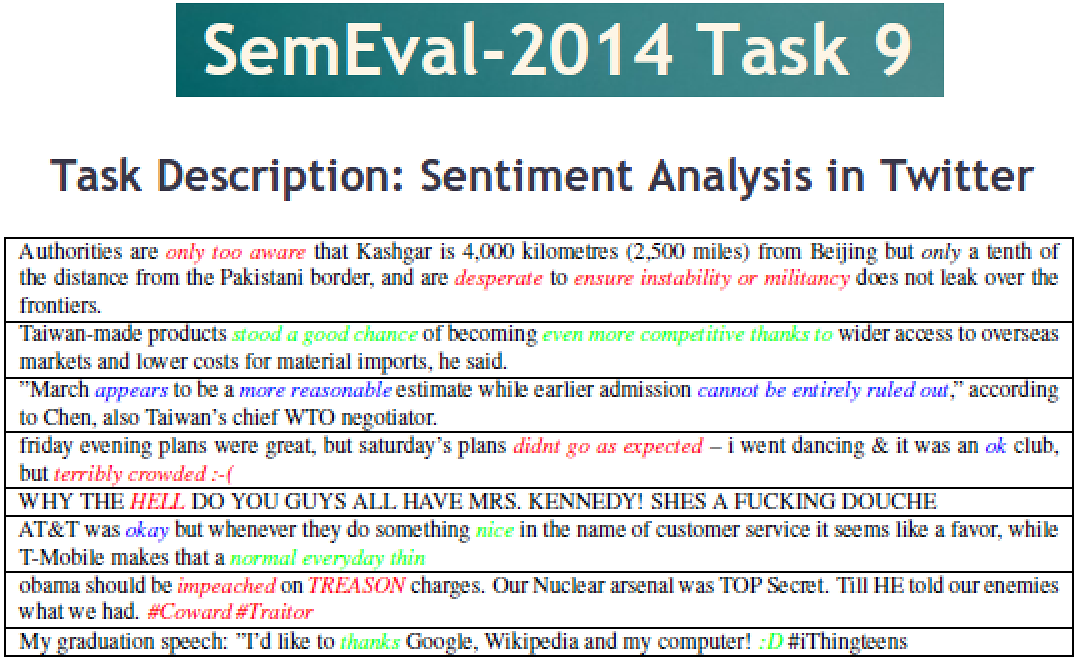
Sentiment Analysis

- Identifying sentiments and opinions stated in a text



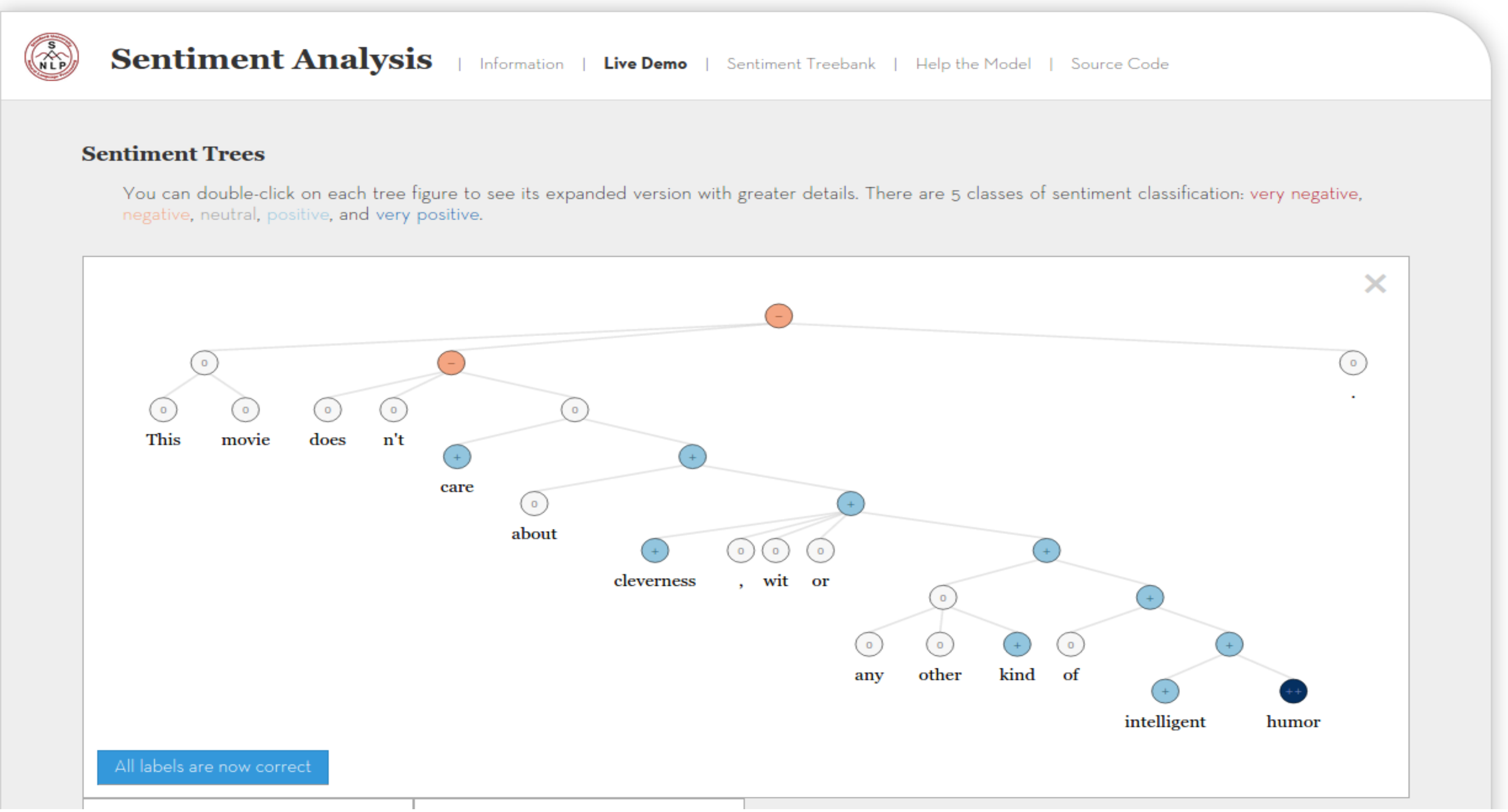
SemEval-2014 Task 9

Task Description: Sentiment Analysis in Twitter

Authorities are *only too aware* that Kashgar is 4,000 kilometres (2,500 miles) from Beijing but *only* a tenth of the distance from the Pakistani border, and are *desperate* to *ensure instability or militancy* does not leak over the frontiers.
Taiwan-made products *stood a good chance* of becoming *even more competitive thanks to* wider access to overseas markets and lower costs for material imports, he said.
"March *appears* to be a *more reasonable* estimate while earlier admission *cannot be entirely ruled out*," according to Chen, also Taiwan's chief WTO negotiator.
friday evening plans were great, but saturday's plans *didnt go as expected* – i went dancing & it was an *ok* club, but *terribly crowded :-(*
WHY THE *HELL* DO YOU GUYS ALL HAVE MRS. KENNEDY! SHES A FUCKING DOUCHE
AT&T was *okay* but whenever they do something *nice* in the name of customer service it seems like a favor, while T-Mobile makes that a *normal everyday thin*
obama should be *impeached* on *TREASON* charges. Our Nuclear arsenal was TOP Secret. Till HE told our enemies what we had. *#Coward #Traitor*
My graduation speech: "I'd like to *thanks* Google, Wikipedia and my computer! *:D* #iThingteens

Sentiment Analysis

- Identifying sentiments and opinions stated in a text



Sentiment Analysis
| Information | Live Demo | Sentiment Treebank | Help the Model | Source Code

Sentiment Trees

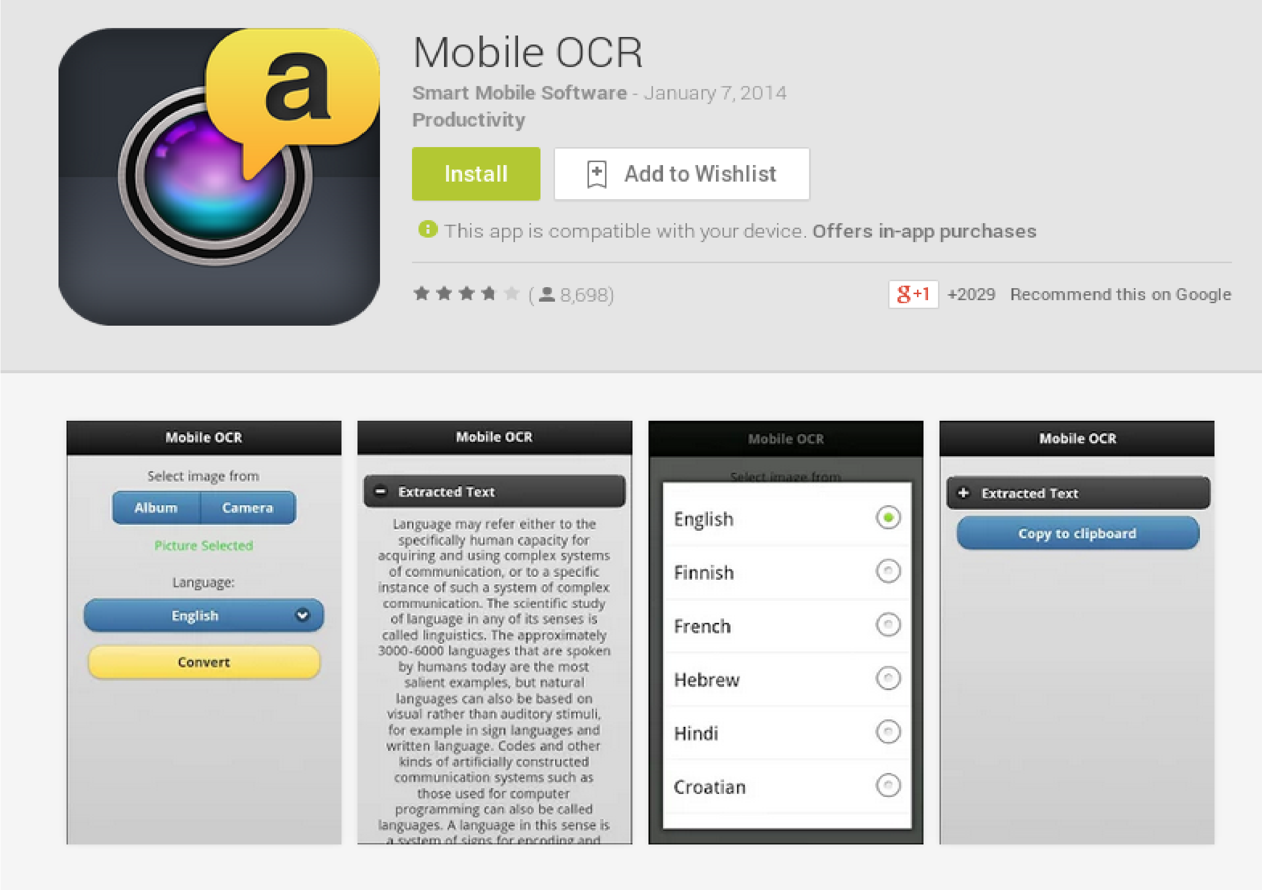
You can double-click on each tree figure to see its expanded version with greater details. There are 5 classes of sentiment classification: very negative, negative, neutral, positive, and very positive.

This
movie
does
n't
care
about
cleverness
,
wit
or
any
other
kind
of
intelligent
humor
.
All labels are now correct

http://nlp.stanford.edu:8080/sentiment/rntnDemo.html

Optical Character Recognition

- Recognizing printed or handwritten texts and converting them to computer-readable texts



Mobile OCR

Smart Mobile Software - January 7, 2014

Productivity

This app is compatible with your device. **Offers in-app purchases**

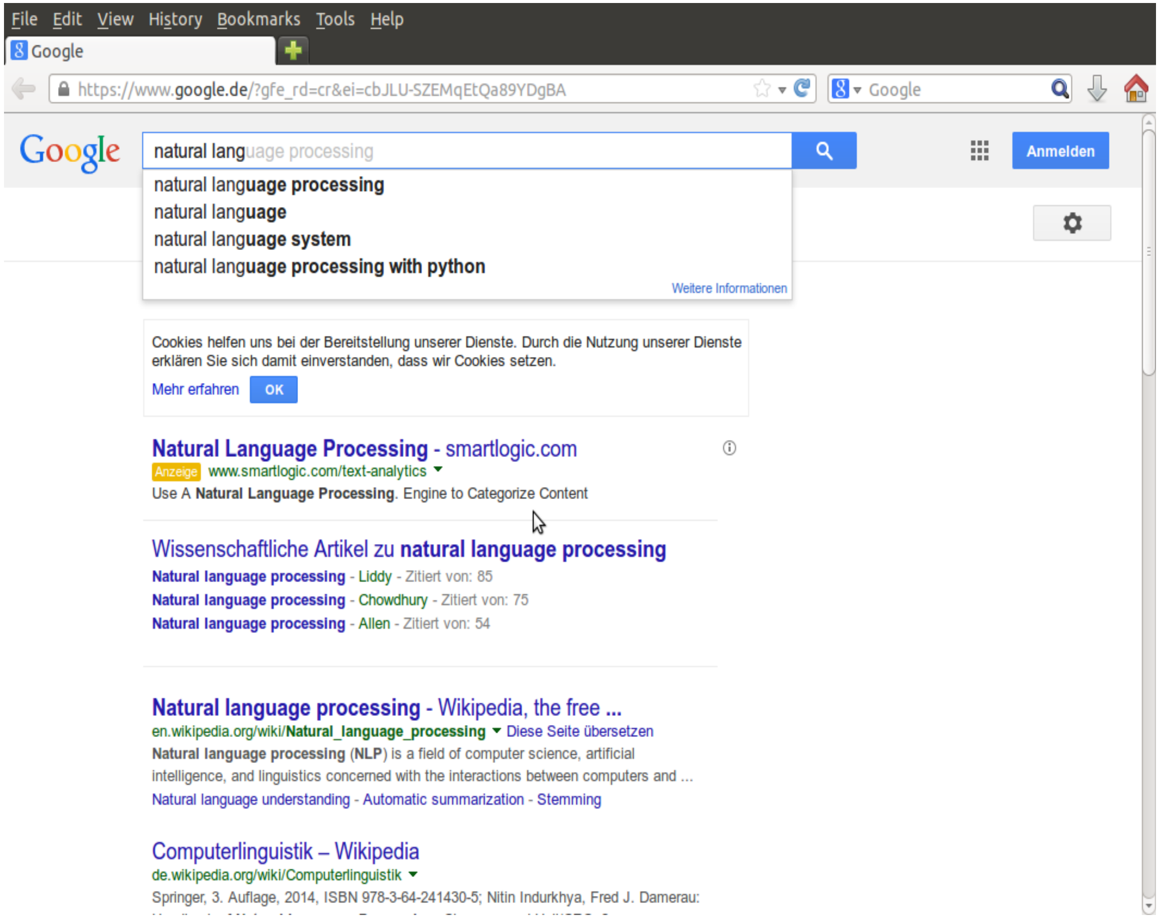
★★★★☆ (8,698)

+2029 Recommend this on Google

Language may refer either to the specifically human capacity for acquiring and using complex systems of communication, or to a specific instance of such a system of complex communication. The scientific study of language in any of its senses is called linguistics. The approximately 3000-6000 languages that are spoken by humans today are the most salient examples, but natural languages can also be based on visual rather than auditory stimuli, for example in sign languages and written language. Codes and other kinds of artificially constructed communication systems such as those used for computer programming can also be called languages. A language in this sense is a system of signs for encoding and

Word Prediction

- Predicting the next word that is highly probable to be typed by the user



natural language processing

natural language **processing**
natural language
natural language **system**
natural language **processing with python**

Weitere Informationen

Cookies helfen uns bei der Bereitstellung unserer Dienste. Durch die Nutzung unserer Dienste erklären Sie sich damit einverstanden, dass wir Cookies setzen.

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Natural Language Processing - smartlogic.com
Anzeige www.smartlogic.com/text-analytics
Use A **Natural Language Processing**. Engine to Categorize Content

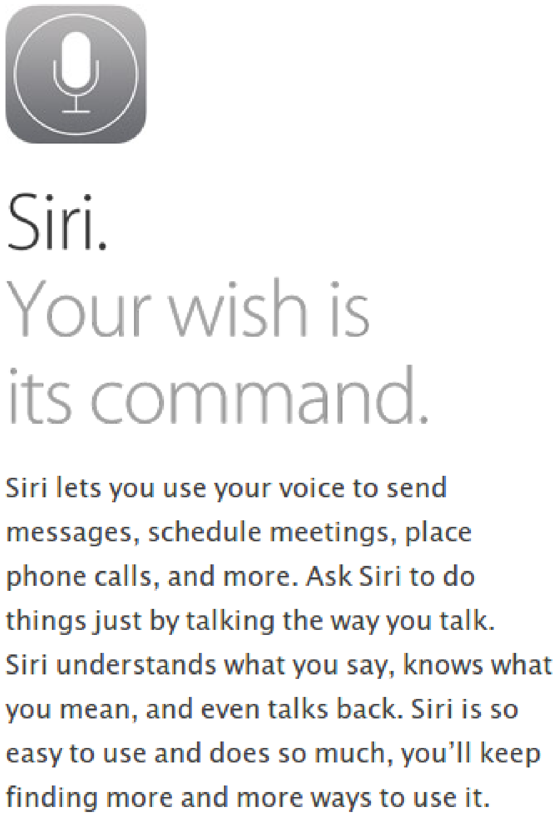
Wissenschaftliche Artikel zu **natural language processing**
Natural language processing - Liddy - Zitiert von: 85
Natural language processing - Chowdhury - Zitiert von: 75
Natural language processing - Allen - Zitiert von: 54

Natural language processing - Wikipedia, the free ...
en.wikipedia.org/wiki/**Natural_language_processing** Diese Seite übersetzen
Natural language processing (**NLP**) is a field of computer science, artificial intelligence, and linguistics concerned with the interactions between computers and ...
Natural language understanding - Automatic summarization - Stemming

Computerlinguistik – Wikipedia
de.wikipedia.org/wiki/Computerlinguistik
Springer, 3. Auflage, 2014, ISBN 978-3-64-241430-5; Nitin Indurkhya, Fred J. Damerau:

Speech recognition

- Recognizing a spoken language and transforming it into a text



Siri.

Your wish is
its command.

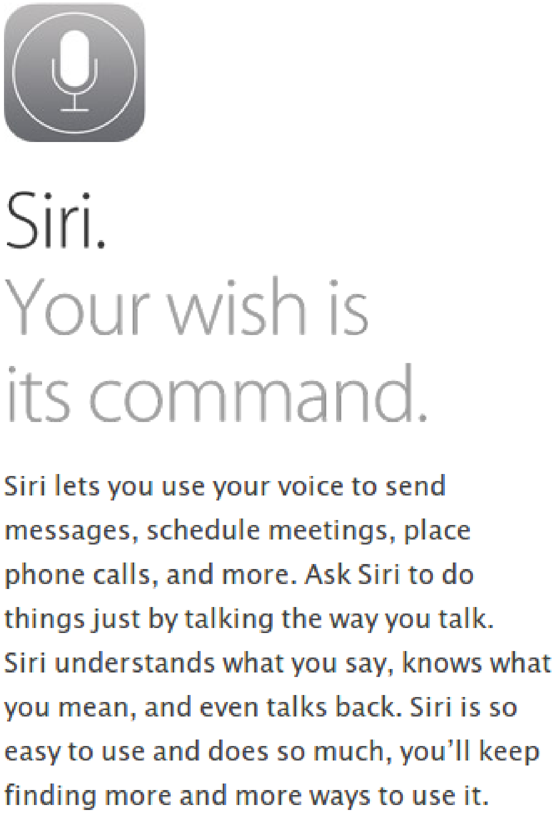
Siri lets you use your voice to send messages, schedule meetings, place phone calls, and more. Ask Siri to do things just by talking the way you talk. Siri understands what you say, knows what you mean, and even talks back. Siri is so easy to use and does so much, you'll keep finding more and more ways to use it.

Speech synthesis

- Producing a spoken language from a text

Spoken dialog systems

- Running a dialog between the user and the system



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Siri lets you use your voice to send messages, schedule meetings, place phone calls, and more. Ask Siri to do things just by talking the way you talk. Siri understands what you say, knows what you mean, and even talks back. Siri is so easy to use and does so much, you'll keep finding more and more ways to use it.

Level of difficulties

- Easy (mostly solved)
  - Spell and grammar checking
  - Some text categorization tasks
  - Some named-entity recognition tasks

- Intermediate (good progress)
  - Information retrieval
  - Sentiment analysis
  - Machine translation
  - Information extraction

Level of difficulties

- Difficult (still hard)
  - Question answering
  - Summarization
  - Dialog systems

Outline

- NLP course
- Introduction to NLP
- NLP Applications
- NLP Techniques
- Linguistic Knowledge
- Challenges
- Course materials

Section splitting

- Splitting a text into sections

Eur Radiol
DOI 10.1007/s00330-014-3135-8

BREAST

Correlation between three-dimensional ultrasound features and pathological prognostic factors in breast cancer

Jun Jiang · Ya-qing Chen · Yi-zhuan Xu · Ming-li Chen · Yun-kai Zhu · Wen-bin Guan · Xiao-jin Wang

Received: 13 November 2013 /Revised: 30 January 2014 /Accepted: 17 February 2014

Abstract

Objectives To investigate the correlation of three-dimensional (3D) ultrasound features with prognostic factors in invasive ductal carcinoma.

Methods Surgical resection specimens of 85 invasive ductal carcinomas of 85 women who had undergone 3D ultrasound were included. Morphology features and vascularization perfusion on 3D ultrasound were evaluated. Pathologic prognostic factors, including tumour size, histological grade, lymph node status, oestrogen and progesterone receptor status (ER, PR), c-erbB-2 and p53 expression, and microvessel density (MVD) were determined. Correlations of 3D ultrasound features and prognostic factors were analysed.

Results The retraction pattern in the coronal plane had a significant value as an independent predictor of a small tumour size (P=0.014), a lower histological grade (P=0.009) and positive ER or PR expression status (P=0.001, 0.044). The retraction pattern with a hyperechoic ring only existed in low-grade and ER-positive tumours. The presence of the hyperechoic ring strengthened the ability of the retraction pattern to predict a good prognosis of breast cancer. The increased intra-tumour vascularization index (VI, the mean tumour vascularity) reflected a higher histological grade (P=0.025) and had a positive correlation with MVD (r=0.530, P=0.001).

Conclusions The retraction pattern and histogram indices of VI provided by 3D ultrasound may be useful in predicting prognostic information about breast cancer.

Key Points

- *Three-dimensional ultrasound can potentially provide prognostic evaluation of breast cancer.*
- *The retraction pattern and hyperechoic ring in the coronal plane suggest good prognosis.*
- *The increased intra-tumour vascularization index reflects a higher histological grade.*
- *The intra-tumour vascularization index is positively correlated with microvessel density.*

Keywords Breast · Neoplasms · Ultrasound · Three-dimensional · Prognostic factors

Introduction

The three strongest prognostic factors in invasive breast cancer are widely accepted to be the size of tumour, histological grade and lymph node stage. The larger tumour size (>2 cm), high nuclear grade, and lymph node-positive status usually predict the aggressive biological behaviour with a high recurrence rate and a low survival rate. In addition, the tumour size and lymph node status greatly influence the choice of operative procedure and the decision to administer neoadjuvant chemotherapy [1, 2].

Biological markers such as oestrogen receptors (ER), progesterone receptors (PR), human epidermal growth factor receptor 2 (c-erbB-2) and the p53 index can also be used for prediction of medical treatment response and patient prognosis. The presence of ER and PR in breast cancer always

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Published online: 12 April 2014

determines the application of antihormonal therapy and usually indicates a good prognosis. Expression of c-erbB-2 or the p53 index is a powerful and independent prognostic factor for lymph node metastasis and tumour infiltration [1, 3]. Microvessel density (MVD) is the current reference standard in the characterization of tumour angiogenesis and has been shown to be associated with tumour growth, invasion, metastasis and disease-specific survival [4].

Three-dimensional (3D) ultrasound can afford additional information such as morphology features on the coronal plane and a global appearance of the mass vascularity, which cannot be achieved with conventional ultrasound. Therefore, it has been increasingly considered as an important imaging modality for evaluating primary breast cancer. However, so far, 3D ultrasound has been used mainly to differentiate benign and malignant lesions; no reports address correlations between the 3D ultrasound features and prognostic factors [5–7]. We therefore investigated possible correlation between the 3D ultrasound characteristics of invasive ductal carcinoma with pathologic prognostic factors to determine whether 3D ultrasound could be useful in the non-invasive prognostic evaluation of breast cancer.

Materials and methods

Patients

This retrospective study was approved by the ethical standards of the institutional ethics committee, and informed consent was obtained from all patients.

From September 2011 to May 2013, 85 patients with 85 lesions, pathologically proven to be invasive ductal carcinoma, were included in this study. The exclusion criteria were pregnancy or lactation, administration of preoperative chemotherapies or adjuvant chemotherapies. Patients with a breast mass larger than 3.0 cm were also excluded because more than one 3D volume acquisition was necessary to include the whole lesion plus 3 mm surrounding the breast lesion. All patients were female and aged 26 to 90 years (mean age, 56.3 years).

Ultrasound examination

All ultrasound images were obtained with one type of system (GE Voluson E8 Expert, Zipf, Austria) by two radiologists with 7–12 years of experience in breast ultrasound. An 11 L-D linear transducer with a frequency of 5–12 MHz was used for 2D ultrasound, and an RSP6-16-D dedicated volume transducer with a frequency of 6–12 MHz was used for 3D ultrasound.

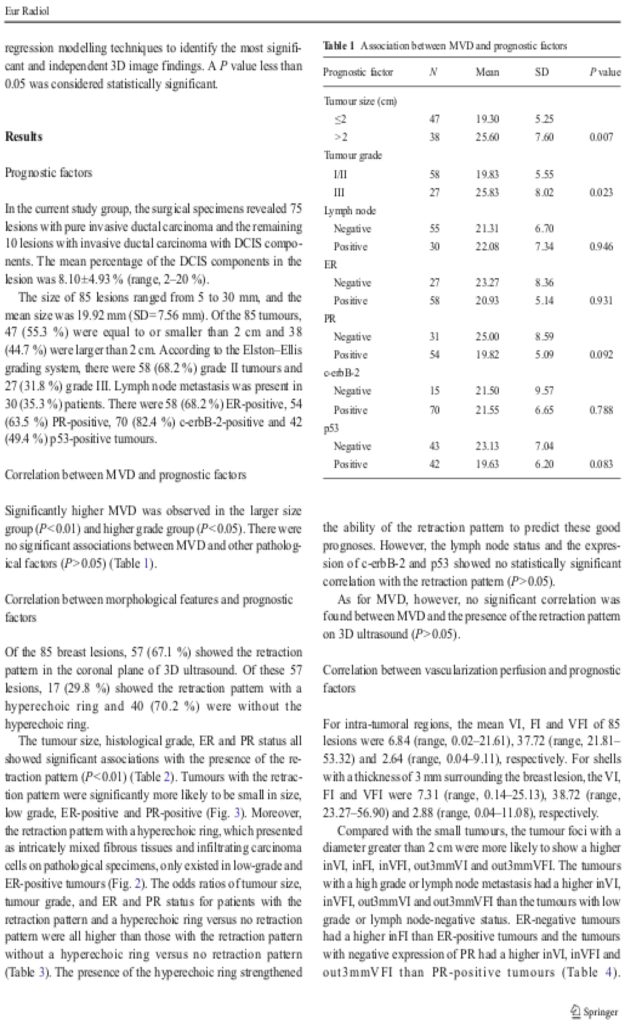
Ultrasound examination was performed with patients in the supine position with elevated arms. Once the breast lesion was detected and the region of interest had been identified, the volume box was superimposed and set to include the entire display screen so as to cover the lesion and maximum amount of normal surrounding tissue. The sweep angle was adjusted to 15–29° according to the size of the breast lesion. Then the ultrasound probe was held still with enough jelly to contact the skin gently. The volume mode was switched on and the 3D ultrasound volume was generated by the automatic rotation of the mechanical transducer. When the first ultrasound examination was finished, the power Doppler mode was added for the second examination and the fixed preinstalled power Doppler settings used were 0.3 kHz pulse repetition frequency, "low 1" wall motion filter, −2.0 gain and high frequency. The first examination for 3D greyscale imaging took 10–20 s and the second, for 3D power Doppler imaging, took 25–45 s, depending on the size of the tumour. Then the total acquisition time for 3D ultrasound was about 1–2 min. The entire examination was saved in DICOM format and stored on the hard disk for further analysis.

Image analysis

The 3D ultrasound images were reviewed for this analysis by another two radiologists with 8–10 years of experience in breast ultrasound and characterized by consensus. In addition, the radiologists had not performed the data acquisition and were blinded to the patients' clinical and mammographic findings.

The ultrasound image was opened by using the 4D View software. Firstly, the tomographic ultrasound imaging (TUI) was used for a slice by slice documentation in the coronal plane. Then, the volume contrast imaging (VCI) and the surface render mode were added for better observation of the lesion and the surrounding tissue. All the slices were carefully observed to identify the presence of the retraction pattern in the surrounding tissue and the margin of the lesion. The retraction pattern was defined as the hyperechoic straight lines that radiated perpendicularly from the surface of the solid nodule, producing a stellar pattern [8, 9] (Fig. 1). The presence of the retraction pattern was further divided into with or without a hyperechoic ring, which was displayed as an echogenic halo ring between the mass and the surrounding tissue in the coronal plane (Fig. 2a).

The 3D power Doppler imaging analyses were performed using a virtual organ computer-aided analysis (VOCAL)-imaging program (GE, Zipf, Austria), which could automatically calculate the histogram indices of vascularization index (VI), flow index (FI) and vascularization flow index (VFI). VI represents the vessels in the defined volume by measuring the number of colour voxels in the region of interest, i.e. the mean tumour vascularity; FI represents the average intensity of flow by measuring the mean colour value in the colour voxels, i.e. the mean blood flow volume; VFI represents both



regression modelling techniques to identify the most significant and independent 3D image findings. A P value less than 0.05 was considered statistically significant.

Results

Prognostic factors

In the current study group, the surgical specimens revealed 75 lesions with pure invasive ductal carcinoma and the remaining 10 lesions with invasive ductal carcinoma with DCIS components. The mean percentage of the DCIS components in the lesion was 8.10±4.93 % (range, 2–20 %).

The size of 85 lesions ranged from 5 to 30 mm, and the mean size was 19.92 mm (SD=7.56 mm). Of the 85 tumours, 47 (55.3 %) were equal to or smaller than 2 cm and 38 (44.7 %) were larger than 2 cm. According to the Elston–Ellis grading system, there were 58 (68.2 %) grade II tumours and 27 (31.8 %) grade III. Lymph node metastasis was present in 30 (35.3 %) patients. There were 58 (68.2 %) ER-positive, 54 (63.5 %) PR-positive, 70 (82.4 %) c-erbB-2-positive and 42 (49.4 %) p53-positive tumours.

Correlation between MVD and prognostic factors

Significantly higher MVD was observed in the larger size group (P<0.01) and higher grade group (P<0.05). There were no significant associations between MVD and other pathological factors (P>0.05) (Table 1).

Correlation between morphological features and prognostic factors

Of the 85 breast lesions, 57 (67.1 %) showed the retraction pattern in the coronal plane of 3D ultrasound. Of these 57 lesions, 17 (29.8 %) showed the retraction pattern with a hyperechoic ring and 40 (70.2 %) were without the hyperechoic ring.

The tumour size, histological grade, ER and PR status all showed significant associations with the presence of the retraction pattern (P<0.01) (Table 2). Tumours with the retraction pattern were significantly more likely to be small in size, low grade, ER-positive and PR-positive (Fig. 3). Moreover, the retraction pattern with a hyperechoic ring, which presented as intricately mixed fibrous tissues and infiltrating carcinoma cells on pathological specimens, only existed in low-grade and ER-positive tumours (Fig. 2). The odds ratios of tumour size, tumour grade, and ER and PR status for patients with the retraction pattern and a hyperechoic ring versus no retraction pattern were all higher than those with the retraction pattern without a hyperechoic ring versus no retraction pattern (Table 3). The presence of the hyperechoic ring strengthened the ability of the retraction pattern to predict these good prognoses. However, the lymph node status and the expression of c-erbB-2 and p53 showed no statistically significant correlation with the retraction pattern (P>0.05).

As for MVD, however, no significant correlation was found between MVD and the presence of the retraction pattern on 3D ultrasound (P>0.05).

Table 1 Association between MVD and prognostic factors

Prognostic factor	N	Mean	SD	P value
Tumour size (cm)				
≤2	47	19.30	5.25	
>2	38	25.60	7.60	0.007
Tumour grade				
I/II	58	19.83	5.55	
III	27	25.83	8.02	0.023
Lymph node				
Negative	55	21.31	6.70	
Positive	30	22.08	7.34	0.946
ER				
Negative	27	23.27	8.36	
Positive	58	20.93	5.14	0.931
PR				
Negative	31	25.00	8.59	
Positive	54	19.82	5.09	0.092
c-erbB-2				
Negative	15	21.50	9.57	
Positive	70	21.55	6.65	0.788
p53				
Negative	43	23.13	7.04	
Positive	42	19.63	6.20	0.083

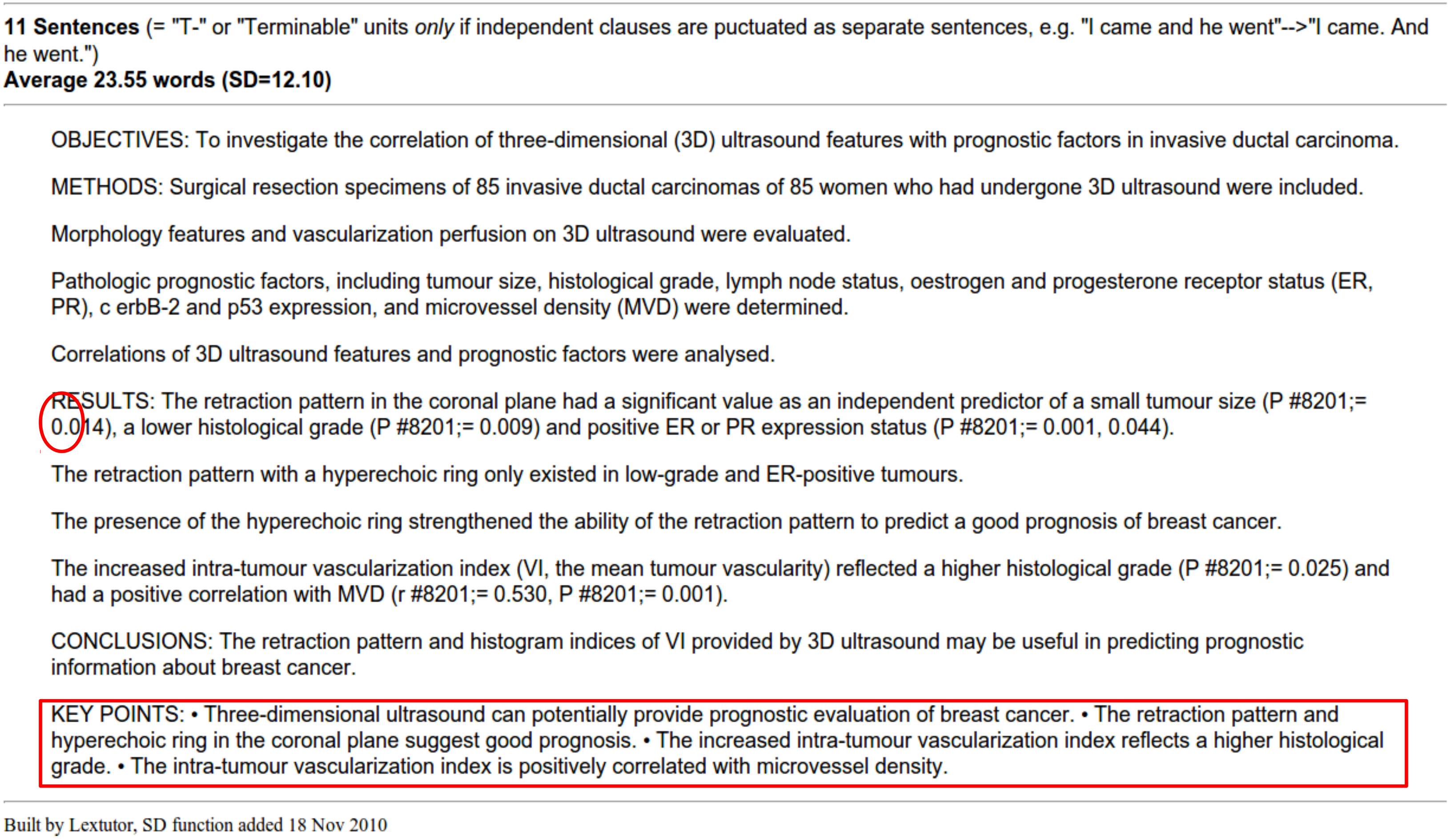
Correlation between vascularization perfusion and prognostic factors

For intra-tumoral regions, the mean VI, FI and VFI of 85 lesions were 6.84 (range, 0.02–21.61), 37.72 (range, 21.81–53.32) and 2.64 (range, 0.04–9.11), respectively. For shells with a thickness of 3 mm surrounding the breast lesion, the VI, FI and VFI were 7.31 (range, 0.14–25.13), 38.72 (range, 23.27–56.90) and 2.88 (range, 0.04–11.08), respectively.

Compared with the small tumours, the tumour foci with a diameter greater than 2 cm were more likely to show a higher inVI, inFI, inVFI, out3mmVI and out3mmVFI. The tumours with a high grade or lymph node metastasis had a higher inVI, inVFI, out3mmVI and out3mmVFI than the tumours with low grade or lymph node-negative status. ER-negative tumours had a higher inFI than ER-positive tumours and the tumours with negative expression of PR had a higher inVI, inVFI and out3mmVFI than PR-positive tumours (Table 4).

Sentence splitting

- Splitting a text into sentences



11 Sentences (= "T-" or "Terminable" units *only* if independent clauses are puctuated as separate sentences, e.g. "I came and he went"-->"I came. And he went.")
Average 23.55 words (SD=12.10)

OBJECTIVES: To investigate the correlation of three-dimensional (3D) ultrasound features with prognostic factors in invasive ductal carcinoma.

METHODS: Surgical resection specimens of 85 invasive ductal carcinomas of 85 women who had undergone 3D ultrasound were included.

Morphology features and vascularization perfusion on 3D ultrasound were evaluated.

Pathologic prognostic factors, including tumour size, histological grade, lymph node status, oestrogen and progesterone receptor status (ER, PR), c erbB-2 and p53 expression, and microvessel density (MVD) were determined.

Correlations of 3D ultrasound features and prognostic factors were analysed.

RESULTS: The retraction pattern in the coronal plane had a significant value as an independent predictor of a small tumour size (P #8201;= 0.014), a lower histological grade (P #8201;= 0.009) and positive ER or PR expression status (P #8201;= 0.001, 0.044).

The retraction pattern with a hyperechoic ring only existed in low-grade and ER-positive tumours.

The presence of the hyperechoic ring strengthened the ability of the retraction pattern to predict a good prognosis of breast cancer.

The increased intra-tumour vascularization index (VI, the mean tumour vascularity) reflected a higher histological grade (P #8201;= 0.025) and had a positive correlation with MVD (r #8201;= 0.530, P #8201;= 0.001).

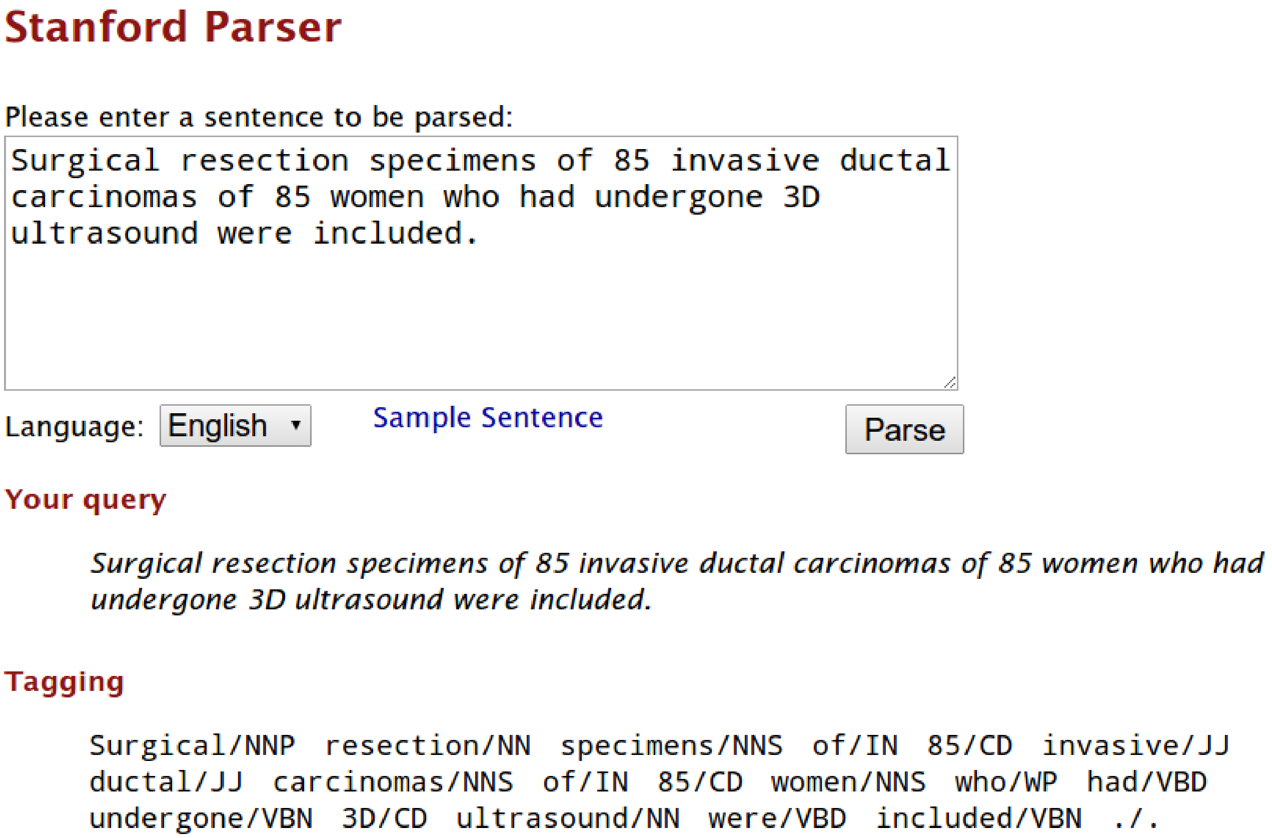
CONCLUSIONS: The retraction pattern and histogram indices of VI provided by 3D ultrasound may be useful in predicting prognostic information about breast cancer.

KEY POINTS: • Three-dimensional ultrasound can potentially provide prognostic evaluation of breast cancer. • The retraction pattern and hyperechoic ring in the coronal plane suggest good prognosis. • The increased intra-tumour vascularization index reflects a higher histological grade. • The intra-tumour vascularization index is positively correlated with microvessel density.

Built by Lextutor, SD function added 18 Nov 2010

Part-of-speech tagging

- Assigning a syntatic tag to each word in a sentence



Stanford Parser

Please enter a sentence to be parsed:

```
Surgical resection specimens of 85 invasive ductal
carcinomas of 85 women who had undergone 3D
ultrasound were included.
```

Your query

Surgical resection specimens of 85 invasive ductal carcinomas of 85 women who had undergone 3D ultrasound were included.

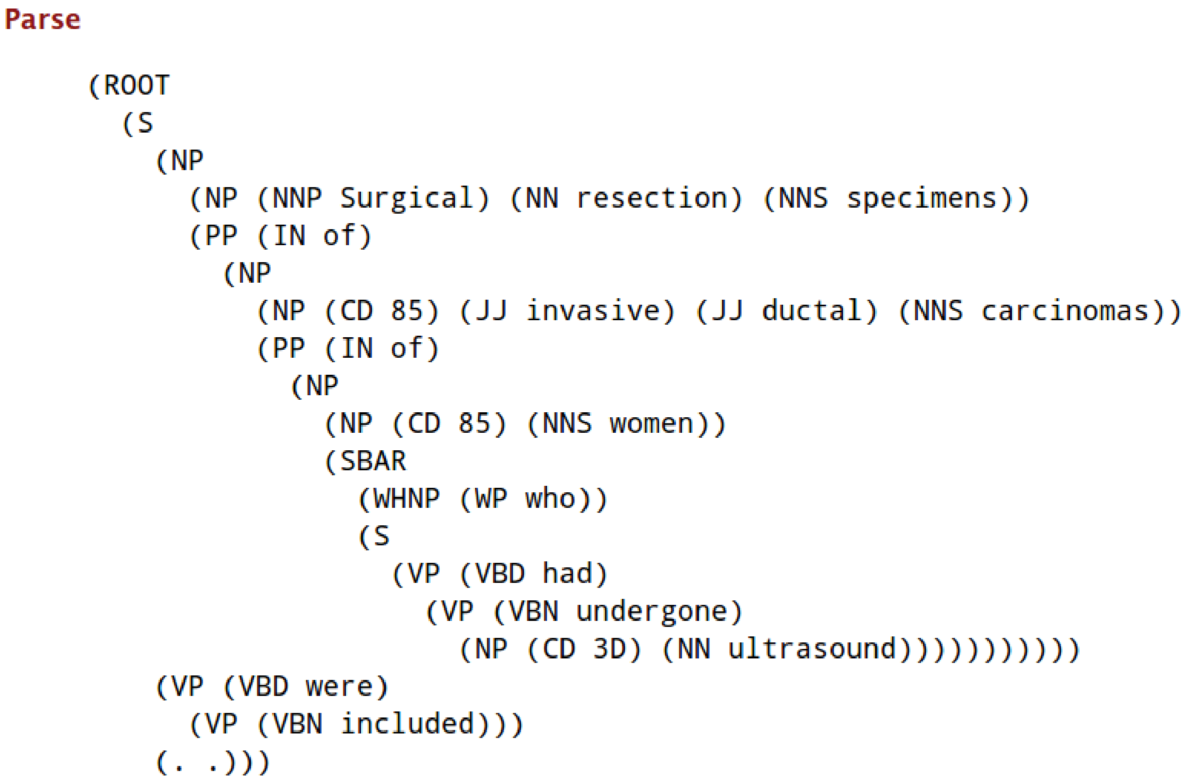
Tagging

```
Surgical/NNP resection/NN specimens/NNS of/IN 85/CD invasive/JJ
ductal/JJ carcinomas/NNS of/IN 85/CD women/NNS who/WP had/VBD
undergone/VBN 3D/CD ultrasound/NN were/VBD included/VBN ./.
```

http://nlp.stanford.edu:8080/corenlp/

Parsing

- Building the synthatic tree of a sentence



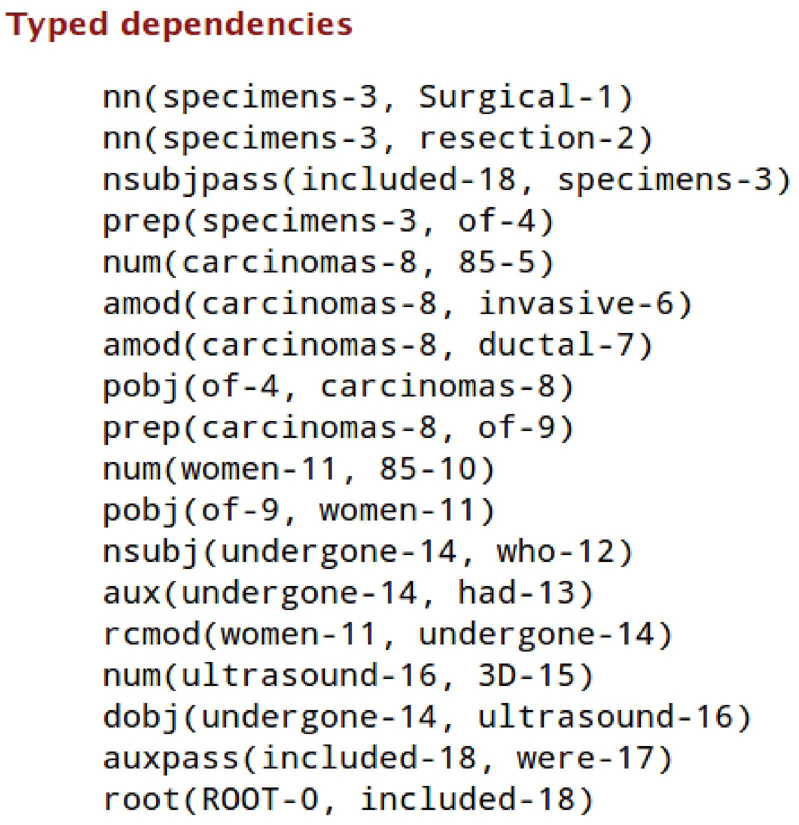
Parse

```
(ROOT
  (S
    (NP
      (NP (NNP Surgical) (NN resection) (NNS specimens))
      (PP (IN of)
        (NP
          (NP (CD 85) (JJ invasive) (JJ ductal) (NNS carcinomas))
          (PP (IN of)
            (NP
              (NP (CD 85) (NNS women))
              (SBAR
                (WHNP (WP who))
                (S
                  (VP (VBD had)
                    (VP (VBN undergone)
                      (NP (CD 3D) (NN ultrasound))))))))))
    (VP (VBD were)
      (VP (VBN included)))
    (. .)))
```

http://nlp.stanford.edu:8080/corenlp/

Parsing

- Building the synthatic tree of a sentence

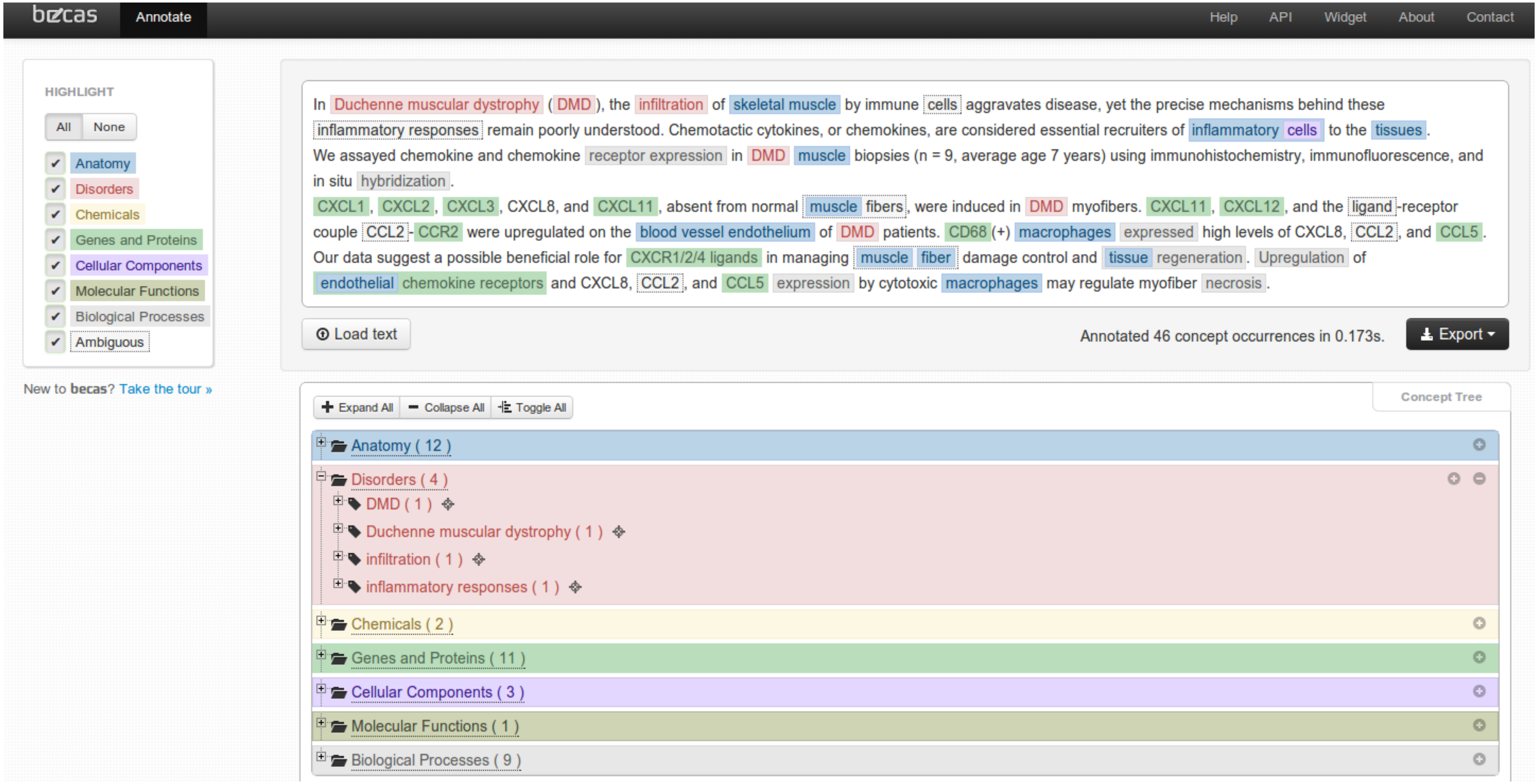


Typed dependencies

```
nn(specimens-3, Surgical-1)
nn(specimens-3, resection-2)
nsubjpass(included-18, specimens-3)
prep(specimens-3, of-4)
num(carcinomas-8, 85-5)
amod(carcinomas-8, invasive-6)
amod(carcinomas-8, ductal-7)
pobj(of-4, carcinomas-8)
prep(carcinomas-8, of-9)
num(women-11, 85-10)
pobj(of-9, women-11)
nsubj(undergone-14, who-12)
aux(undergone-14, had-13)
rcmod(women-11, undergone-14)
num(ultrasound-16, 3D-15)
dobj(undergone-14, ultrasound-16)
auxpass(included-18, were-17)
root(ROOT-0, included-18)
```

Named-entity recognition

- Identifying pre-defined entity types in a sentence



- ✓ Anatomy
- ✓ Disorders
- ✓ Chemicals
- ✓ Genes and Proteins
- ✓ Cellular Components
- ✓ Molecular Functions
- ✓ Biological Processes
- ✓ Ambiguous

New to **becas**? Take the tour »

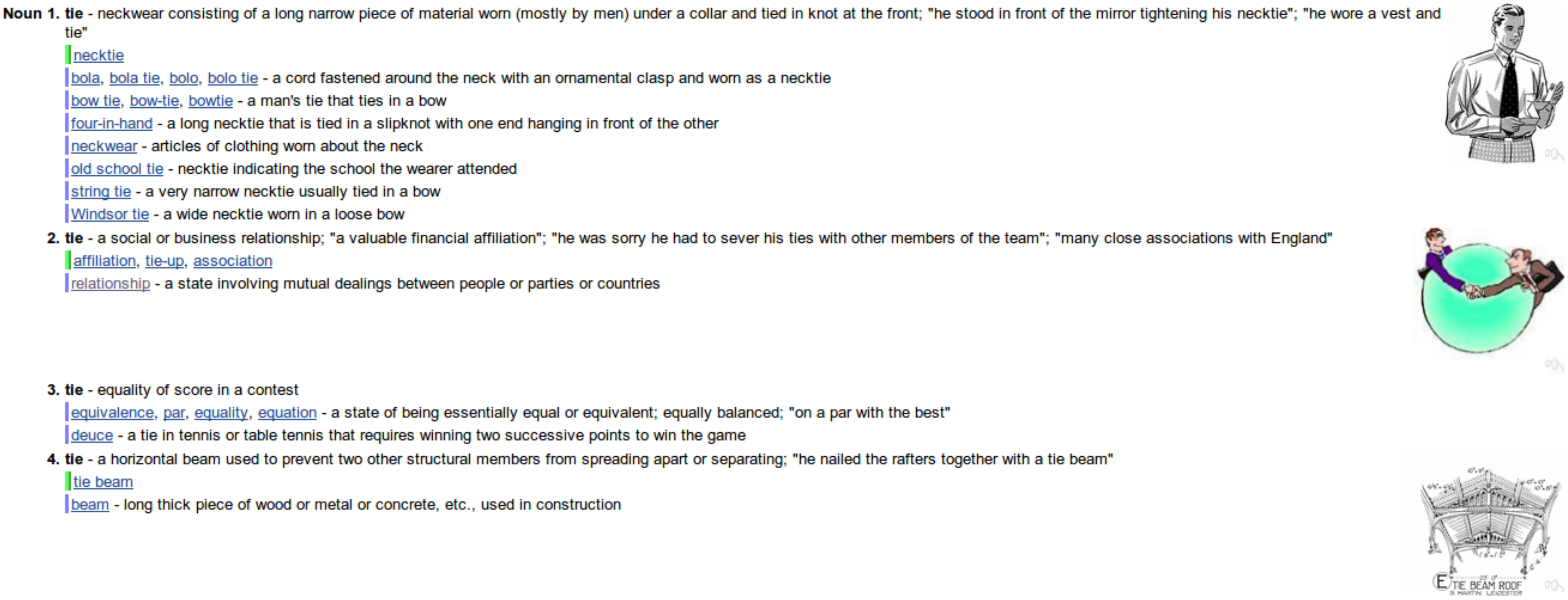
In Duchenne muscular dystrophy (DMD), the infiltration of skeletal muscle by immune cells aggravates disease, yet the precise mechanisms behind these inflammatory responses remain poorly understood. Chemotactic cytokines, or chemokines, are considered essential recruiters of inflammatory cells to the tissues. We assayed chemokine and chemokine receptor expression in DMD muscle biopsies (n = 9, average age 7 years) using immunohistochemistry, immunofluorescence, and in situ hybridization. CXCL1, CXCL2, CXCL3, CXCL8, and CXCL11, absent from normal muscle fibers, were induced in DMD myofibers. CXCL11, CXCL12, and the ligand-receptor couple CCL2-CCR2 were upregulated on the blood vessel endothelium of DMD patients. CD68 (+) macrophages expressed high levels of CXCL8, CCL2, and CCL5. Our data suggest a possible beneficial role for CXCR1/2/4 ligands in managing muscle fiber damage control and tissue regeneration. Upregulation of endothelial chemokine receptors and CXCL8, CCL2, and CCL5 expression by cytotoxic macrophages may regulate myofiber necrosis.

Annotated 46 concept occurrences in 0.173s.

- Anatomy (12)
- Disorders (4)
  - DMD (1)
  - Duchenne muscular dystrophy (1)
  - infiltration (1)
  - inflammatory responses (1)
- Chemicals (2)
- Genes and Proteins (11)
- Cellular Components (3)
- Molecular Functions (1)
- Biological Processes (9)

Word sense disambiguation

- Figuring out the exact meaning of a word or entity



Noun 1. tie - neckwear consisting of a long narrow piece of material worn (mostly by men) under a collar and tied in knot at the front; "he stood in front of the mirror tightening his necktie"; "he wore a vest and tie"

necktie

bola, bola tie, bolo, bolo tie - a cord fastened around the neck with an ornamental clasp and worn as a necktie

bow tie, bow-tie, bowtie - a man's tie that ties in a bow

four-in-hand - a long necktie that is tied in a slipknot with one end hanging in front of the other

neckwear - articles of clothing worn about the neck

old school tie - necktie indicating the school the wearer attended

string tie - a very narrow necktie usually tied in a bow

Windsor tie - a wide necktie worn in a loose bow

2. tie - a social or business relationship; "a valuable financial affiliation"; "he was sorry he had to sever his ties with other members of the team"; "many close associations with England"

affiliation, tie-up, association

relationship - a state involving mutual dealings between people or parties or countries

3. tie - equality of score in a contest

equivalence, par, equality, equation - a state of being essentially equal or equivalent; equally balanced; "on a par with the best"

deuce - a tie in tennis or table tennis that requires winning two successive points to win the game

4. tie - a horizontal beam used to prevent two other structural members from spreading apart or separating; "he nailed the rafters together with a tie beam"

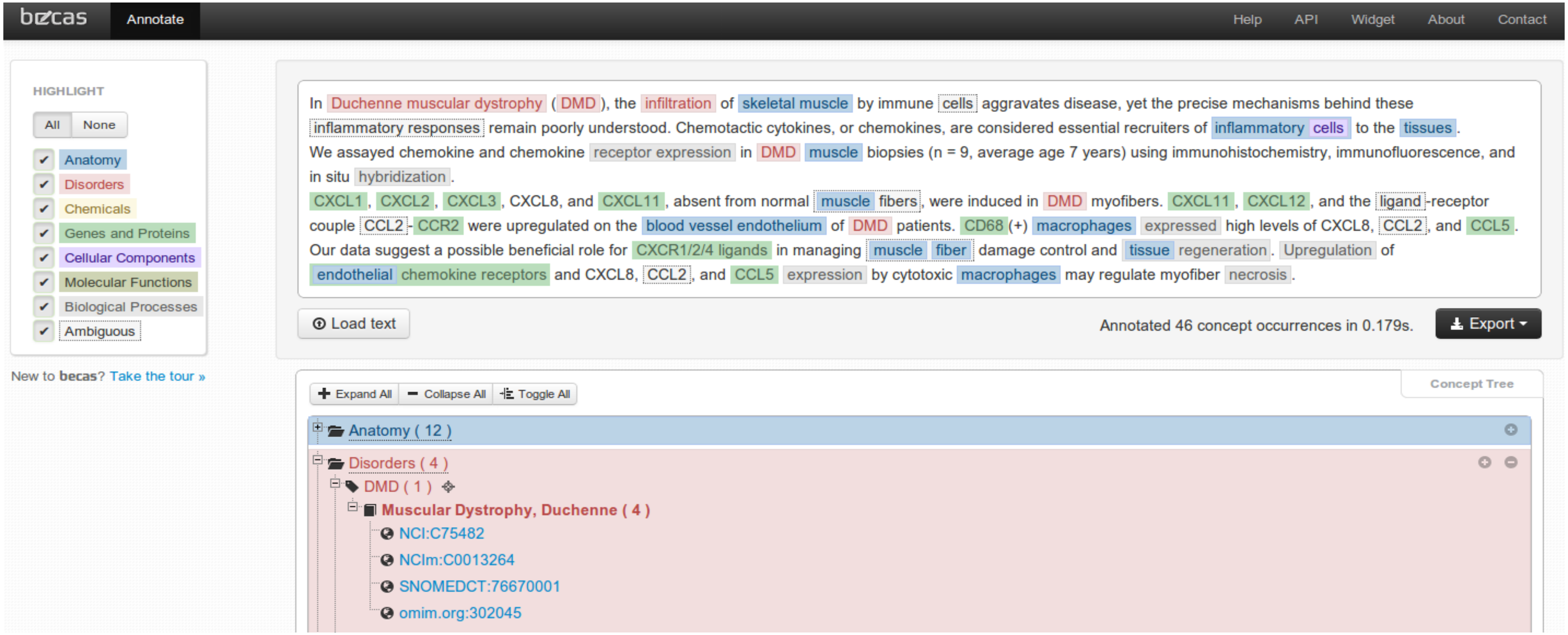
tie beam

beam - long thick piece of wood or metal or concrete, etc., used in construction

http://www.thefreedictionary.com/tie

Word sense disambiguation

- Figuring out the exact meaning of a word or entity



In Duchenne muscular dystrophy (DMD), the infiltration of skeletal muscle by immune cells aggravates disease, yet the precise mechanisms behind these inflammatory responses remain poorly understood. Chemotactic cytokines, or chemokines, are considered essential recruiters of inflammatory cells to the tissues. We assayed chemokine and chemokine receptor expression in DMD muscle biopsies (n = 9, average age 7 years) using immunohistochemistry, immunofluorescence, and in situ hybridization. CXCL1, CXCL2, CXCL3, CXCL8, and CXCL11, absent from normal muscle fibers, were induced in DMD myofibers. CXCL11, CXCL12, and the ligand-receptor couple CCL2-CCR2 were upregulated on the blood vessel endothelium of DMD patients. CD68(+) macrophages expressed high levels of CXCL8, CCL2, and CCL5. Our data suggest a possible beneficial role for CXCR1/2/4 ligands in managing muscle fiber damage control and tissue regeneration. Upregulation of endothelial chemokine receptors and CXCL8, CCL2, and CCL5 expression by cytotoxic macrophages may regulate myofiber necrosis.

Annotated 46 concept occurrences in 0.179s.

Anatomy (12)

Disorders (4)

DMD (1)

Muscular Dystrophy, Duchenne (4)

NCI:C75482

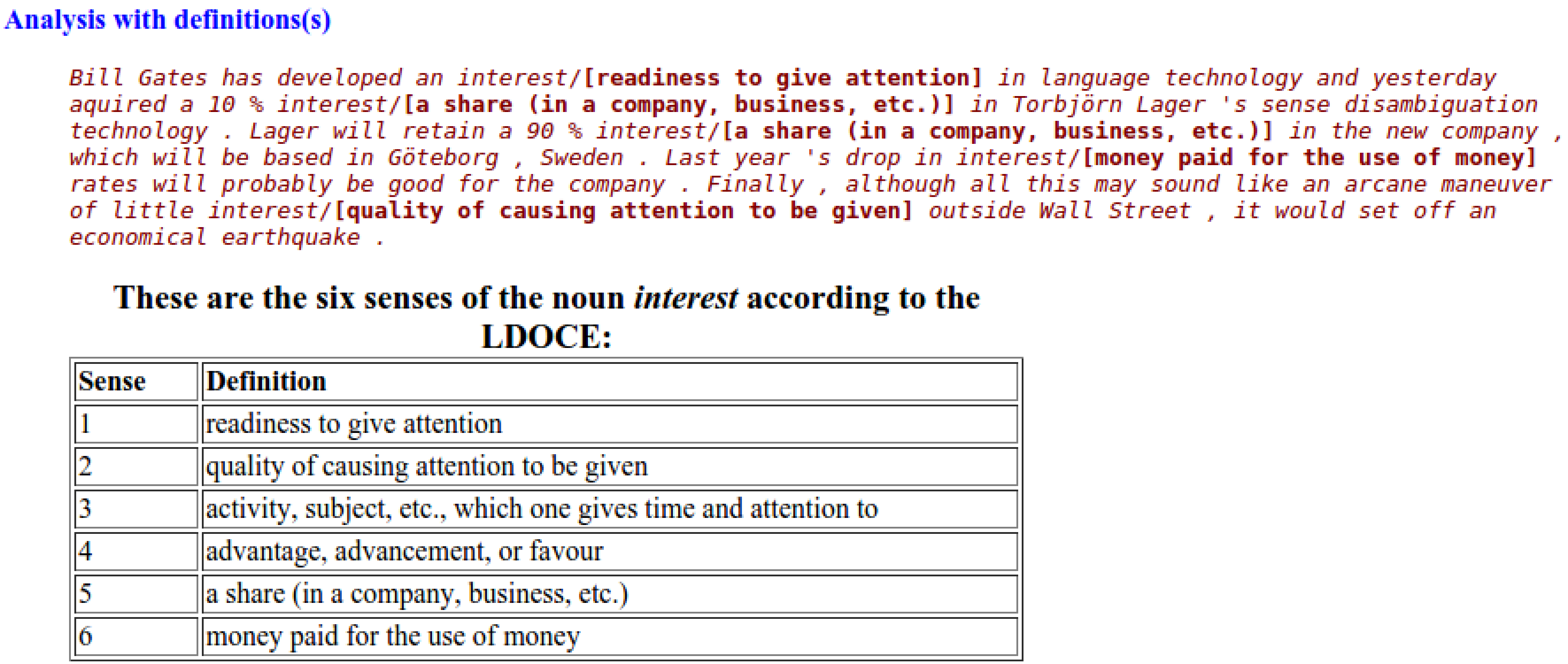
NCIm:C0013264

SNOMEDCT:76670001

omim.org:302045

Word sense disambiguation

- Figuring out the exact meaning of a word or entity



Analysis with definitions(s)

*Bill Gates has developed an interest/***[readiness to give attention]** *in language technology and yesterday aquired a 10 % interest/***[a share (in a company, business, etc.)]** *in Torbjörn Lager 's sense disambiguation technology . Lager will retain a 90 % interest/***[a share (in a company, business, etc.)]** *in the new company , which will be based in Göteborg , Sweden . Last year 's drop in interest/***[money paid for the use of money]** *rates will probably be good for the company . Finally , although all this may sound like an arcane maneuver of little interest/***[quality of causing attention to be given]** *outside Wall Street , it would set off an economical earthquake .*

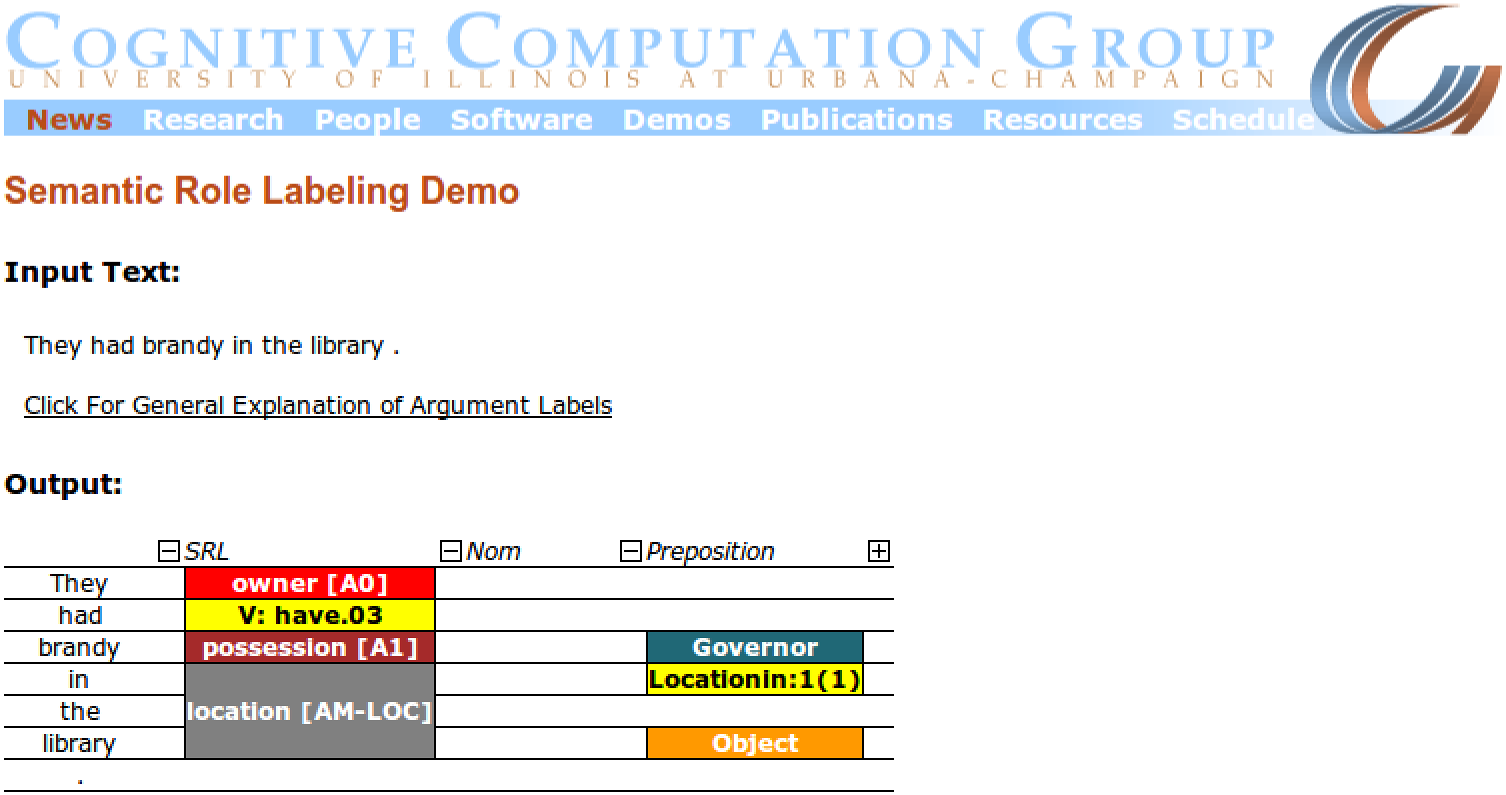
These are the six senses of the noun *interest* according to the LDOCE:

Sense	Definition
1	readiness to give attention
2	quality of causing attention to be given
3	activity, subject, etc., which one gives time and attention to
4	advantage, advancement, or favour
5	a share (in a company, business, etc.)
6	money paid for the use of money

http://www.ling.gu.se/~lager/Home/pwe_ui.html

Semantic role labeling

- Extracting subject-predicate-object triples from a sentence


Cognitive Computation Group
University of Illinois at Urbana-Champaign
News
Research
People
Software
Demos
Publications
Resources
Schedule

Semantic Role Labeling Demo

Input Text:

They had brandy in the library .

Click For General Explanation of Argument Labels

Output:

	⊟ SRL	⊟ Nom	⊟ Preposition	⊞
They	owner [A0]			
had	V: have.03			
brandy	possession [A1]		Governor	
in	location [AM-LOC]		LocationIn:1(1)	
the				
library			Object	
.				

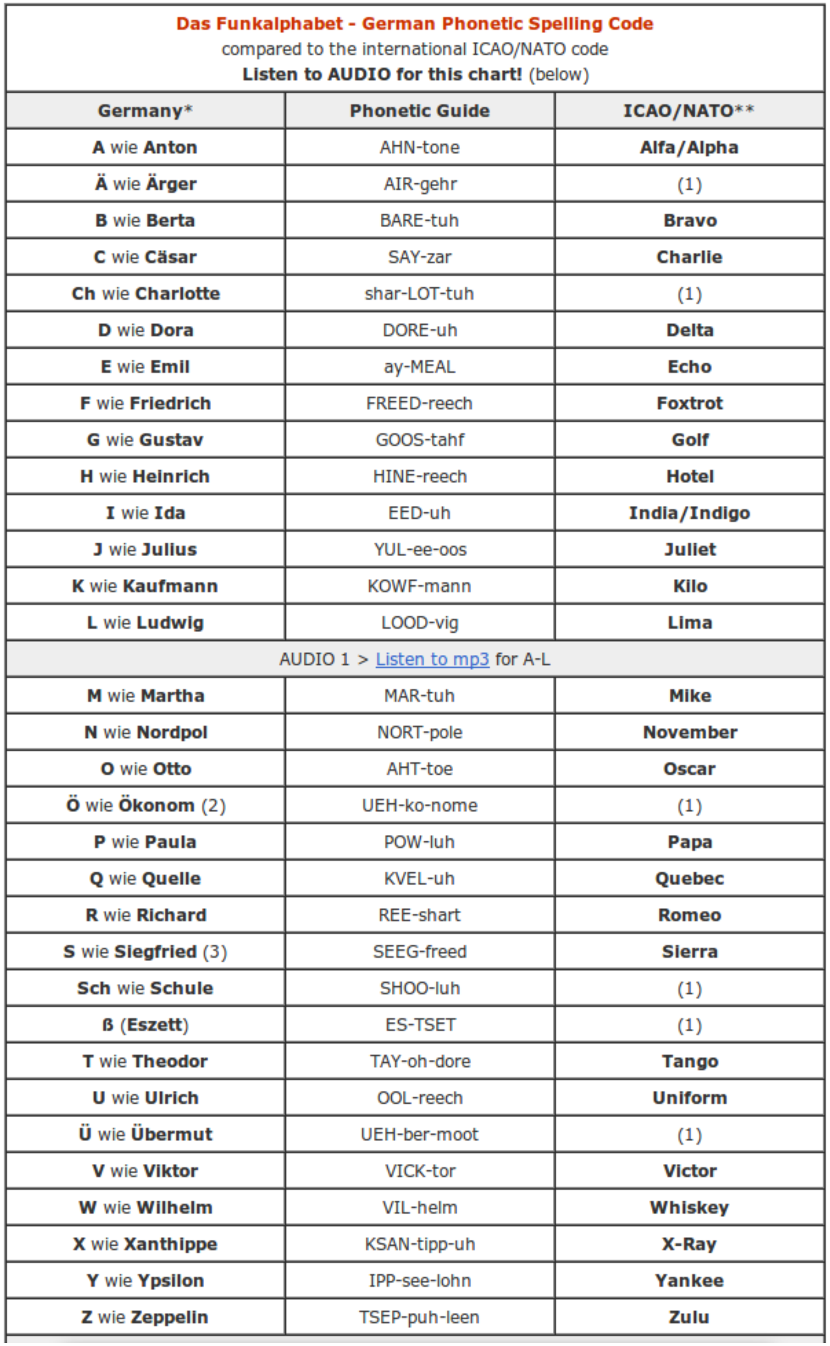
http://cogcomp.cs.illinois.edu/page/demo_view/srl

Outline

- NLP course
- Introduction to NLP
- NLP Applications
- NLP Techniques
- Linguistic Knowledge
- Challenges
- Course materials

Phetics and phonology

- The study of linguistic sounds and their relations to words



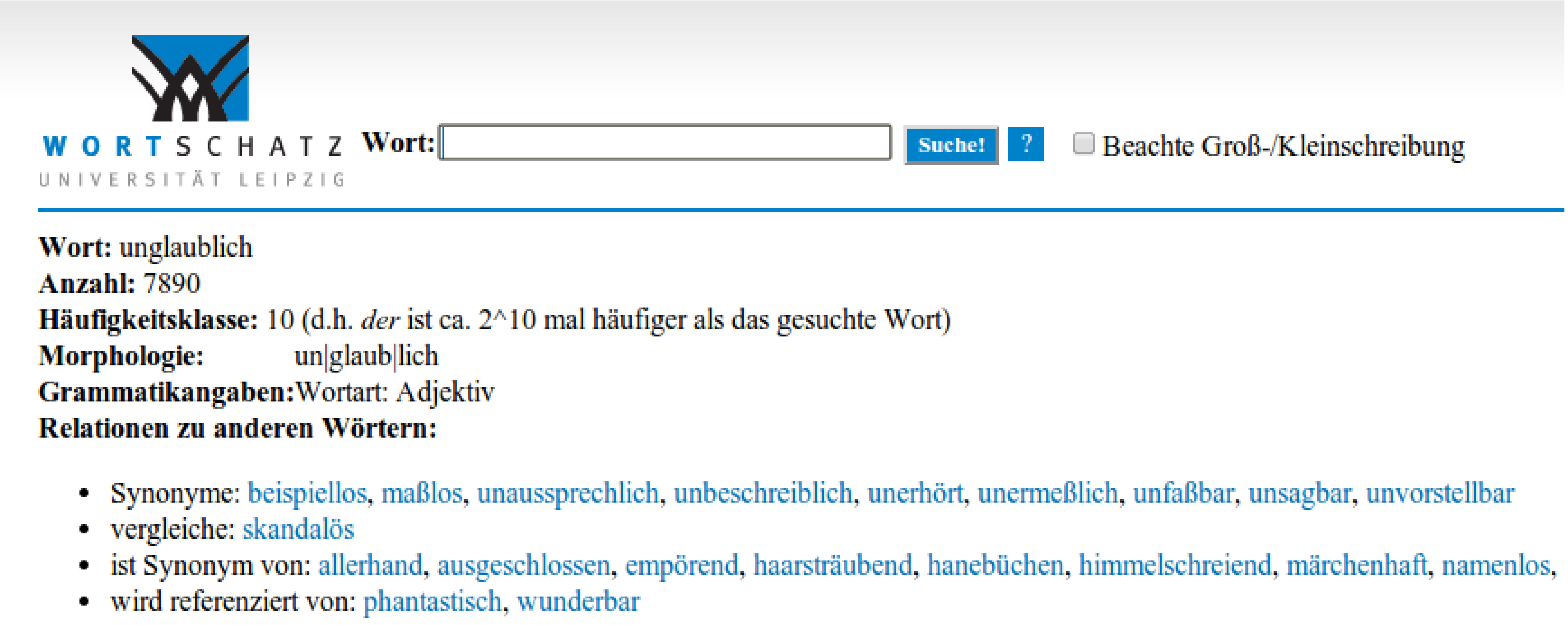
Das Funkalphabet - German Phonetic Spelling Code
compared to the international ICAO/NATO code
Listen to AUDIO for this chart! (below)

Germany*	Phonetic Guide	ICAO/NATO**
A wie **Anton**	AHN-tone	**Alfa/Alpha**
Ä wie **Ärger**	AIR-gehr	(1)
B wie **Berta**	BARE-tuh	**Bravo**
C wie **Cäsar**	SAY-zar	**Charlie**
Ch wie **Charlotte**	shar-LOT-tuh	(1)
D wie **Dora**	DORE-uh	**Delta**
E wie **Emil**	ay-MEAL	**Echo**
F wie **Friedrich**	FREED-reech	**Foxtrot**
G wie **Gustav**	GOOS-tahf	**Golf**
H wie **Heinrich**	HINE-reech	**Hotel**
I wie **Ida**	EED-uh	**India/Indigo**
J wie **Julius**	YUL-ee-oos	**Juliet**
K wie **Kaufmann**	KOWF-mann	**Kilo**
L wie **Ludwig**	LOOD-vig	**Lima**
AUDIO 1 > Listen to mp3 for A-L		
M wie **Martha**	MAR-tuh	**Mike**
N wie **Nordpol**	NORT-pole	**November**
O wie **Otto**	AHT-toe	**Oscar**
Ö wie **Ökonom** (2)	UEH-ko-nome	(1)
P wie **Paula**	POW-luh	**Papa**
Q wie **Quelle**	KVEL-uh	**Quebec**
R wie **Richard**	REE-shart	**Romeo**
S wie **Siegfried** (3)	SEEG-freed	**Sierra**
Sch wie **Schule**	SHOO-luh	(1)
ß (**Eszett**)	ES-TSET	(1)
T wie **Theodor**	TAY-oh-dore	**Tango**
U wie **Ulrich**	OOL-reech	**Uniform**
Ü wie **Übermut**	UEH-ber-moot	(1)
V wie **Viktor**	VICK-tor	**Victor**
W wie **Wilhelm**	VIL-helm	**Whiskey**
X wie **Xanthippe**	KSAN-tipp-uh	**X-Ray**
Y wie **Ypsilon**	IPP-see-lohn	**Yankee**
Z wie **Zeppelin**	TSEP-puh-leen	**Zulu**

http://german.about.com/library/blfunkabc.htm

Morphology

- The study of internal structures of words and how they can be modified
- Parsing complex words into their components

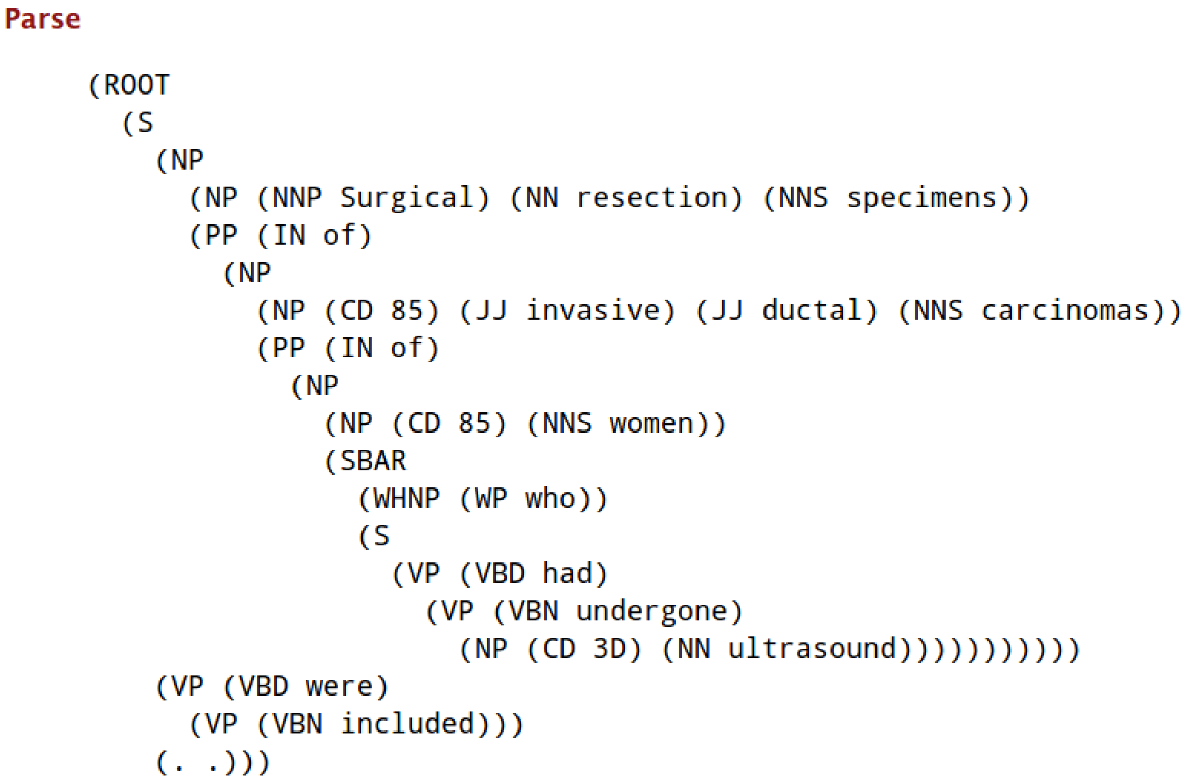


Wort: unglaublich
Anzahl: 7890
Häufigkeitsklasse: 10 (d.h. *der* ist ca. 2^10 mal häufiger als das gesuchte Wort)
Morphologie: un|glaub|lich
Grammatikangaben: Wortart: Adjektiv
Relationen zu anderen Wörtern:

- Synonyme: beispiellos, maßlos, unaussprechlich, unbeschreiblich, unerhört, unermeßlich, unfaßbar, unsagbar, unvorstellbar
- vergleiche: skandalös
- ist Synonym von: allerhand, ausgeschlossen, empörend, haarsträubend, hanebüchen, himmelschreiend, märchenhaft, namenlos,
- wird referenziert von: phantastisch, wunderbar

Syntax

- The study of the structural relationships between words in a sentence



Parse

```
(ROOT
  (S
    (NP
      (NP (NNP Surgical) (NN resection) (NNS specimens))
      (PP (IN of)
        (NP
          (NP (CD 85) (JJ invasive) (JJ ductal) (NNS carcinomas))
          (PP (IN of)
            (NP
              (NP (CD 85) (NNS women))
              (SBAR
                (WHNP (WP who))
                (S
                  (VP (VBD had)
                    (VP (VBN undergone)
                      (NP (CD 3D) (NN ultrasound))))))))))
    (VP (VBD were)
      (VP (VBN included)))
    (. .)))
```

Semantics

- The study of the meaning of words, and how these combine to form the meanings of sentences
  - Synonymy: fall & autumn
  - Hypernymy, hyponymy (is a): dog & animal
  - Meronymy (part of): finger & hand
  - Homonymy: fall (verb & season)
  - Antonymy: big & small

Pragmatics

- Social language use
- The study of how language is used to accomplish goals, and the influence of context on meaning
- Understanding the aspects of a language which depends on situation and world knowledge

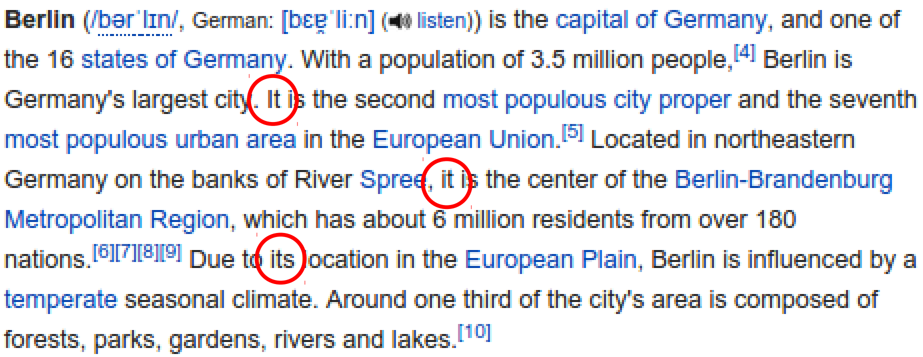
Give me the salt!

Could you please give me the salt?

Discourse

- The study of linguistic units larger than a single statement

John reads a book. He borrowed it from his friend.



Berlin (/bərˈlɪn/, German: [bɛɐ̯ˈliːn] (listen)) is the capital of Germany, and one of the 16 states of Germany. With a population of 3.5 million people,[4] Berlin is Germany's largest city. It is the second most populous city proper and the seventh most populous urban area in the European Union.[5] Located in northeastern Germany on the banks of River Spree, it is the center of the Berlin-Brandenburg Metropolitan Region, which has about 6 million residents from over 180 nations.[6][7][8][9] Due to its location in the European Plain, Berlin is influenced by a temperate seasonal climate. Around one third of the city's area is composed of forests, parks, gardens, rivers and lakes.[10]

(http://en.wikipedia.org/wiki/Berlin)

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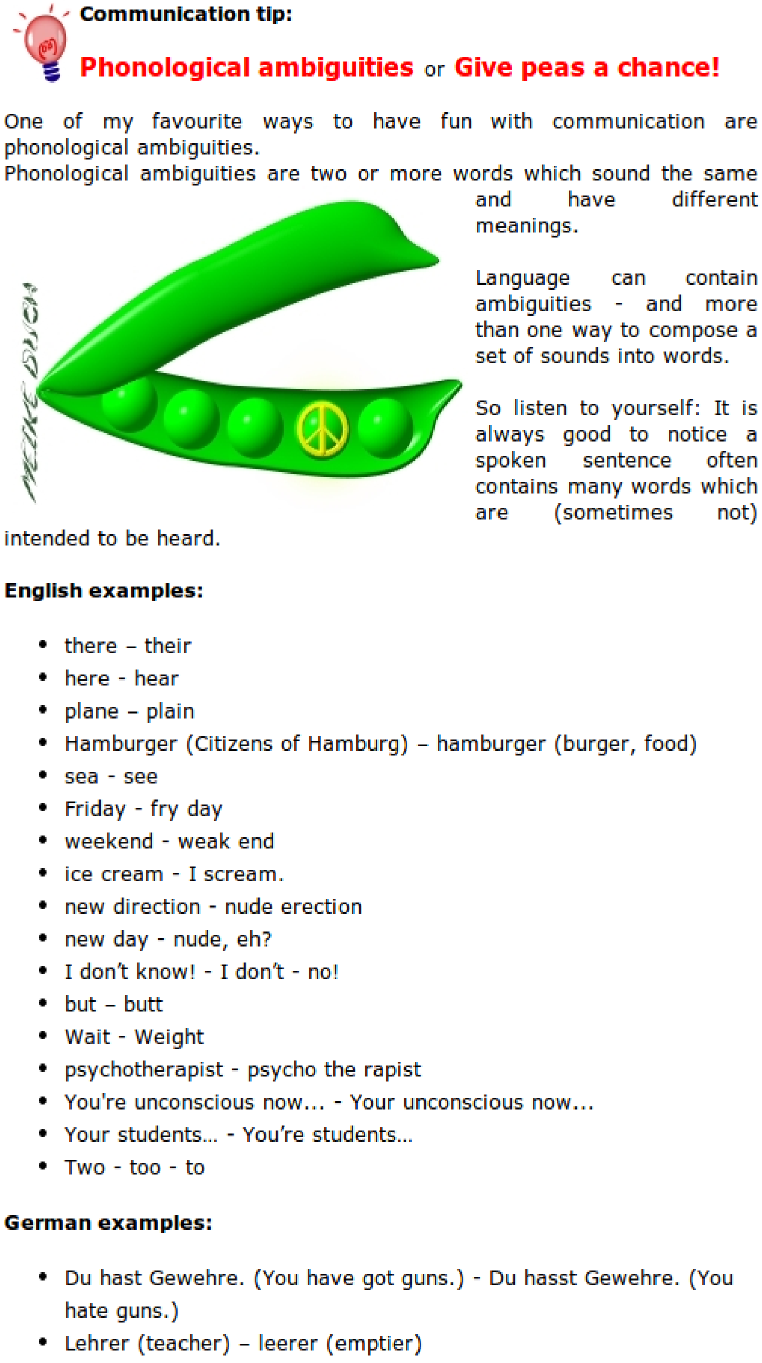
Paraphrasing

- Different words/sentences express the same meaning
  - Season of the year
    - Fall
    - Autumn
  - Book delivery time
    - When will my book arrive?
    - When will I receive my book?

Ambiguity

- One word/sentence can have different meanings
  - Fall
    - The third season of the year
    - Moving down towards the ground or towards a lower position
  - The door is open.
    - Expressing a fact
    - A request to close the door

Phonetics and Phonology



Communication tip:

Phonological ambiguities or **Give peas a chance!**

One of my favourite ways to have fun with communication are phonological ambiguities.

Phonological ambiguities are two or more words which sound the same and have different meanings.

Language can contain ambiguities - and more than one way to compose a set of sounds into words.

So listen to yourself: It is always good to notice a spoken sentence often contains many words which are (sometimes not) intended to be heard.

English examples:

- there – their
- here - hear
- plane – plain
- Hamburger (Citizens of Hamburg) – hamburger (burger, food)
- sea - see
- Friday - fry day
- weekend - weak end
- ice cream - I scream.
- new direction - nude erection
- new day - nude, eh?
- I don’t know! - I don’t - no!
- but – butt
- Wait - Weight
- psychotherapist - psycho the rapist
- You're unconscious now... - Your unconscious now...
- Your students... - You’re students...
- Two - too - to

German examples:

- Du hast Gewehre. (You have got guns.) - Du hasst Gewehre. (You hate guns.)
- Lehrer (teacher) – leerer (emptier)

http://worldsgreatestsmile.com/html/phonological_ambiguity.html

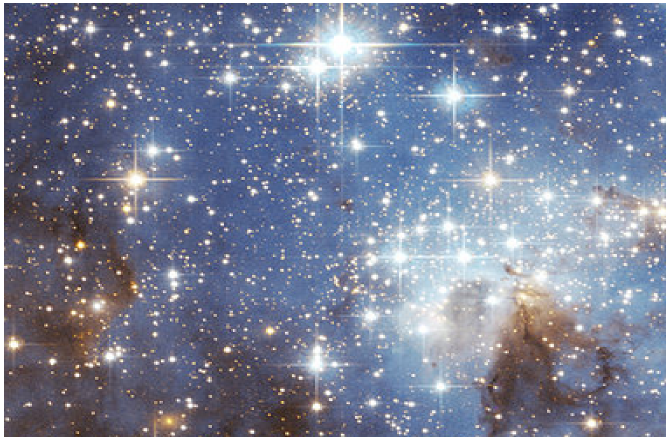
Syntax and ambiguity

- I saw the man with a telescope.
  - Who had the telescope?

(http://www.realtytrac.com/landing/2009-year-end-foreclosure-report.html)

Semantics

- The astronomer loves the star.
  - Star in the sky
  - Celebrity



(http://en.wikipedia.org/wiki/Star#/media/File:Starsinthesky.jpg)

(http://www.businessnewsdaily.com/2023-celebrity-hiring.html)

Discourse

- Alice understands that you like your mother, but she …
  - Does she refer to Alice or your mother?

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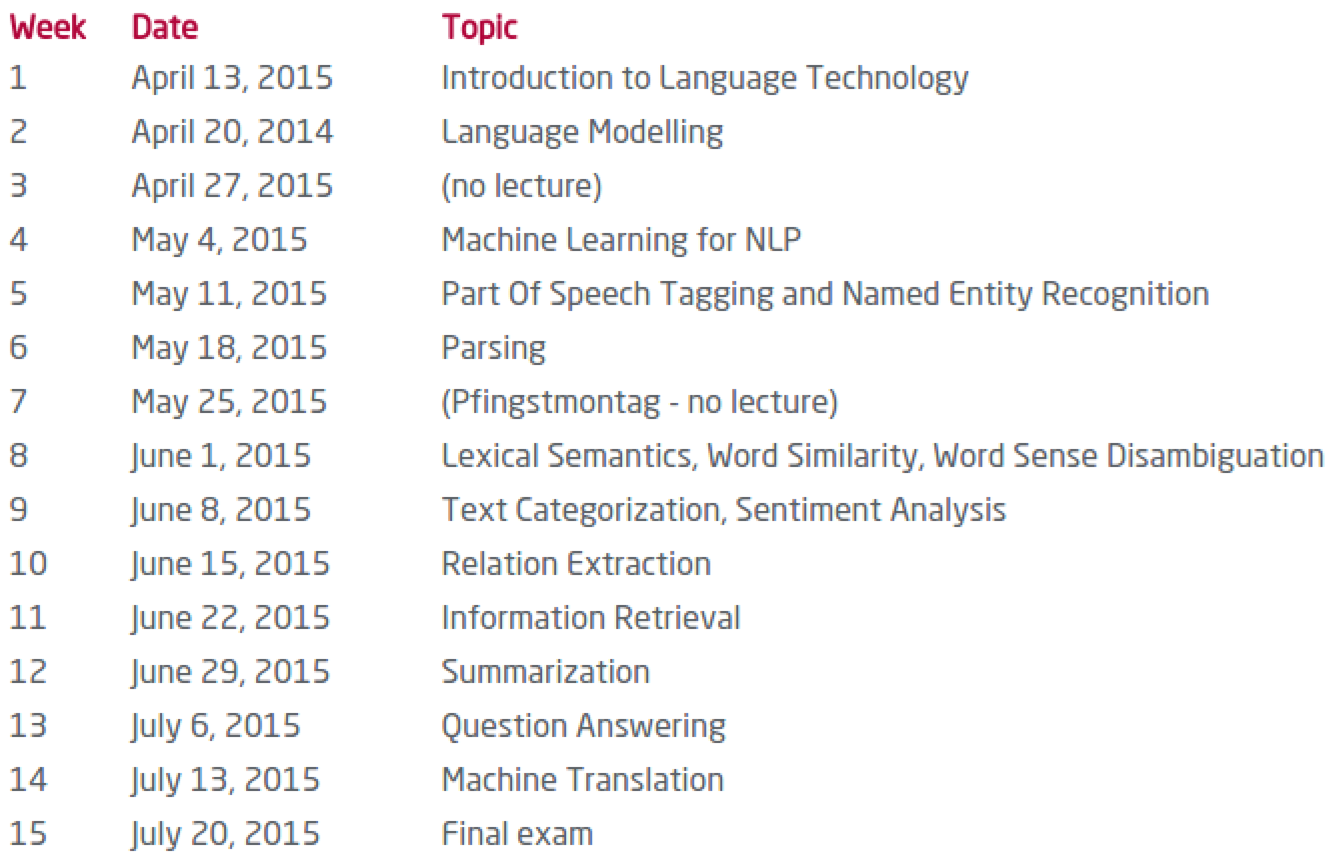
NLP Course

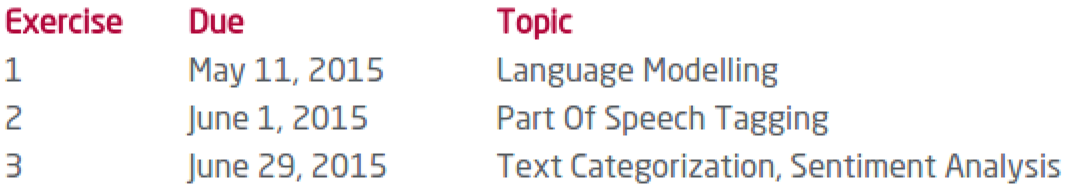
- Home page:
  - http://hpi.de/plattner/teaching/summerterm2015/naturallanguageprocessing.html
- Lecture
  - Monday 15:15-16:45
  - D-E.9/10
  - 3 credit points
- Assessment
  - Deliver of the exercises (not graded, but mandatory)
  - Final exam
- Contact
  - Mariana.Neves@hpi.uni-potsdam.de
  - Room 1.02 (Villa), Monday 11:00-12:00 or under request

Topics



Week	Date	Topic
1	April 13, 2015	Introduction to Language Technology
2	April 20, 2014	Language Modelling
3	April 27, 2015	(no lecture)
4	May 4, 2015	Machine Learning for NLP
5	May 11, 2015	Part Of Speech Tagging and Named Entity Recognition
6	May 18, 2015	Parsing
7	May 25, 2015	(Pfingstmontag - no lecture)
8	June 1, 2015	Lexical Semantics, Word Similarity, Word Sense Disambiguation
9	June 8, 2015	Text Categorization, Sentiment Analysis
10	June 15, 2015	Relation Extraction
11	June 22, 2015	Information Retrieval
12	June 29, 2015	Summarization
13	July 6, 2015	Question Answering
14	July 13, 2015	Machine Translation
15	July 20, 2015	Final exam

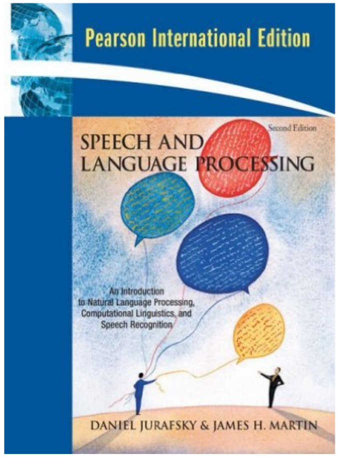
Exercises

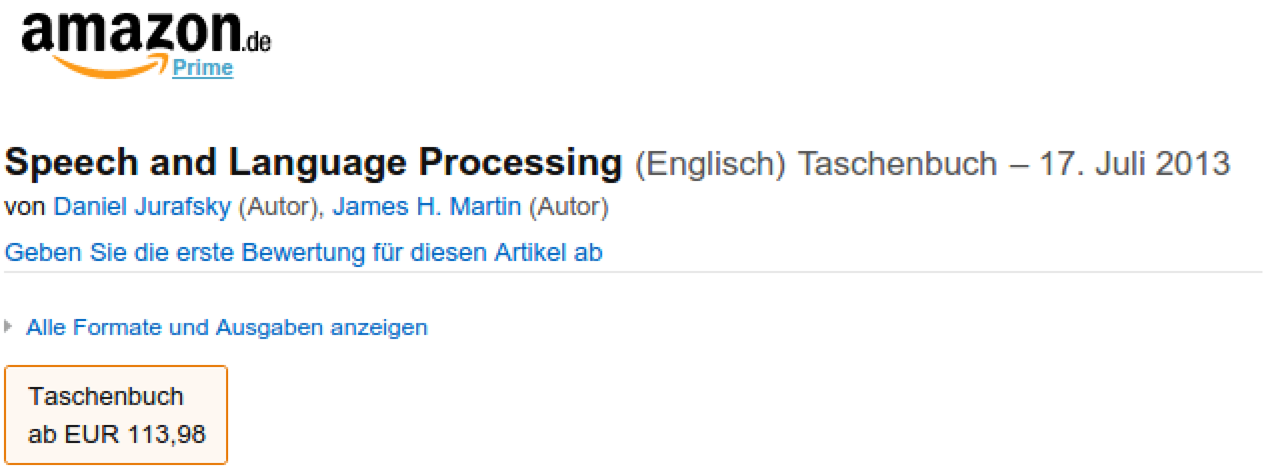


Exercise	Due	Topic
1	May 11, 2015	Language Modelling
2	June 1, 2015	Part Of Speech Tagging
3	June 29, 2015	Text Categorization, Sentiment Analysis

Course book

- Speech and Language Processing
  - Daniel Jurafsky and James H. Martin


Pearson International Edition
Second Edition
SPEECH AND LANGUAGE PROCESSING
An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition
DANIEL JURAFSKY & JAMES H. MARTIN



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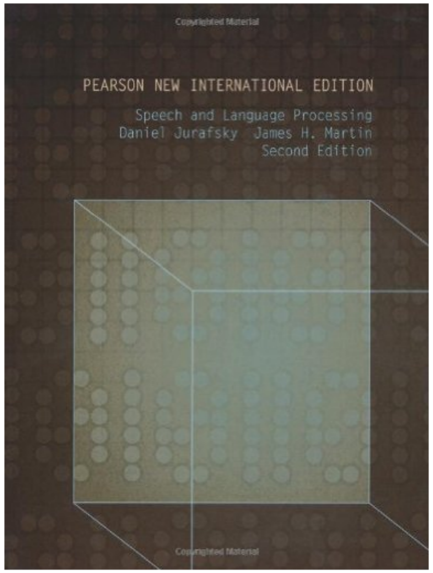
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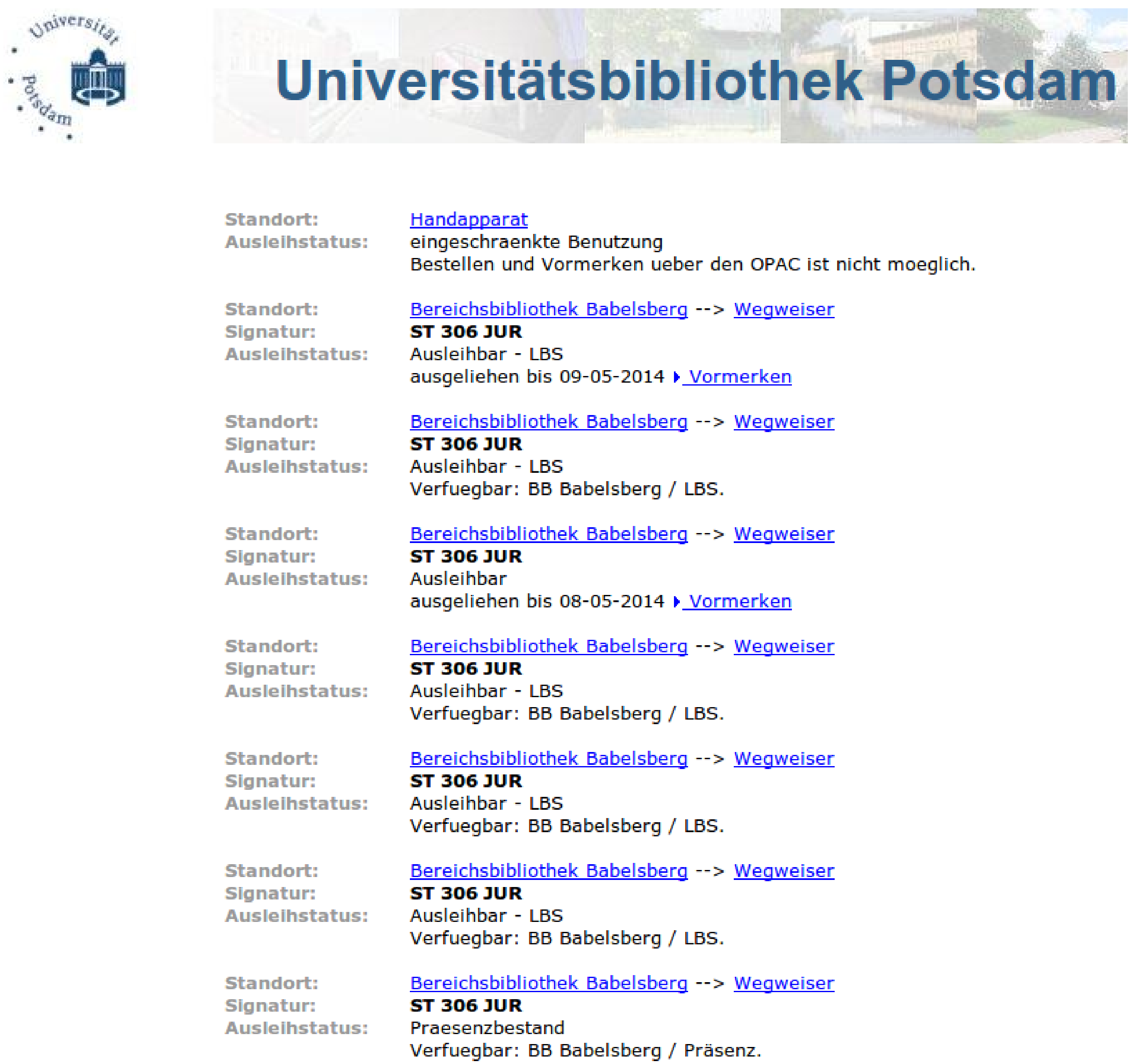

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Journal and conferences

- Journal
  - Computational Linguistics
- Conferences
  - ACL: Association for Computational Linguistics (ACL'16 in Berlin!)
  - NAACL: North American Chapter
  - EACL: European Chapter
  - HLT: Human Language Technology
  - EMNLP: Empirical Methods on Natural Language Processing
  - CoLing: Computational Linguistics
  - LREC: Language Resources and Evaluation