Tamkang University
淡江大學

Tamkang University

Social Computing and Big Data Analytics
社群運算與大數據分析

Text Mining Techniques and Natural Language Processing
(文字探勘分析技術與自然語言處理)

1052SCBDA07
MIS MBA (M2226) (8606)
Wed, 8,9, (15:10-17:00) (L206)

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http://mail. tku.edu.tw/myday/

2017-03-29

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
1	2017/02/15	Course Orientation for Social Computing and Big Data Analytics (社群運算與大數據分析課程介紹)
2	2017/02/22	Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data (資料科學與大數據分析：探索、分析、視覺化與呈現資料)
3	2017/03/01	Fundamental Big Data: MapReduce Paradigm, Hadoop and Spark Ecosystem (大數據基礎：MapReduce典範、Hadoop與Spark生態系統)

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
4	2017/03/08	Big Data Processing Platforms with SMACK: Spark, Mesos, Akka, Cassandra and Kafka (大數據處理平台SMACK： Spark, Mesos, Akka, Cassandra, Kafka)
5	2017/03/15	Big Data Analytics with Numpy in Python (Python Numpy 大數據分析)
6	2017/03/22	Finance Big Data Analytics with Pandas in Python (Python Pandas 財務大數據分析)
7	2017/03/29	Text Mining Techniques and Natural Language Processing (文字探勘分析技術與自然語言處理)
8	2017/04/05	Off-campus study (教學行政觀摩日)

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
9	2017/04/12	Social Media Marketing Analytics (社群媒體行銷分析)
10	2017/04/19	期中報告 (Midterm Project Report)
11	2017/04/26	Deep Learning with Theano and Keras in Python (Python Theano 和 Keras 深度學習)
12	2017/05/03	Deep Learning with Google TensorFlow (Google TensorFlow 深度學習)
13	2017/05/10	Sentiment Analysis on Social Media with Deep Learning (深度學習社群媒體情感分析)

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
14	2017/05/17	Social Network Analysis (社會網絡分析)
15	2017/05/24	Measurements of Social Network (社會網絡量測)
16	2017/05/31	Tools of Social Network Analysis (社會網絡分析工具)
17	2017/06/07	Final Project Presentation I (期末報告 I)
18	2017/06/14	Final Project Presentation II (期末報告 II)

Text Mining (TM)

Natural Language Processing (NLP)

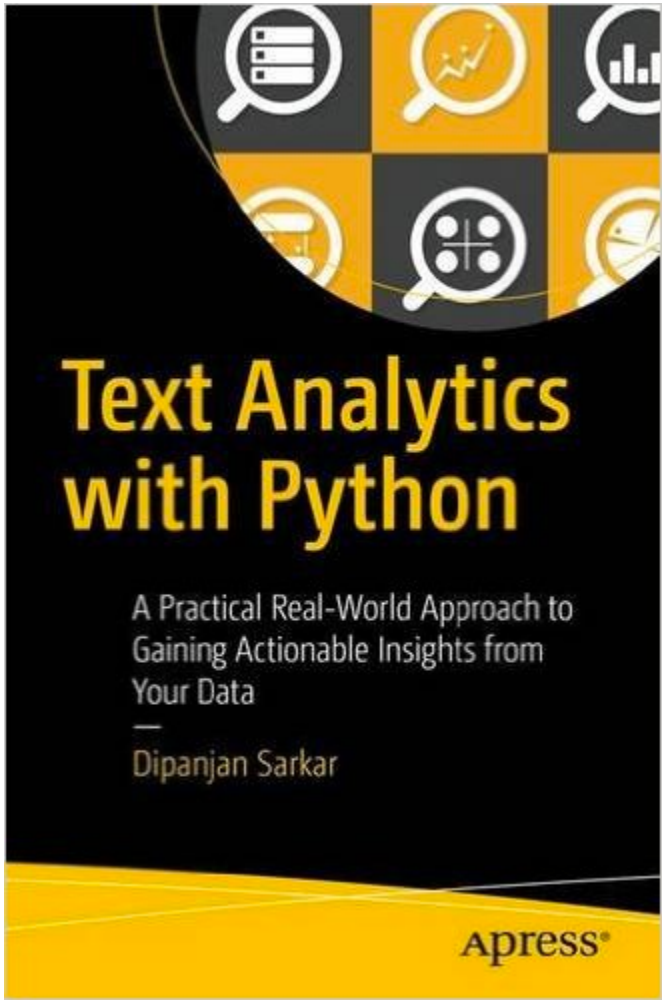
Outline

- Text mining
  - Differentiate between text mining, Web mining and data mining
  - Web mining
    - Web content mining
    - Web structure mining
    - Web usage mining
- Natural Language Processing (NLP)
  - Natural Language Processing with NLTK in Python

Dipanjan Sarkar (2016),

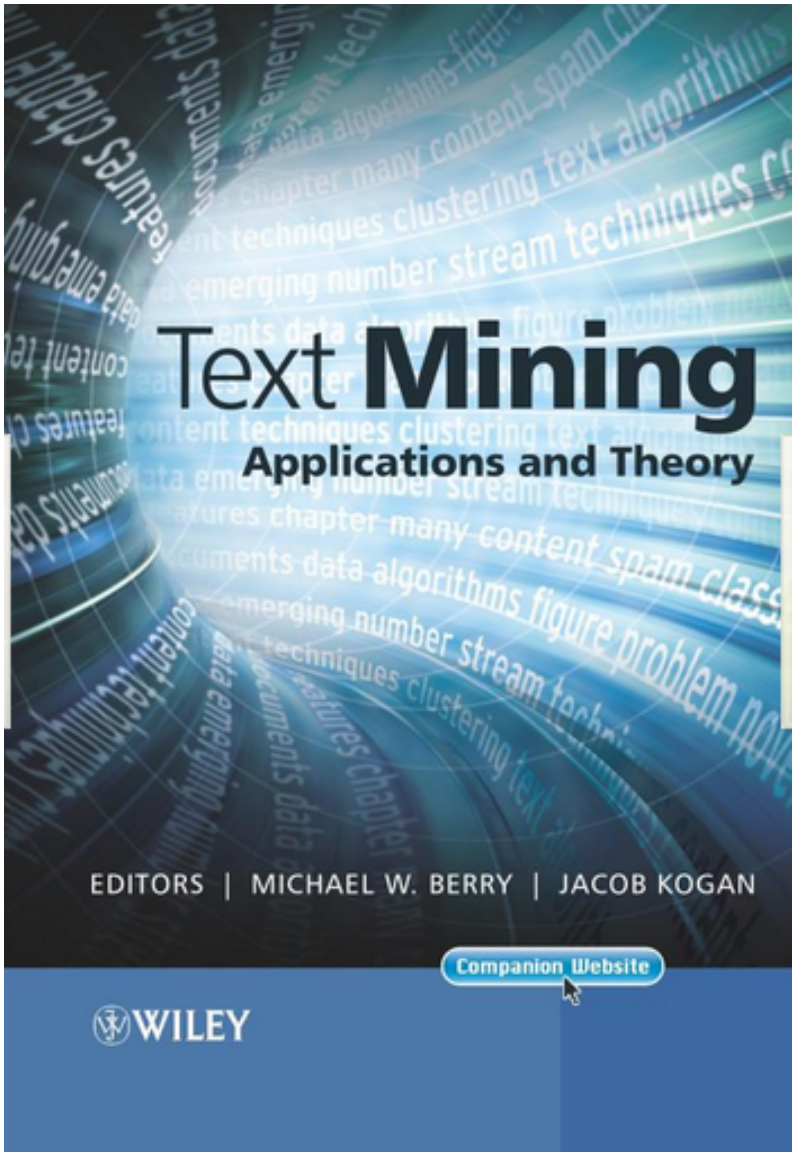
Text Analytics with Python:

A Practical Real-World Approach to Gaining Actionable Insights from your Data, Apress



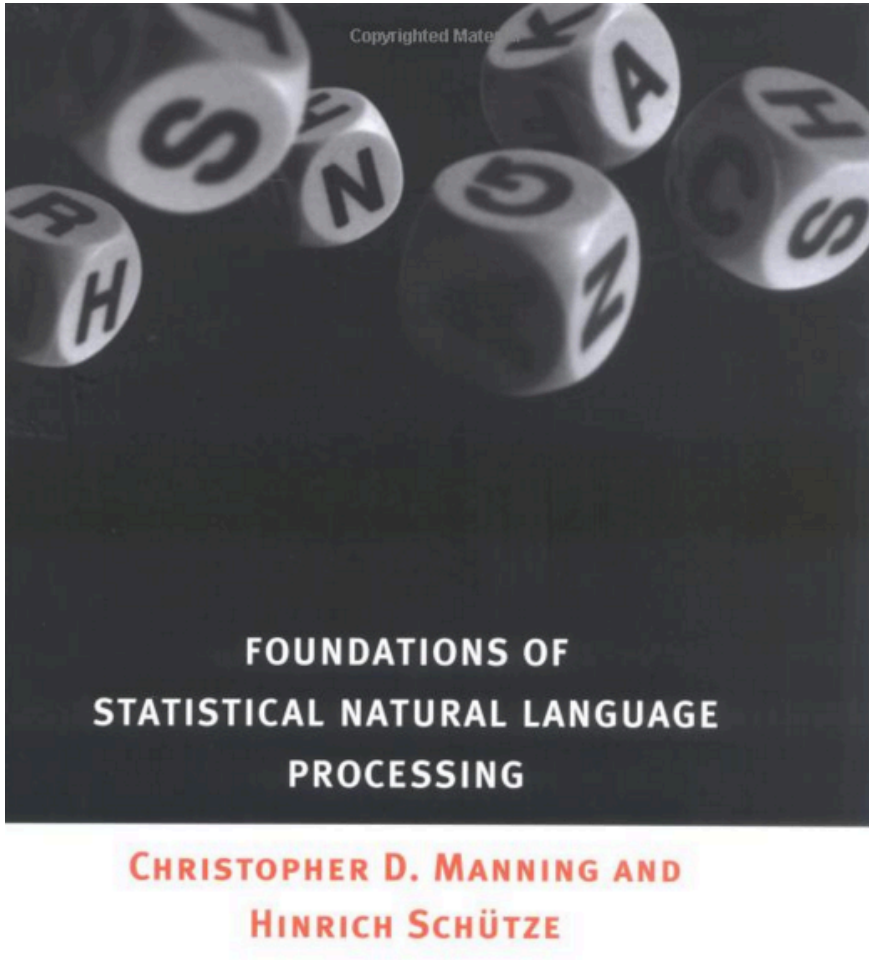
Source: https://www.amazon.com/Text-Analytics-Python-Real-World-Actionable/dp/148422387X

Text Mining



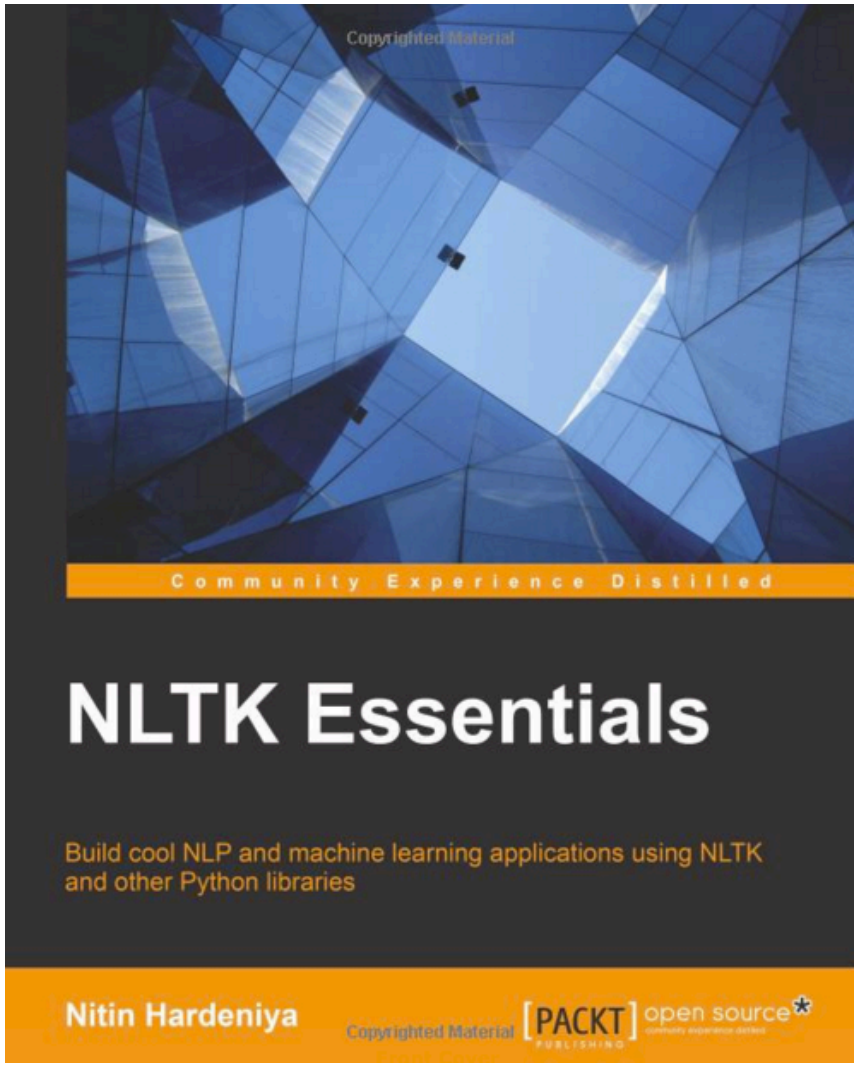
http://www.amazon.com/Text-Mining-Applications-Michael-Berry/dp/0470749822/

Christopher D. Manning and Hinrich Schütze (1999), Foundations of Statistical Natural Language Processing, The MIT Press



http://www.amazon.com/Foundations-Statistical-Natural-Language-Processing/dp/0262133601

Nitin Hardeniya (2015), NLTK Essentials, Packt Publishing

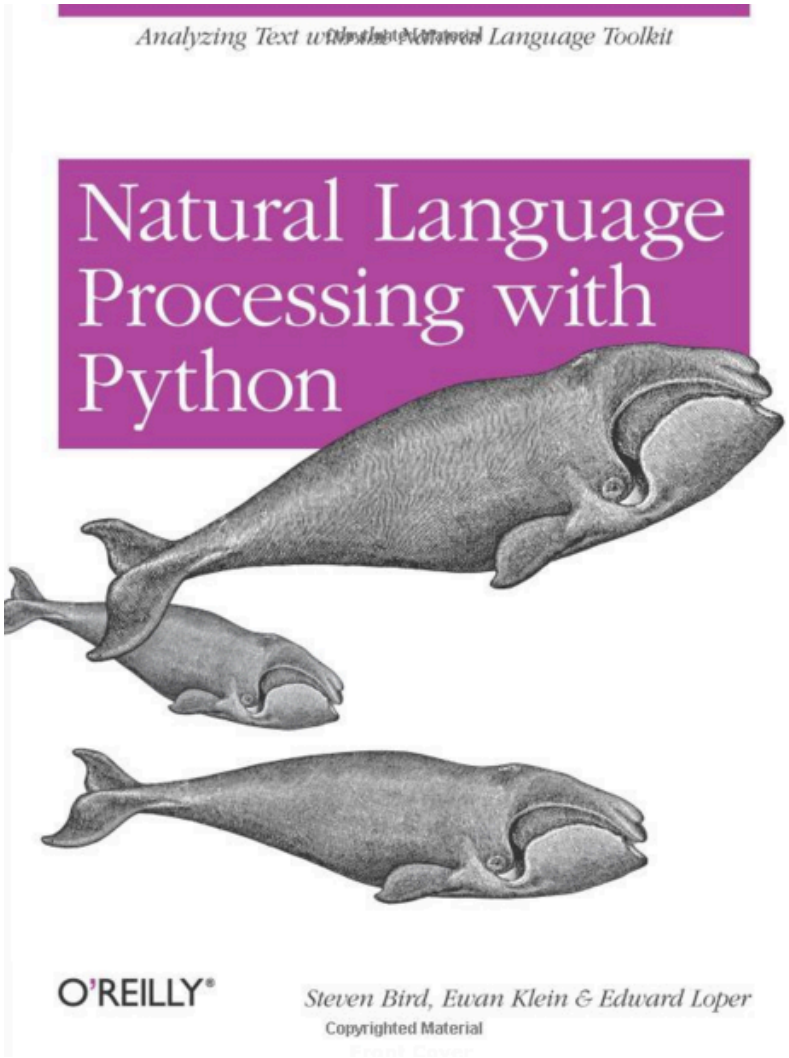


http://www.amazon.com/NLTK-Essentials-Nitin-Hardeniya/dp/1784396907

Steven Bird, Ewan Klein and Edward Loper (2009),

Natural Language Processing with Python,

O'Reilly Media



http://www.amazon.com/Natural-Language-Processing-Python-Steven/dp/0596516495

Natural Language Processing with Python
– Analyzing Text with the Natural Language Toolkit

www.nltk.org/book/

Natural Language Processing with Python

– Analyzing Text with the Natural Language Toolkit

NLTK

Steven Bird, Ewan Klein, and Edward Loper

This version of the NLTK book is updated for Python 3 and NLTK 3. The first edition of the book, published by O'Reilly, is available at http://nltk.org/book_1ed/. (There are currently no plans for a second edition of the book.)

Please post any questions about the materials to the nltk-users mailing list. Please report any errors on the issue tracker.

http://www.nltk.org/book/

gensim

Fork me on GitHub

gensim

topic modelling for humans

Download
latest version from the Python Package Index

Direct install with:
easy_install -U gensim

Home | Tutorials | Install | Support | API | About

```
>>> from gensim import corpora, models, similarities
>>>
>>> # Load corpus iterator from a Matrix Market file on disk.
>>> corpus = corpora.MmCorpus('/path/to/corpus.mm')
>>>
>>> # Initialize Latent Semantic Indexing with 200 dimensions.
>>> lsi = models.LsiModel(corpus, num_topics=200)
>>>
>>> # Convert another corpus to the latent space and index it.
>>> index = similarities.MatrixSimilarity(lsi[another_corpus])
>>>
>>> # Compute similarity of a query vs. indexed documents
>>> sims = index[query]
```

Gensim is a FREE Python library

- Scalable statistical semantics
- Analyze plain-text documents for semantic structure
- Retrieve semantically similar documents

https://radimrehurek.com/gensim/

TextBlob

TextBlob

Star 3,777

TextBlob is a Python (2 and 3) library for processing textual data. It provides a consistent API for diving into common natural language processing (NLP) tasks such as part-of-speech tagging, noun phrase extraction, sentiment analysis, and more.

Useful Links

TextBlob @ PyPI
TextBlob @ GitHub
Issue Tracker

Stay Informed

Follow @sloria

Donate

If you find TextBlob useful,

TextBlob: Simplified Text Processing

Release v0.12.0. (Changelog)

TextBlob is a Python (2 and 3) library for processing textual data. It provides a simple API for diving into common natural language processing (NLP) tasks such as part-of-speech tagging, noun phrase extraction, sentiment analysis, classification, translation, and more.

```
from textblob import TextBlob

text = '''
The titular threat of The Blob has always struck me as the ultimate movie
monster: an insatiably hungry, amoeba-like mass able to penetrate
virtually any safeguard, capable of--as a doomed doctor chillingly
describes it--"assimilating flesh on contact.
Snide comparisons to gelatin be damned, it's a concept with the most
devastating of potential consequences, not unlike the grey goo scenario
proposed by technological theorists fearful of
artificial intelligence run rampant.
'''

blob = TextBlob(text)
blob.tags           # [('The', 'DT'), ('titular', 'JJ'),
                    #  ('threat', 'NN'), ('of', 'IN'), ...]

blob.noun_phrases   # WordList(['titular threat', 'blob',
                    #           'ultimate movie monster',
                    #           'amoeba-like mass', ...])

for sentence in blob.sentences:
    print(sentence.sentiment.polarity)
# 0.060
```

https://textblob.readthedocs.io

spaCy

spaCy

HOME USAGE API DEMOS BLOG

Industrial-Strength Natural Language Processing

in Python

Fastest in the world

spaCy excels at large-scale information extraction tasks. It's written from the ground up in carefully memory-managed Cython. Independent research has confirmed that spaCy is the fastest in the world. If your application needs to process entire web dumps, spaCy is the library you want to be using.

Get things done

spaCy is designed to help you do real work — to build real products, or gather real insights. The library respects your time, and tries to avoid wasting it. It's easy to install, and its API is simple and productive. I like to think of spaCy as the Ruby on Rails of Natural Language Processing.

Deep learning

spaCy is the best way to prepare text for deep learning. It interoperates seamlessly with TensorFlow, Keras, Scikit-Learn, Gensim and the rest of Python's awesome AI ecosystem. spaCy helps you connect the statistical models trained by these libraries to the rest of your application.

https://spacy.io/

scikit-learn

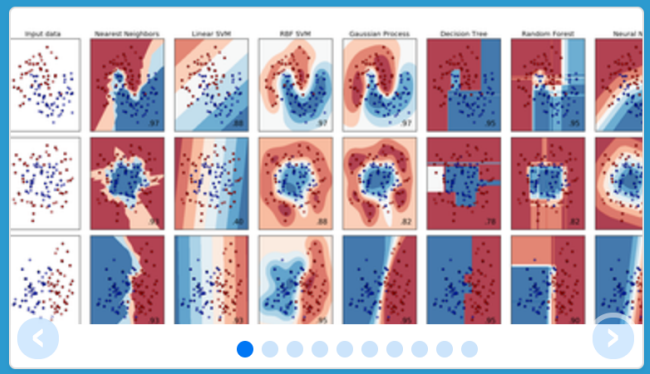
scikit learn

Home Installation Documentation Examples

powered by Google

Google Custom Search Search

Fork me on GitHub



scikit-learn

Machine Learning in Python

- Simple and efficient tools for data mining and data analysis
- Accessible to everybody, and reusable in various contexts
- Built on NumPy, SciPy, and matplotlib
- Open source, commercially usable - BSD license

Classification

Identifying to which category an object belongs to.

Applications: Spam detection, Image recognition.
Algorithms: SVM, nearest neighbors, random forest, ... — Examples

Regression

Predicting a continuous-valued attribute associated with an object.

Applications: Drug response, Stock prices.
Algorithms: SVR, ridge regression, Lasso, ... — Examples

Clustering

Automatic grouping of similar objects into sets.

Applications: Customer segmentation, Grouping experiment outcomes
Algorithms: k-Means, spectral clustering, mean-shift, ... — Examples

Dimensionality reduction

Reducing the number of random variables to consider.

Applications: Visualization, Increased efficiency

Model selection

Comparing, validating and choosing parameters and models.

Goal: Improved accuracy via parameter tuning

Preprocessing

Feature extraction and normalization.

Application: Transforming input data such as text for use with machine learning algorithms.
Modules: preprocessing, feature extraction.

http://scikit-learn.org/

Text Mining
(text data mining)

the process of deriving high-quality information from text

http://en.wikipedia.org/wiki/Text_mining

Emotions

Love

Anger

Joy

Sadness

Surprise

Fear

Source: Bing Liu (2011) , “Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data,” Springer, 2nd Edition,

Example of Opinion: review segment on iPhone

"I bought an iPhone a few days ago.

It was such a nice phone.

The touch screen was really cool.

The voice quality was clear too.

However, my mother was mad with me as I did not tell her before I bought it.

She also thought the phone was too expensive, and wanted me to return it to the shop. … "

Source: Bing Liu (2011) , "Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data," Springer, 2nd Edition,

Example of Opinion: review segment on iPhone

"(1) I bought an iPhone a few days ago.

(2) It was such a **nice** phone.

(3) The touch screen was really **cool**.

(4) The voice quality was **clear** too.

+Positive Opinion

(5) However, my mother was mad with me as I did not tell her before I bought it.

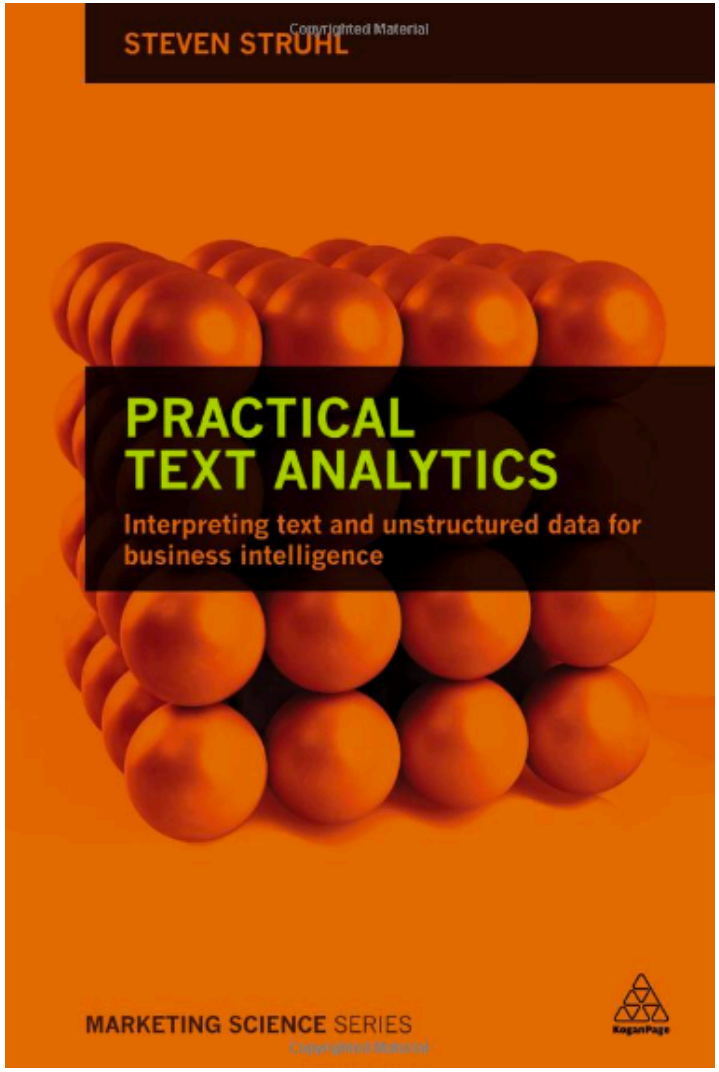
(6) She also thought the phone was too **expensive**, and wanted me to return it to the shop. … "

-Negative Opinion

Source: Bing Liu (2011) , "Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data," Springer, 2nd Edition,

Text Mining Technologies

Steven Struhl (2015), Practical Text Analytics: Interpreting Text and Unstructured Data for Business Intelligence (Marketing Science), Kogan Page



http://www.amazon.com/Practical-Text-Analytics-Interpreting-Unstructured/dp/0749474017

Text Mining Concepts

- 85-90 percent of all corporate data is in some kind of unstructured form (e.g., text)
- Unstructured corporate data is doubling in size every 18 months
- Tapping into these information sources is not an option, but a need to stay competitive
- Answer: text mining
  - A semi-automated process of extracting knowledge from unstructured data sources
  - a.k.a. text data mining or knowledge discovery in textual databases

Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Text mining

Text Data Mining

Intelligent Text Analysis

Knowledge-Discovery in Text (KDT)

Source: Vishal Gupta and Gurpreet S. Lehal (2009), "A survey of text mining techniques and applications," Journal of emerging technologies in web intelligence, vol. 1, no. 1, pp. 60-76.

Text Mining:

the process of extracting interesting and non-trivial information and knowledge from unstructured text.

Source: Vishal Gupta and Gurpreet S. Lehal (2009), "A survey of text mining techniques and applications," Journal of emerging technologies in web intelligence, vol. 1, no. 1, pp. 60-76.

Text Mining:

discovery by computer of

new, previously

unknown information,

by automatically

extracting information

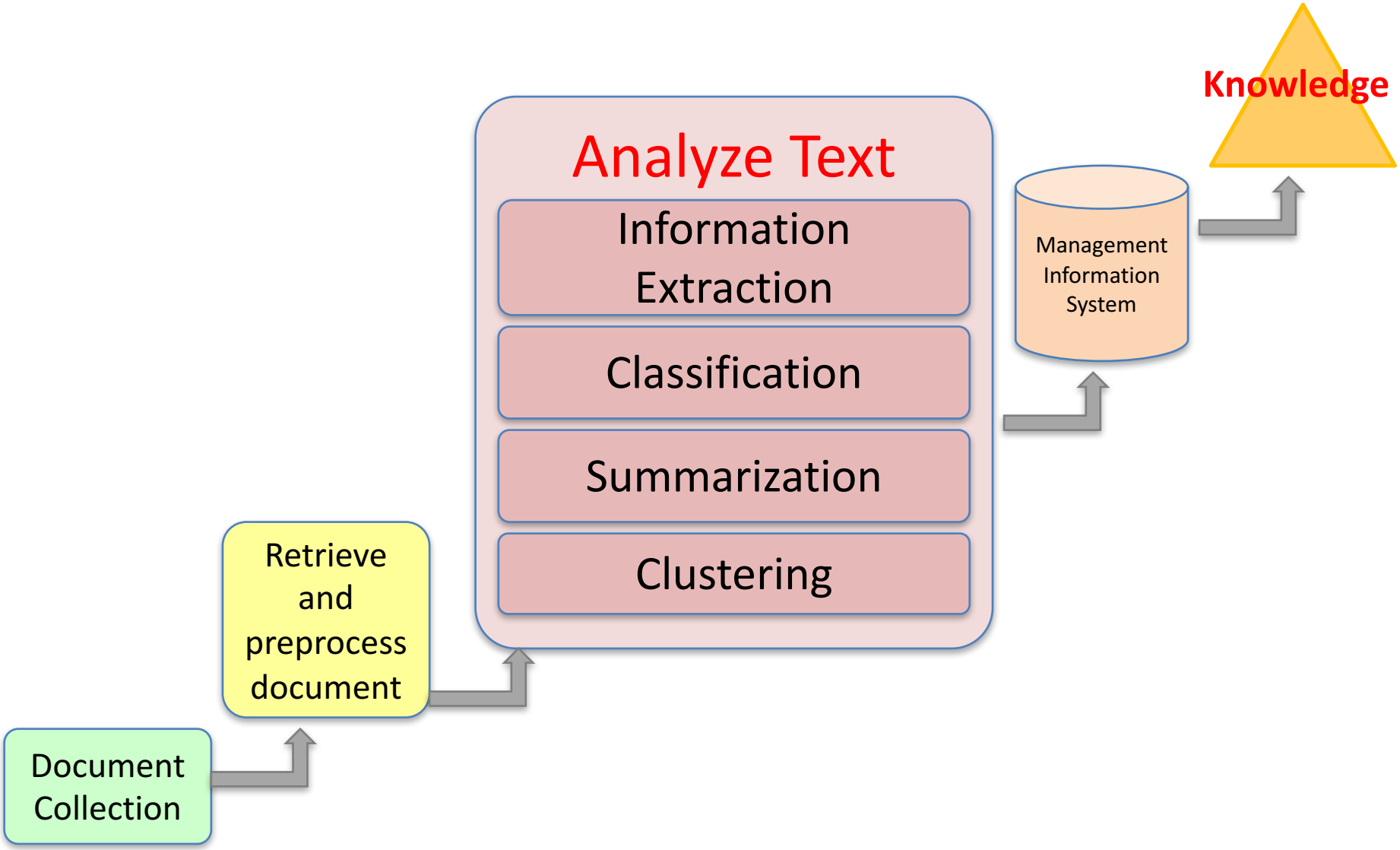
from different written resources.

Source: Vishal Gupta and Gurpreet S. Lehal (2009), "A survey of text mining techniques and applications," Journal of emerging technologies in web intelligence, vol. 1, no. 1, pp. 60-76.

Text Mining (TM)

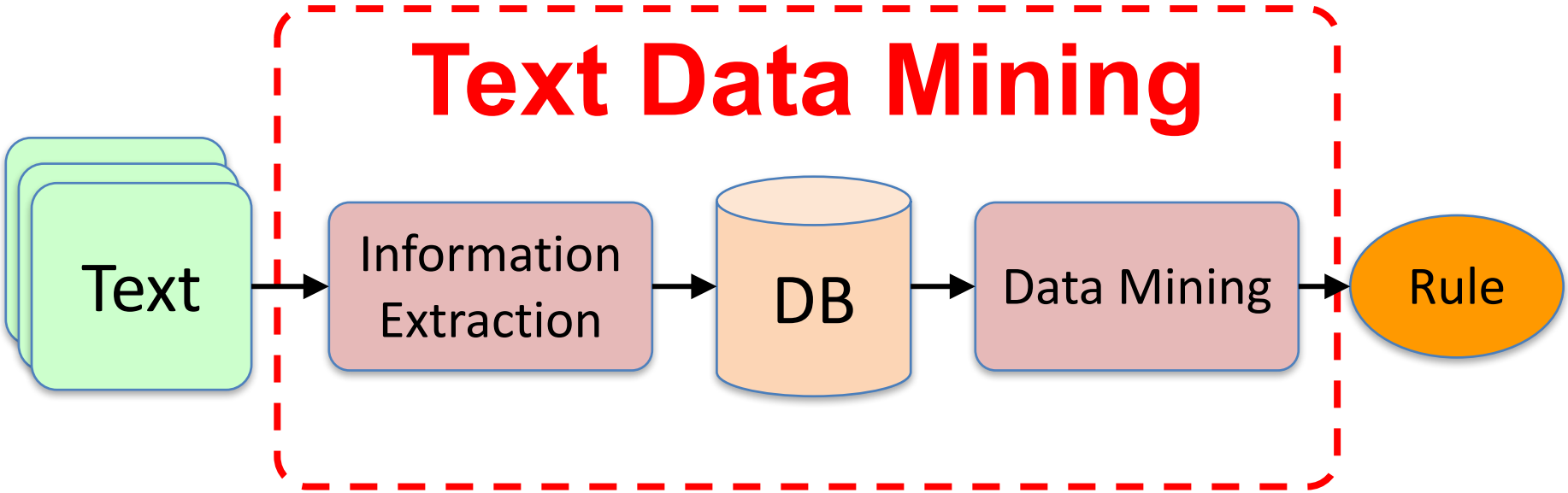
Natural Language Processing (NLP)

An example of Text Mining



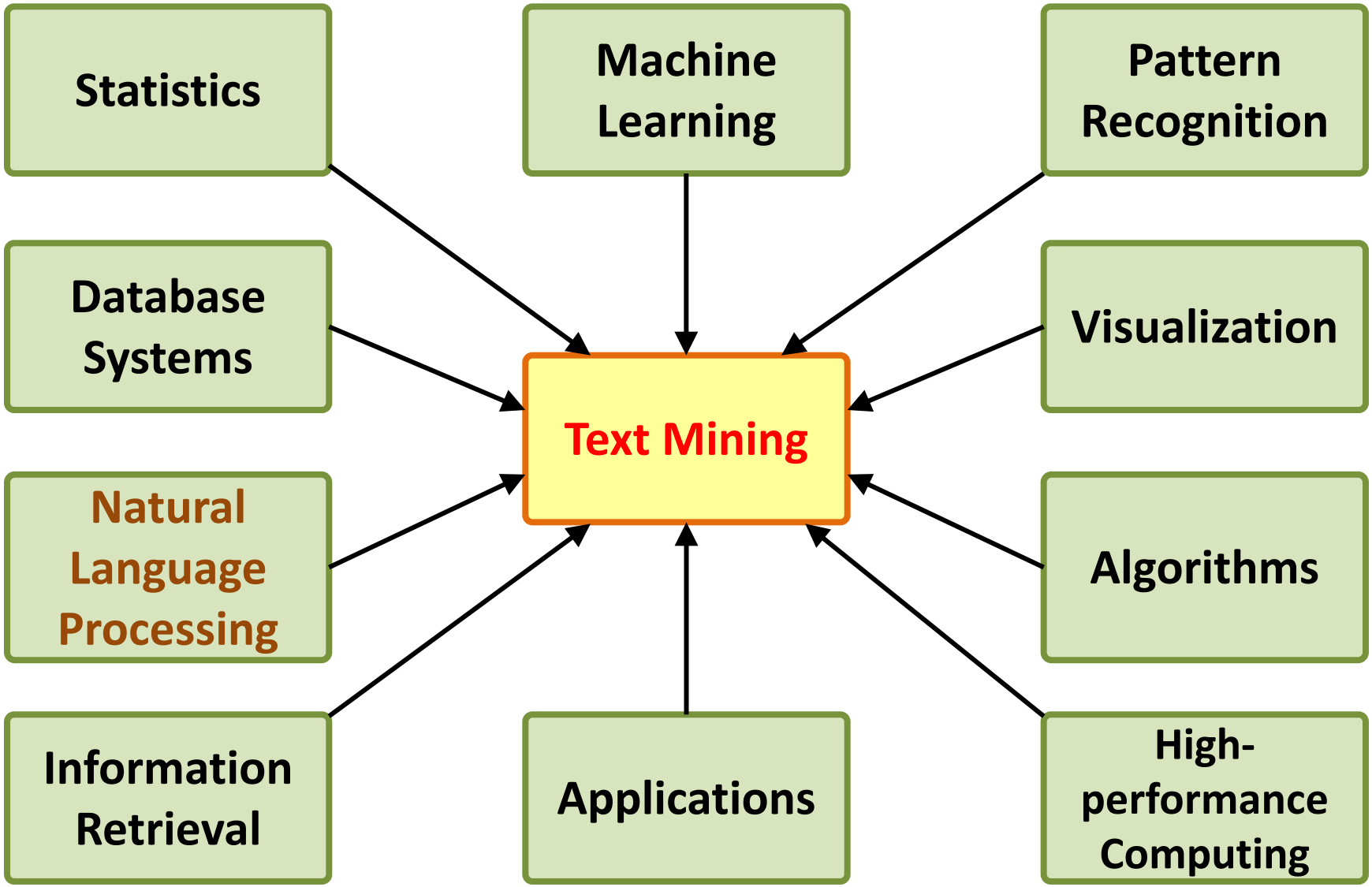
Source: Vishal Gupta and Gurpreet S. Lehal (2009), "A survey of text mining techniques and applications," Journal of emerging technologies in web intelligence, vol. 1, no. 1, pp. 60-76.

Overview of Information Extraction based Text Mining Framework



Source: Vishal Gupta and Gurpreet S. Lehal (2009), "A survey of text mining techniques and applications," Journal of emerging technologies in web intelligence, vol. 1, no. 1, pp. 60-76.

Text Mining Technologies



Adapted from: Jiawei Han and Micheline Kamber (2011), Data Mining: Concepts and Techniques, Third Edition, Elsevier

Data Mining versus Text Mining

- Both seek for novel and useful patterns
- Both are semi-automated processes
- Difference is the nature of the data:
  - Structured versus unstructured data
  - Structured data: in databases
  - Unstructured data: Word documents, PDF files, text excerpts, XML files, and so on
- Text mining – first, impose structure to the data, then mine the structured data

Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Text Mining and Natural Language Processing (NLP)

Raw text

Sentence Segmentation

Tokenization

Part-of-Speech (POS)

Stop word removal

Stemming / Lemmatization

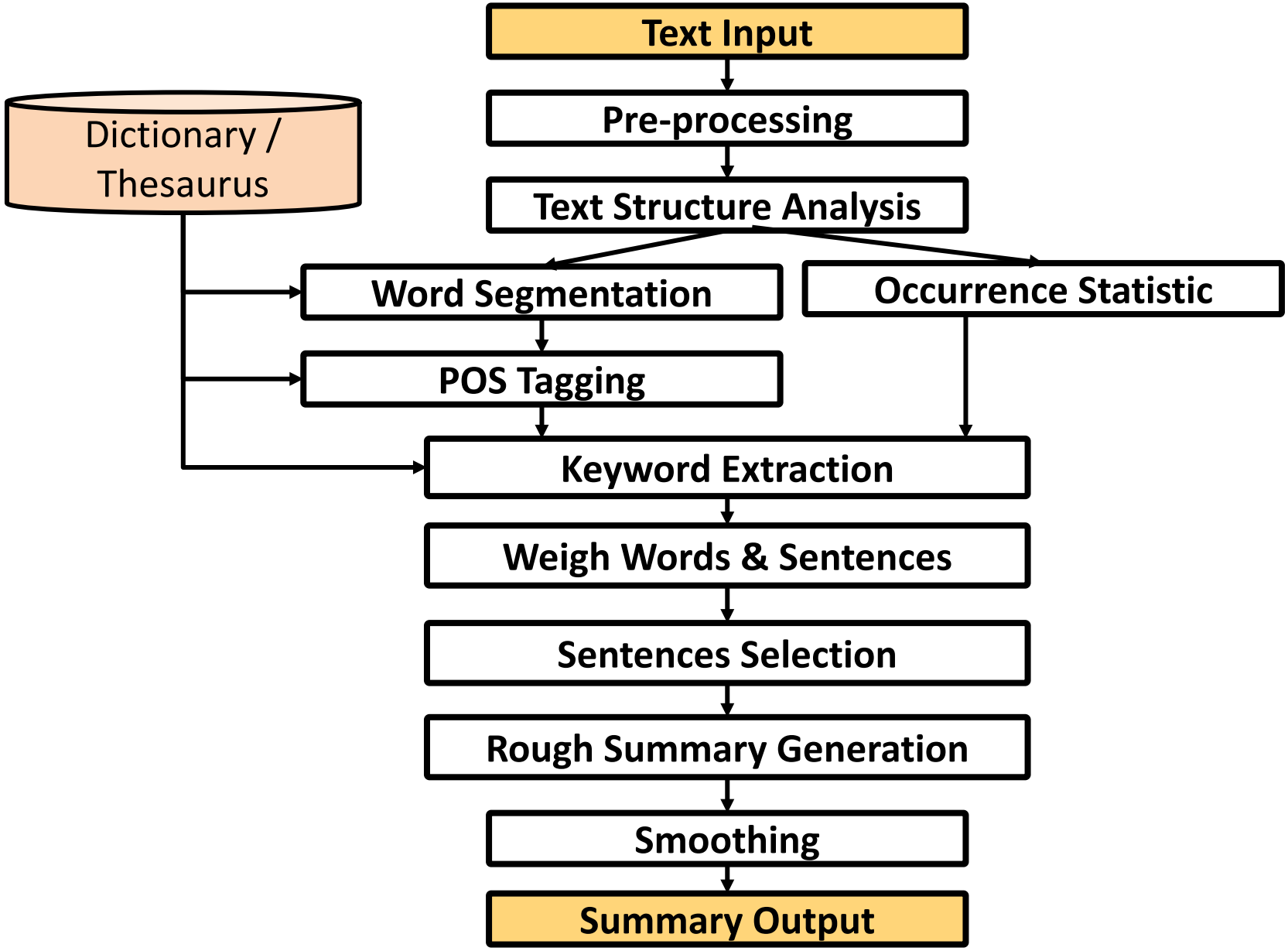
Dependency Parser

String Metrics & Matching

word's stem	word's lemma
am → am	am → be
having → hav	having → have

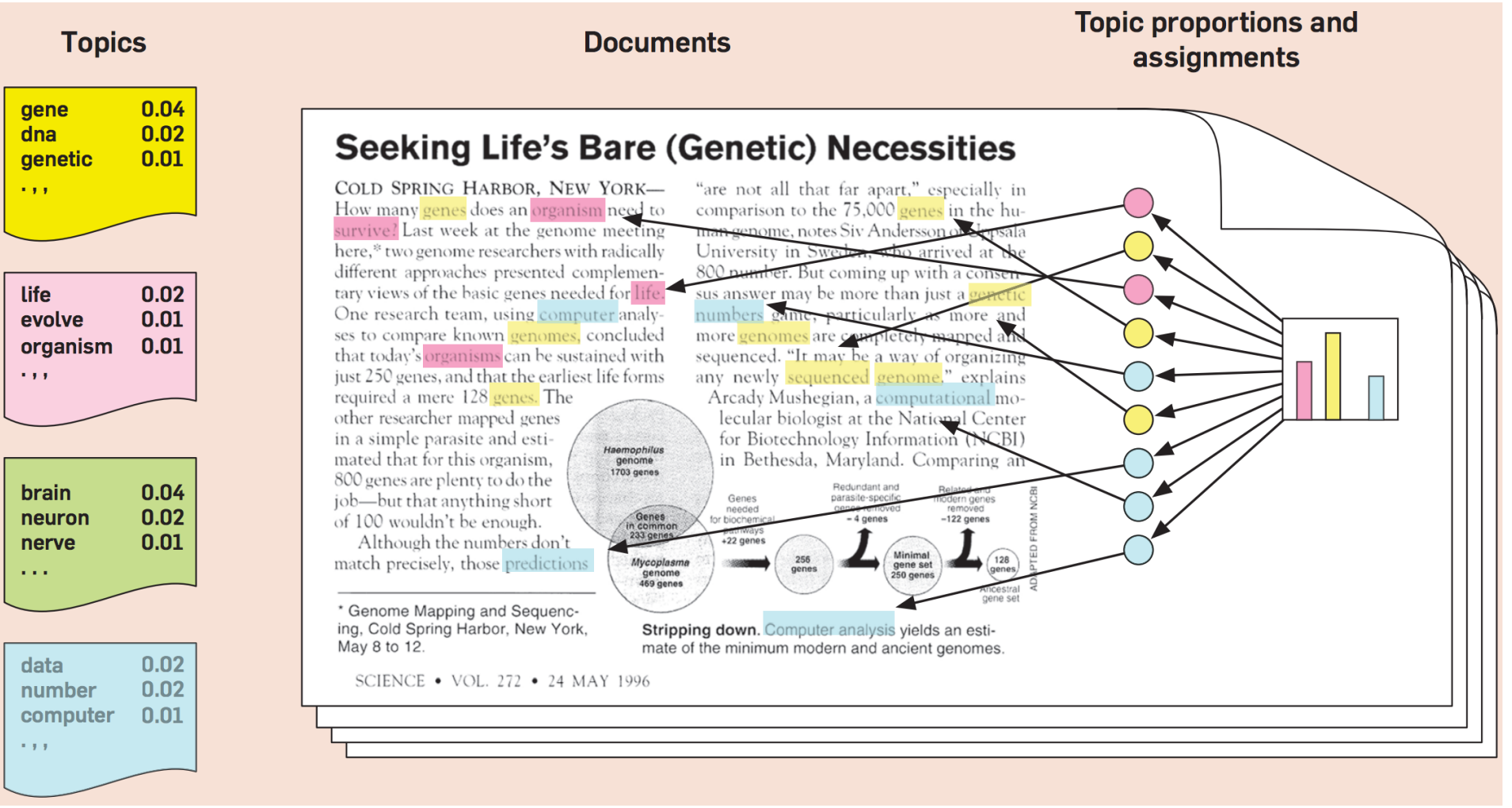
Source: Nitin Hardeniya (2015), NLTK Essentials, Packt Publishing; Florian Leitner (2015), Text mining - from Bayes rule to dependency parsing

Text Summarization



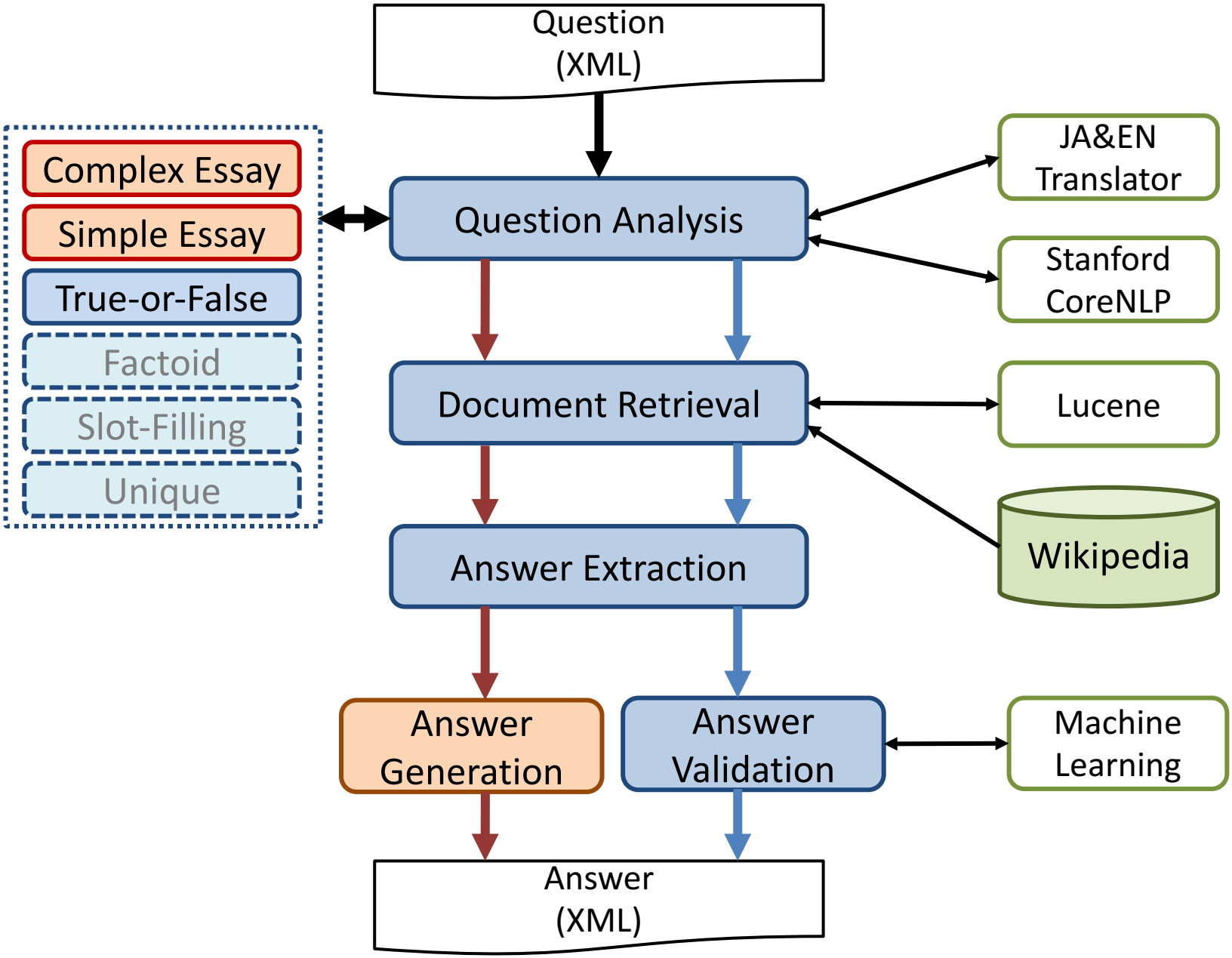
Source: Vishal Gupta and Gurpreet S. Lehal (2009), "A survey of text mining techniques and applications," Journal of emerging technologies in web intelligence, vol. 1, no. 1, pp. 60-76.

Topic Modeling



Source: Blei, David M. "Probabilistic topic models." *Communications of the ACM* 55, no. 4 (2012): 77-84.

Question Answering System



Data Mining:

Core Analytics Process

The KDD Process for Extracting Useful Knowledge from Volumes of Data

Source: Fayyad, U., Piatetsky-Shapiro, G., & Smyth, P. (1996). The KDD Process for Extracting Useful Knowledge from Volumes of Data. Communications of the ACM, 39(11), 27-34.

Fayyad, U., Piatetsky-Shapiro, G., & Smyth, P. (1996).

The KDD Process for Extracting Useful Knowledge from Volumes of Data.

Communications of the ACM, 39(11), 27-34.

Knowledge Discovery in Databases creates the context for developing the tools needed to control the flood of data facing organizations that depend on ever-growing databases of business, manufacturing, scientific, and personal information.

The KDD Process for Extracting Useful Knowledge from Volumes of Data

Usama Fayyad, Gregory Piatetsky-Shapiro, and Padhraic Smyth

As we march into the age of digital information, the problem of data overload looms ominously ahead. Our ability to analyze and understand massive datasets lags far behind our ability to gather and store the data. A new generation of computational techniques and tools is required to support the extraction of useful knowledge from the rapidly growing volumes of data. These techniques and tools are the subject of the emerging field of knowledge discovery in databases (KDD) and data mining.

Large databases of digital information are ubiquitous. Data from the neighborhood store's checkout register, your bank's credit card authorization device, records in your doctor's office, patterns in your telephone calls, and many more applications generate streams of digital records archived in huge databases, sometimes in so-called data warehouses.

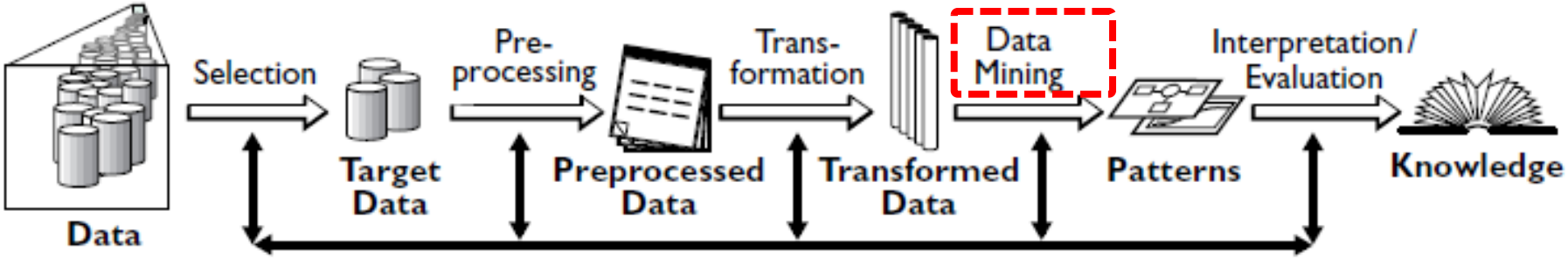
Current hardware and database technology allow efficient and inexpensive reliable data storage and access. However, whether the context is business, medicine, science, or government, the datasets themselves (in raw form) are of little direct value. What is of value is the knowledge that can be inferred from the data and put to use. For example, the marketing database of a consumer

TERRY WEISHER

Data Mining

Knowledge Discovery in Databases (KDD) Process

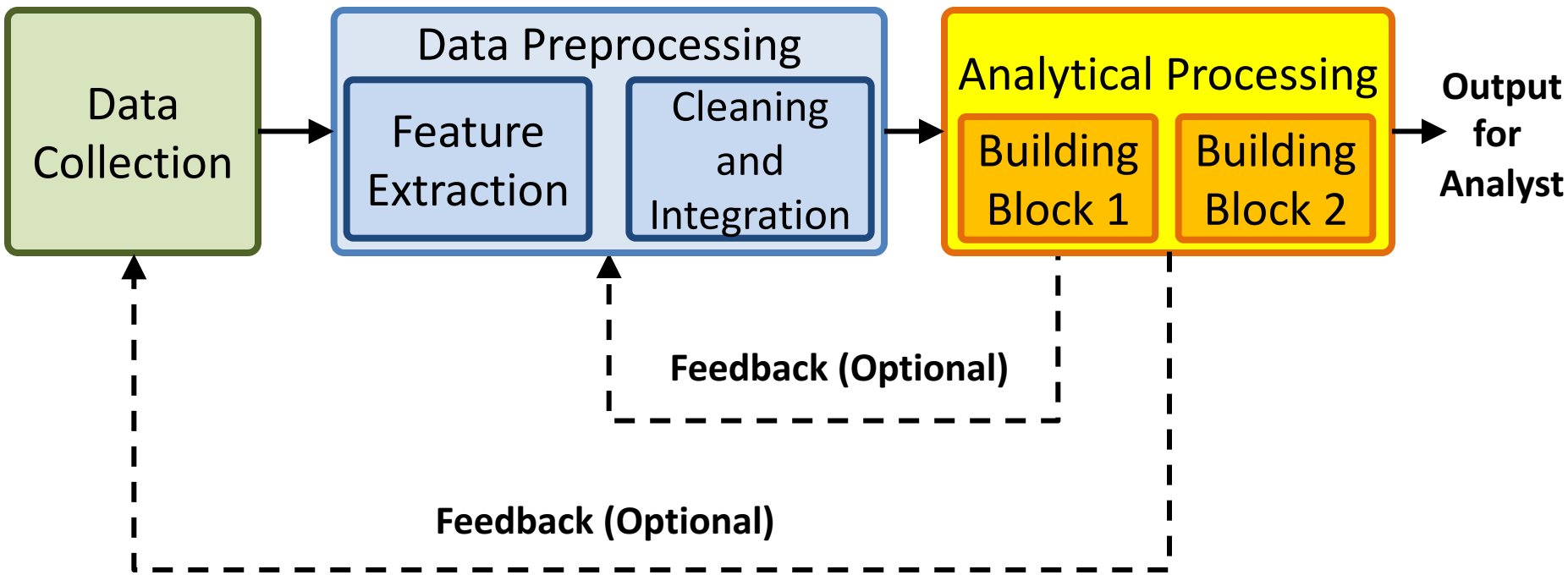
(Fayyad et al., 1996)



Source: Fayyad, U., Piatetsky-Shapiro, G., & Smyth, P. (1996). The KDD Process for Extracting Useful Knowledge from Volumes of Data. Communications of the ACM, 39(11), 27-34.

Data Mining Processing Pipeline

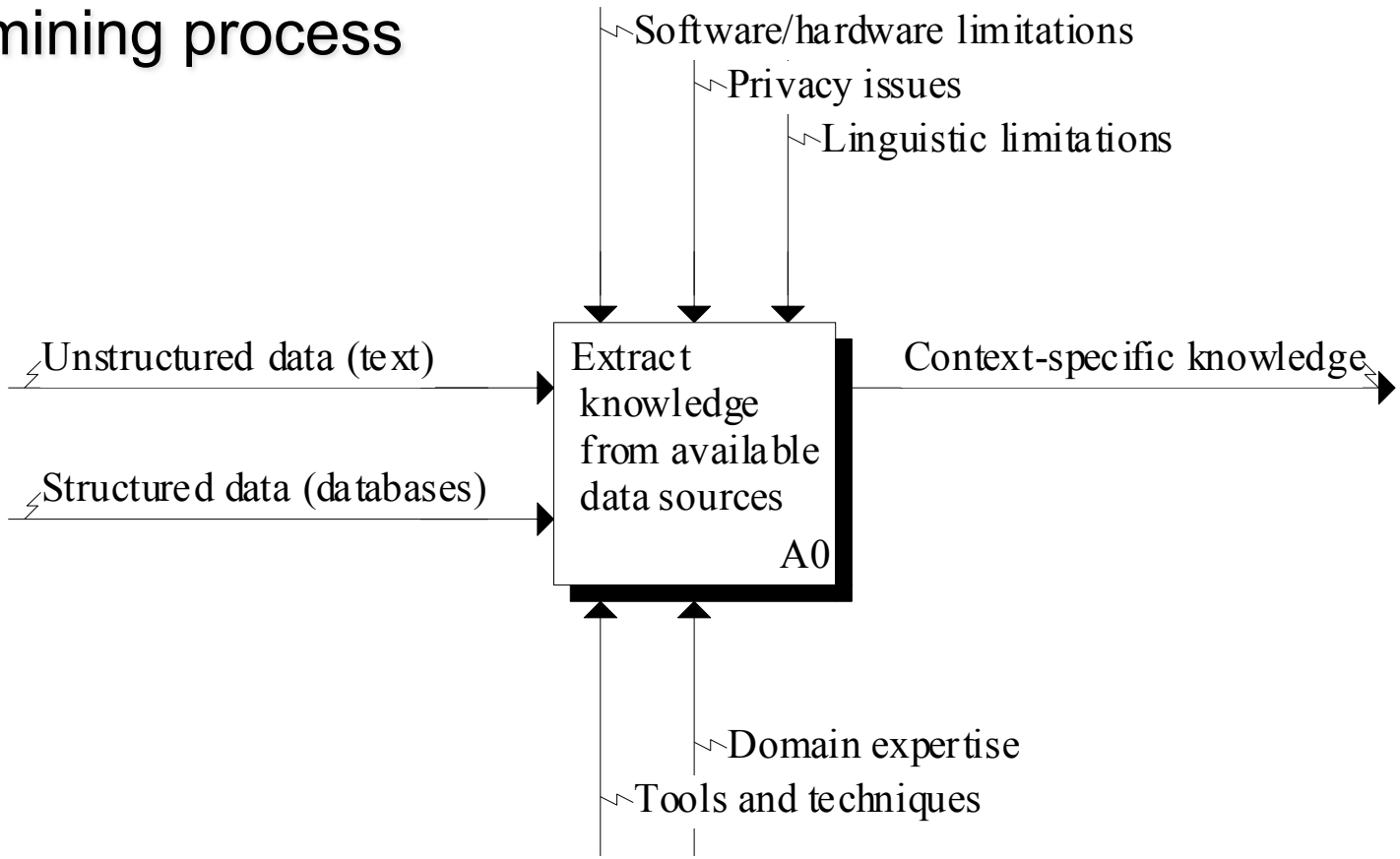
(Charu Aggarwal, 2015)



Source: Charu Aggarwal (2015), Data Mining: The Textbook Hardcover, Springer

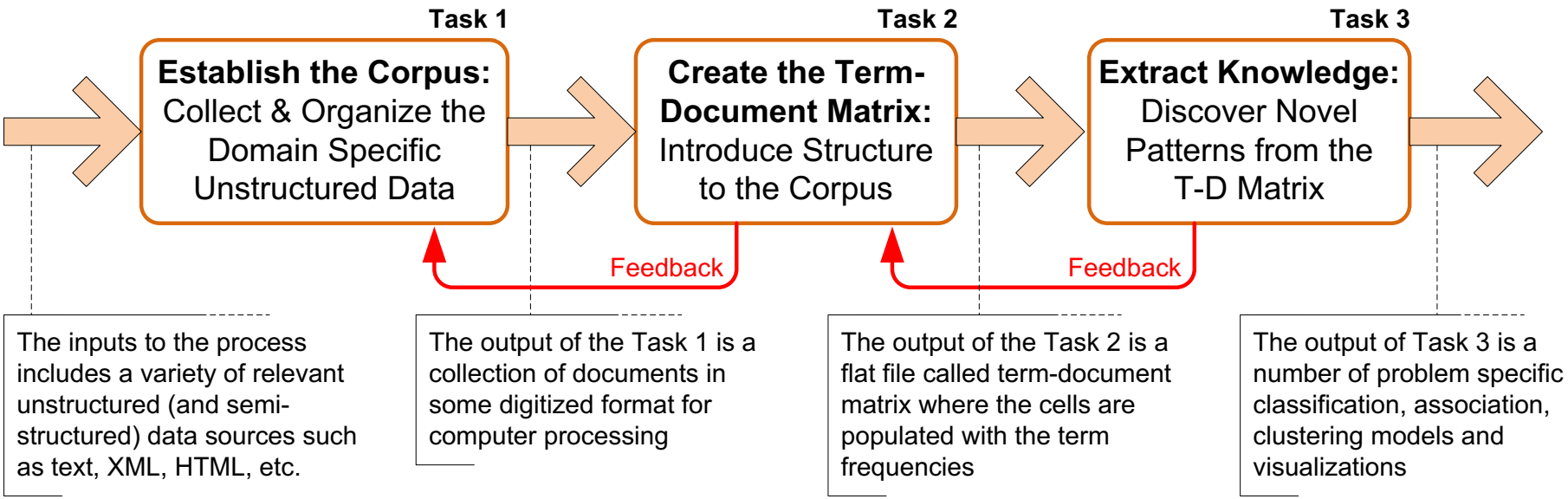
Text Mining Process

Context diagram for the text mining process



Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Text Mining Process



The three-step text mining process

Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Text Mining Process

- Step 1: Establish the corpus
  - Collect all relevant unstructured data (e.g., textual documents, XML files, emails, Web pages, short notes, voice recordings…)
  - Digitize, standardize the collection (e.g., all in ASCII text files)
  - Place the collection in a common place (e.g., in a flat file, or in a directory as separate files)

Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Text Mining Process

- Step 2: Create the Term–by–Document Matrix

Terms / Documents	investment risk	project management	software engineering	development	SAP	...	
Document 1	1			1			
Document 2		1					
Document 3			3		1		
Document 4		1					
Document 5			2	1			
Document 6	1			1			
...							

Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Text Mining Process

- Step 2: Create the Term–by–Document Matrix (TDM), cont.
  - Should all terms be included?
    - Stop words, include words
    - Synonyms, homonyms
    - Stemming
  - What is the best representation of the indices (values in cells)?
    - Row counts; binary frequencies; log frequencies;
    - Inverse document frequency

Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Text Mining Process

- Step 2: Create the Term–by–Document Matrix (TDM), cont.
  - TDM is a sparse matrix. How can we reduce the dimensionality of the TDM?
    - Manual - a domain expert goes through it
    - Eliminate terms with very few occurrences in very few documents (?)
    - Transform the matrix using Singular Value Decomposition (SVD)
    - SVD is similar to Principle Component Analysis (PCA)

Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

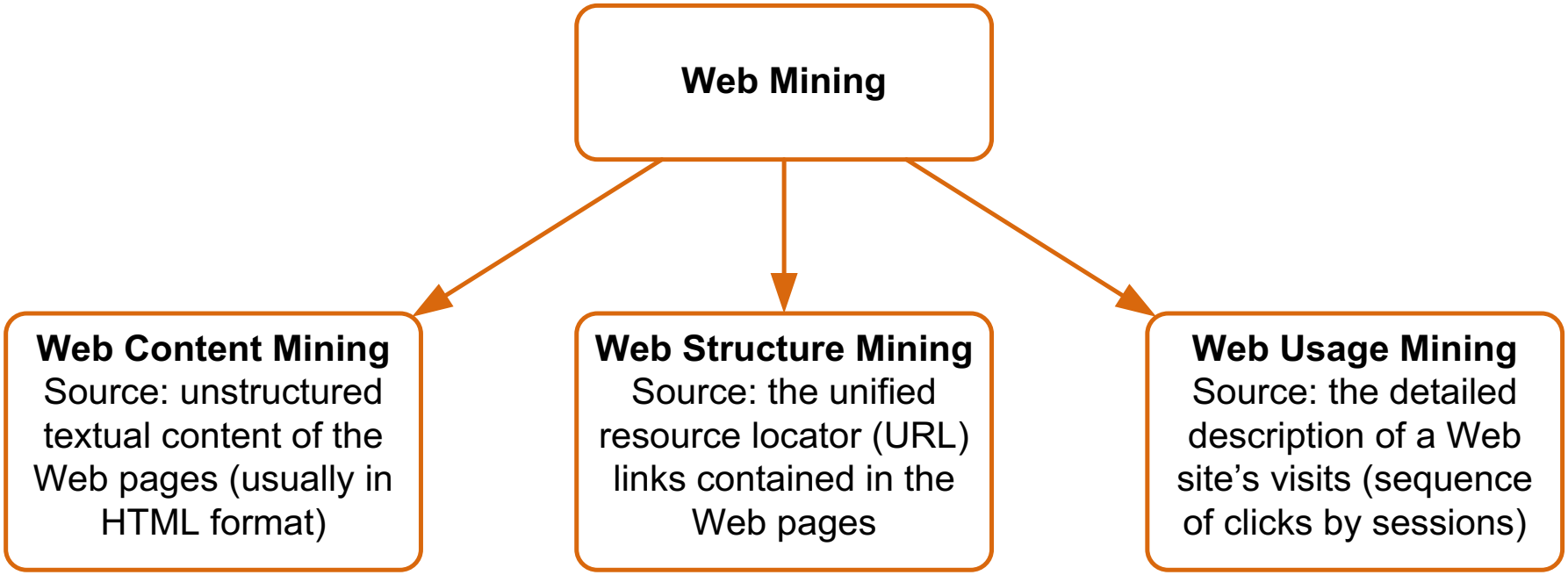
Text Mining Process

- Step 3: Extract patterns/knowledge
  - Classification (text categorization)
  - Clustering (natural groupings of text)
    - Improve search recall
    - Improve search precision
    - Scatter/gather
    - Query-specific clustering
  - Association
  - Trend Analysis (…)

Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Web Mining

- Web mining (or Web data mining) is the process of discovering intrinsic relationships from Web data (textual, linkage, or usage)



Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Text Mining Concepts

- Benefits of text mining are obvious especially in text-rich data environments
  - e.g., law (court orders), academic research (research articles), finance (quarterly reports), medicine (discharge summaries), biology (molecular interactions), technology (patent files), marketing (customer comments), etc.
- Electronic communization records (e.g., Email)
  - Spam filtering
  - Email prioritization and categorization
  - Automatic response generation

Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Text Mining Application Area

- Information extraction
- Topic tracking
- Summarization
- Categorization
- Clustering
- Concept linking
- Question answering

Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Text Mining Terminology

- Unstructured or semistructured data
- Corpus (and corpora)
- Terms
- Concepts
- Stemming
- Stop words (and include words)
- Synonyms (and polysemes)
- Tokenizing

Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Text Mining Terminology

- Term dictionary
- Word frequency
- Term Frequency (TF)
- Inverse Document Frequency (IDF)
- Part-of-speech tagging (POS)
- Morphology
- Term-by-document matrix (TDM)
  - Occurrence matrix
- Singular Value Decomposition (SVD)
  - Latent Semantic Indexing (LSI)

Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Natural Language Processing (NLP)

- Structuring a collection of text
  - Old approach: bag-of-words
  - New approach: natural language processing
- NLP is …
  - a very important concept in text mining
  - a subfield of artificial intelligence and computational linguistics
  - the studies of "understanding" the natural human language
- Syntax versus semantics based text mining

Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Natural Language Processing (NLP)

- What is "Understanding" ?
  - Human understands, what about computers?
  - Natural language is vague, context driven
  - True understanding requires extensive knowledge of a topic

  - Can/will computers ever understand natural language the same/accurate way we do?

Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Natural Language Processing (NLP)

- Challenges in NLP
  - Part-of-speech tagging
  - Text segmentation
  - Word sense disambiguation
  - Syntax ambiguity
  - Imperfect or irregular input
  - Speech acts
- Dream of AI community
  - to have algorithms that are capable of automatically reading and obtaining knowledge from text

Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

Natural Language Processing (NLP)

- WordNet
  - A laboriously hand-coded database of English words, their definitions, sets of synonyms, and various semantic relations between synonym sets
  - A major resource for NLP
  - Need automation to be completed
- Sentiment Analysis
  - A technique used to detect favorable and unfavorable opinions toward specific products and services
  - CRM application

Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

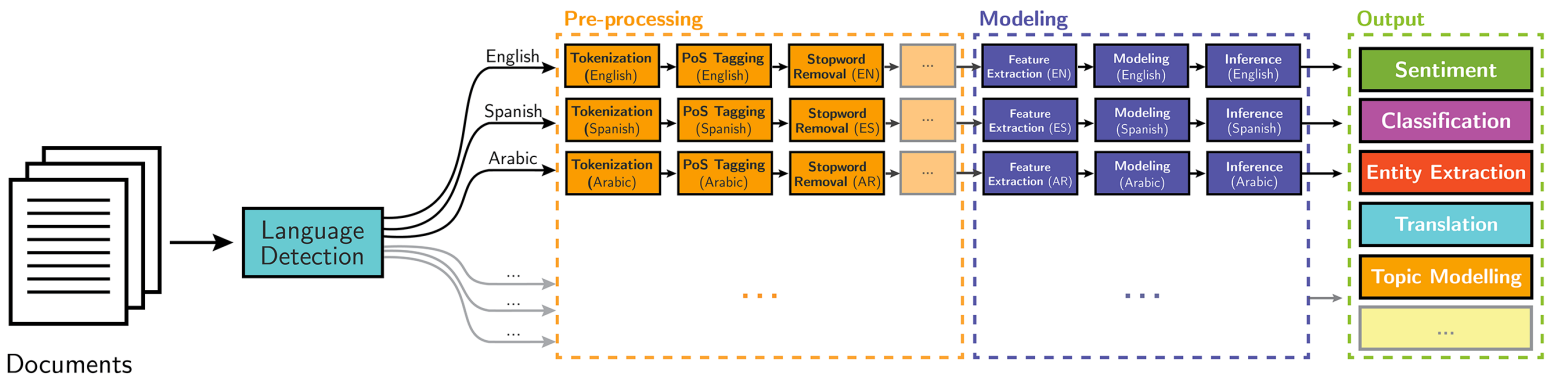
NLP Task Categories

- Information retrieval (IR)
- Information extraction (IE)
- Named-entity recognition (NER)
- Question answering (QA)
- Automatic summarization
- Natural language generation and understanding (NLU)
- Machine translation (ML)
- Foreign language reading and writing
- Speech recognition
- Text proofing
- Optical character recognition (OCR)

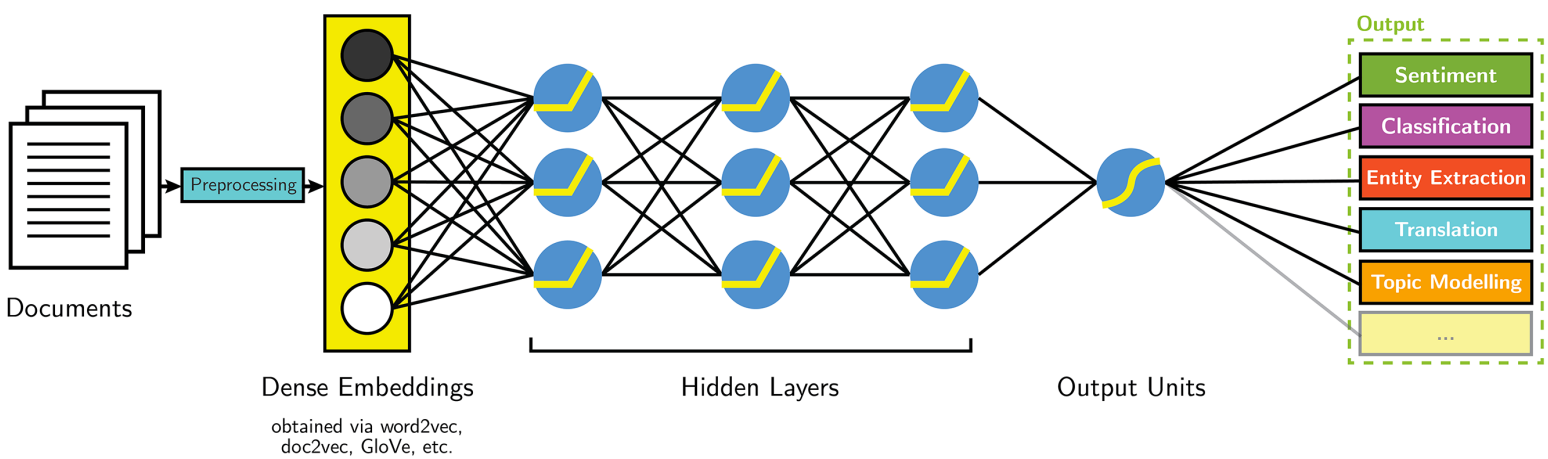
Source: Turban et al. (2011), Decision Support and Business Intelligence Systems

NLP

Classical NLP



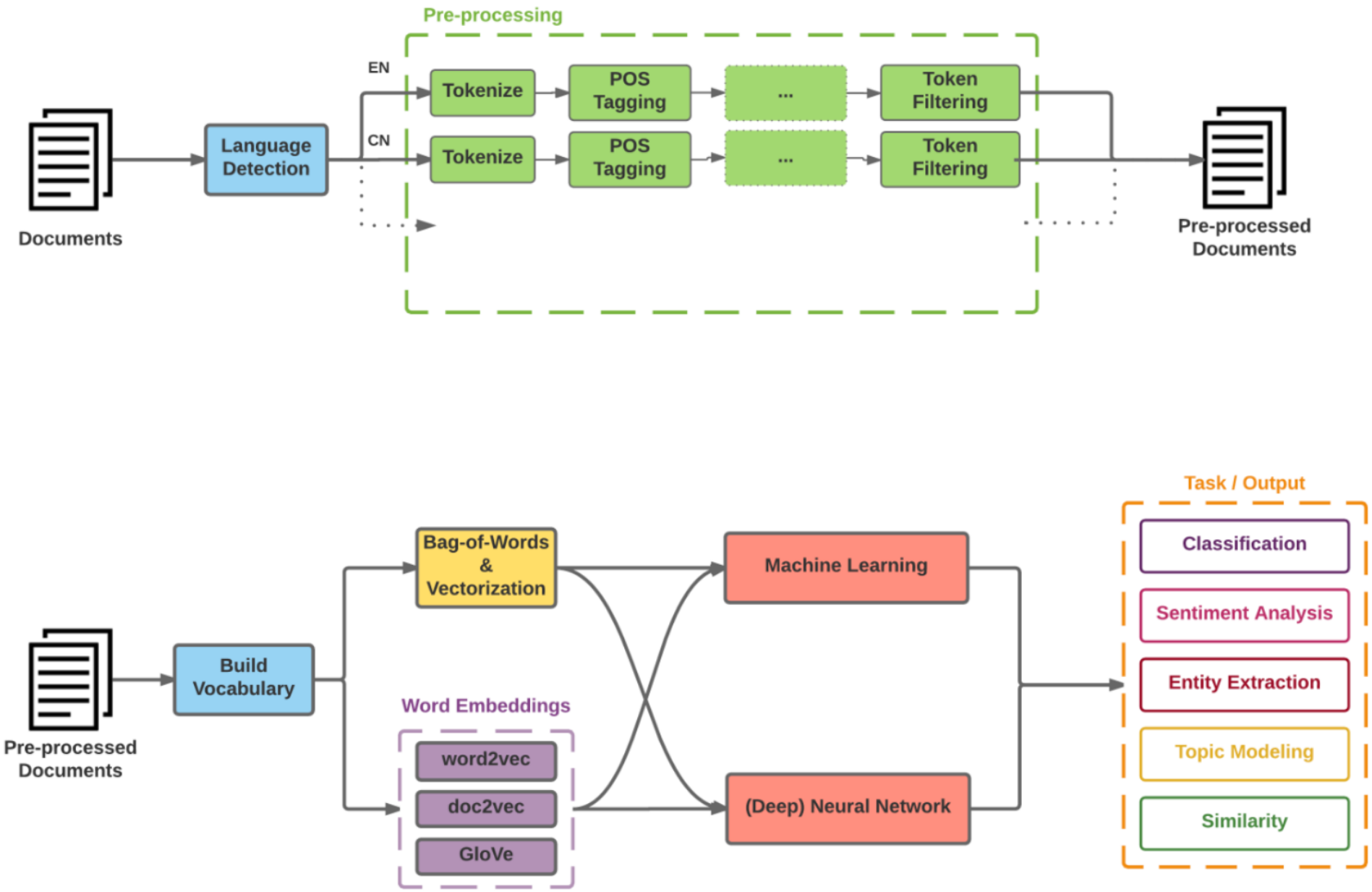
Deep Learning-based NLP



AYLIEN

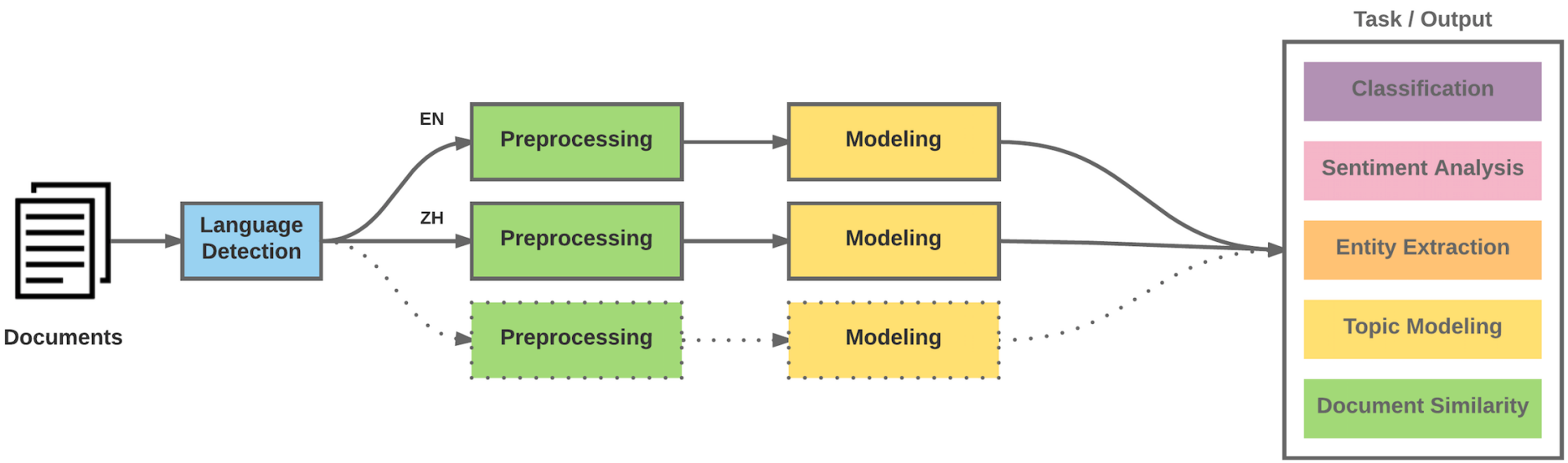
Source: http://blog.aylien.com/leveraging-deep-learning-for-multilingual/

Modern NLP Pipeline



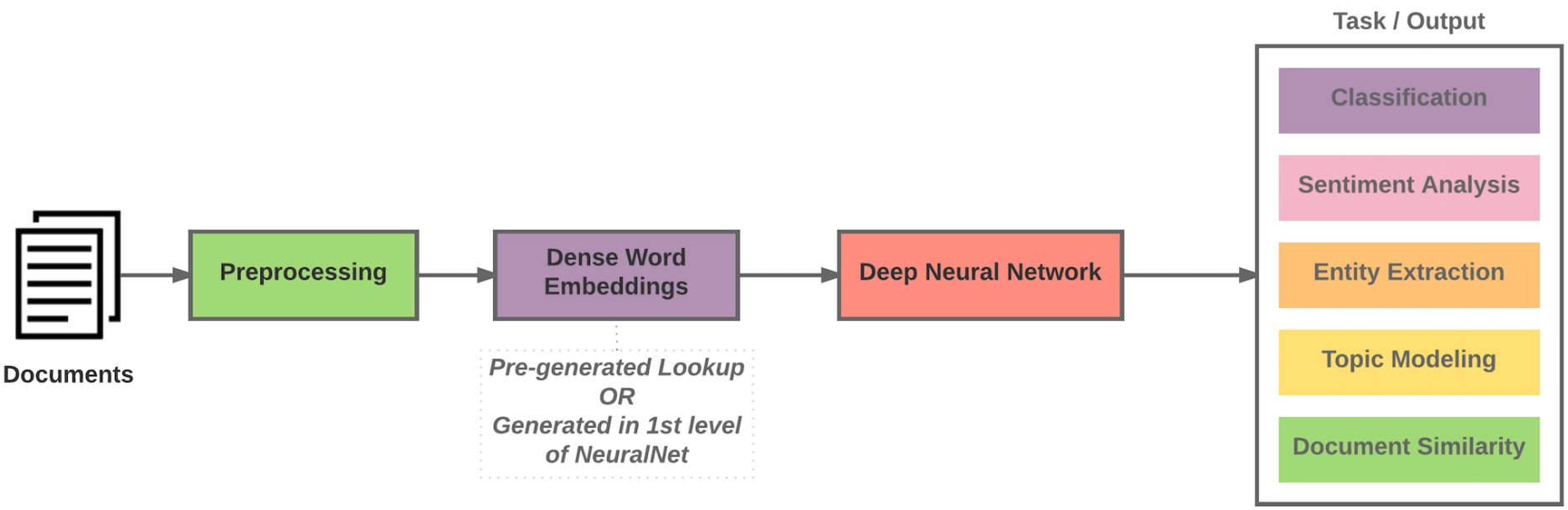
Source: https://github.com/fortiema/talks/blob/master/opendata2016sh/pragmatic-nlp-opendata2016sh.pdf

Modern NLP Pipeline



Source: http://mattfortier.me/2017/01/31/nlp-intro-pt-1-overview/

Deep Learning NLP



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文章的文字檔
擷取未知詞過程
包含未知詞的斷詞標記結果
未知詞列表

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中文文字處理:中文斷詞

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莎士比亞在淡江 遇見賽萬提斯

分享 分享 留言 列印 存新聞 A- A+

2016-04-26 02:27 聯合報 記者徐葳倫／淡水報導 讚 分享 20 傳送 G+1 0

淡江大學舉辦「當莎士比亞遇見賽萬提斯」系列活動，讓師生幫莎士比亞、賽萬提斯著色，畫出五彩繽紛的「文學大師」。 記者徐葳倫／攝影

4月23日是「世界閱讀日」，也是英國大文豪莎士比亞的生日與忌日，及「唐吉訶德」作

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首波登場的「主題書展」，展出2大文豪經典作品的原著、各種譯本以及DVD、電子書等數位化資料，校方也添購許多新書，吸引學生「搶鮮」閱讀經典名作。現場還規畫「彩繪大師」，讓學生發揮創意，畫出五彩繽紛的莎士比亞和賽萬提斯人像。
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http://udn.com/news/story/7323/1653437-%E8%8E%8E%E5%A3%AB%E6%AF%94%E4%BA%9E%E5%9C%A8%E6%B7%A1%E6%B1%9F-%E9%81%87%E8%A6%8B%E8%B3%BD%E8%90%AC%E6%8F%90%E6%96%AF

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及(Caa) 「(PARENTHESISCATEGORY) 唐吉訶德(Nb) 」(PARENTHESISCATEGORY) 作者(Na) 賽萬提(Nb) 斯(Nep) 逝世(VH) 之(DE) 日(Na)

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並(Cbb) 添購(VC) 新書(Na) ，(COMMACATEGORY)

拉近(VC) 學生(Na) 與(Caa) 經典(Na) 文學(Na) 的(DE) 距離(Na) 。(PERIODCATEGORY)

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展出(VC) ２(Neu) 大(VH) 文豪(Na) 經典(Na) 作品(Na) 的(DE) 原著(Na) 、(PAUSECATEGORY) 各(Nes) 種(Nf) 譯本(Na) 以及(Caa)

校方(Na) 也(D) 添購(VC) 許多(Neqa) 新書(Na) ，(COMMACATEGORY)

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英語系(Nc) 四年級(Na) 學生(Na) 陳彥伶(Nb) 說(VE) ，(COMMACATEGORY)

讀(VC) 英語系(Nc) 接觸(VC) 莎士比亞(Nb) 作品(Na) ，(COMMACATEGORY)

但(Cbb) 過去(Nd) 沒有(D) 舉辦(VC) 書展(Na) 時(Ng) ，(COMMACATEGORY)

這些(Neqa) 作品(Na) 都(D) 放(VC) 在(P) 圖書館(Nc) ８樓(Nc) ，(COMMACATEGORY)

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http://nlp.stanford.edu/software/index.shtml

The Stanford Natural Language Processing Group

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The Stanford NLP Group makes parts of our Natural Language Processing software available to everyone. These are statistical NLP toolkits for various major computational linguistics problems. They can be incorporated into applications with human language technology needs.

All the software we distribute here is written in Java. All recent distributions require Oracle Java 6+ or OpenJDK 7+. Distribution packages include components for command-line invocation, jar files, a Java API, and source code. A number of helpful people have extended our work with bindings or translations for other languages. As a result, much of this software can also easily be used from Python (or Jython), Ruby, Perl, Javascript, and F# or other .NET languages.

Stanford NLP Software

Supported software distributions

This code is being developed, and we try to answer questions and fix bugs on a best-effort basis.

All these software distributions are open source, **licensed under the GNU General Public License** (v2 or later). Note that this is the *full* GPL, which allows many free uses, but *does not allow* its incorporation into any type of distributed proprietary software, even in part or in translation. **Commercial licensing** is also available; please contact us if you are interested.

Stanford CoreNLP
: An integrated suite of natural language processing tools for English and (mainland) Chinese in Java, including tokenization, part-of-speech tagging, named entity recognition, parsing, and coreference. See also: Stanford Deterministic Coreference Resolution, and the online CoreNLP demo, and the CoreNLP FAQ.

Stanford Parser
: Implementations of probabilistic natural language parsers in Java: highly optimized PCFG and dependency parsers, a lexicalized PCFG parser, and a deep learning reranker. See also: Online parser demo, the Stanford Dependencies page, and Parser FAQ.

Stanford POS Tagger
: A maximum-entropy (CMM) part-of-speech (POS) tagger for English,

Stanford CoreNLP http://nlp.stanford.edu:8080/corenlp/process

Stanford CoreNLP

Output format: Visualise

Please enter your text here:

Stanford University is located in California. It is a great university.

Submit Clear

Part-of-Speech:

1 Stanford/NNP University/NNP is/VBZ located/JJ in/IN California/NNP ./.

2 It/PRP is/VBZ a/DT great/JJ university/NN ./.

Named Entity Recognition:

1 Stanford University/Organization is located in California/Location.

2 It is a great university.

Coreference:

1 Stanford University/Mention is located in California. (Coref)

2 It/M is a great university/Mention. (Coref)

Stanford CoreNLP

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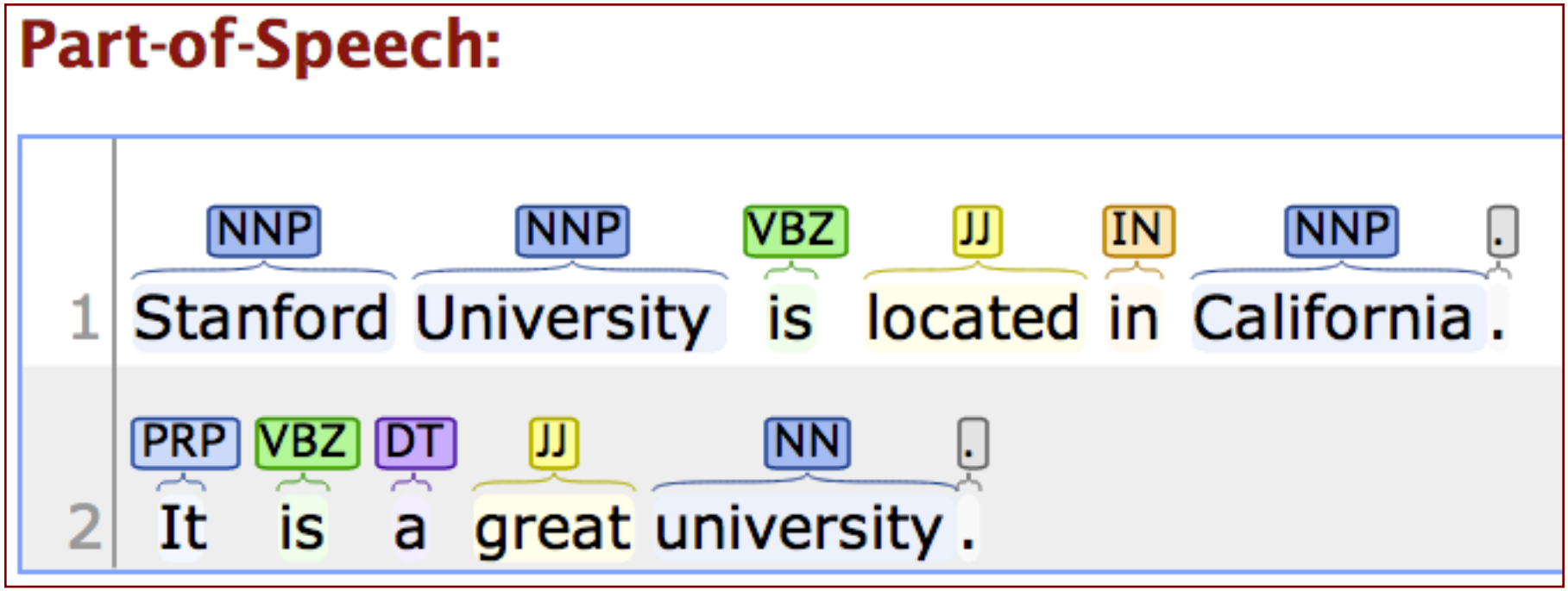

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Named Entity Recognition:

Organization Location

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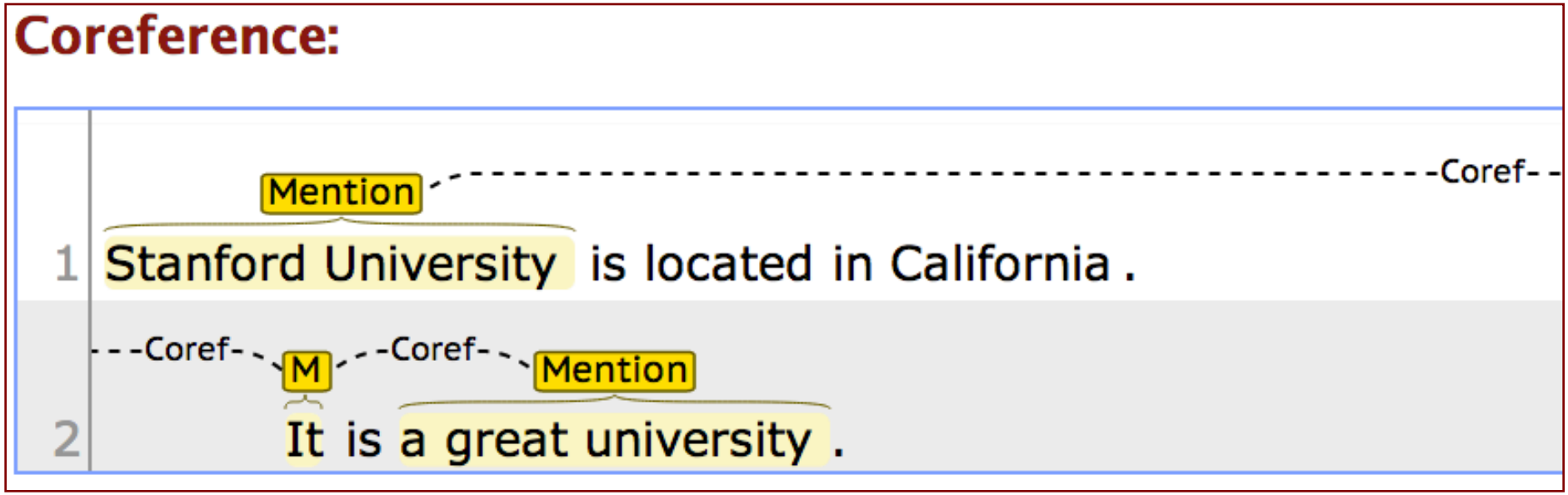

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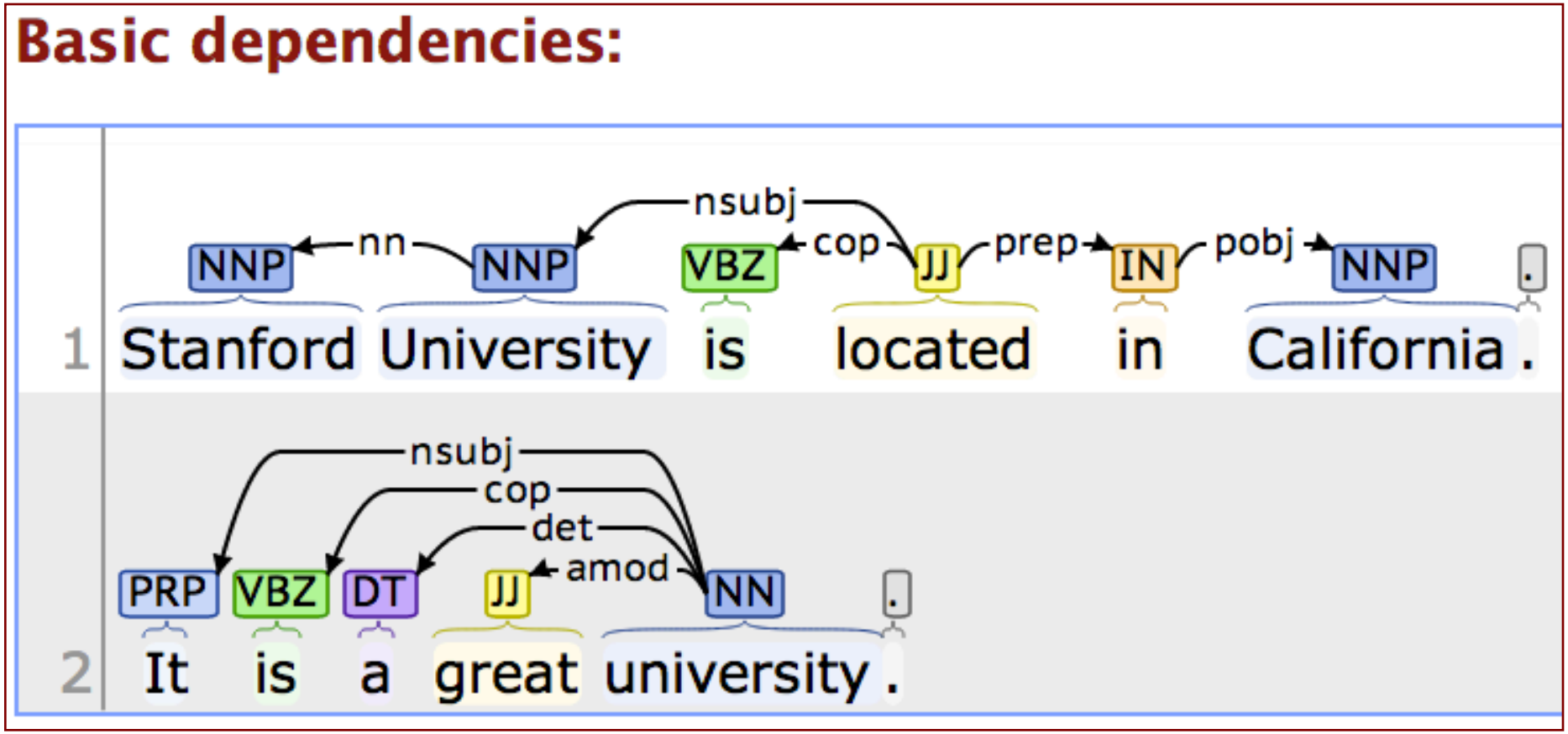
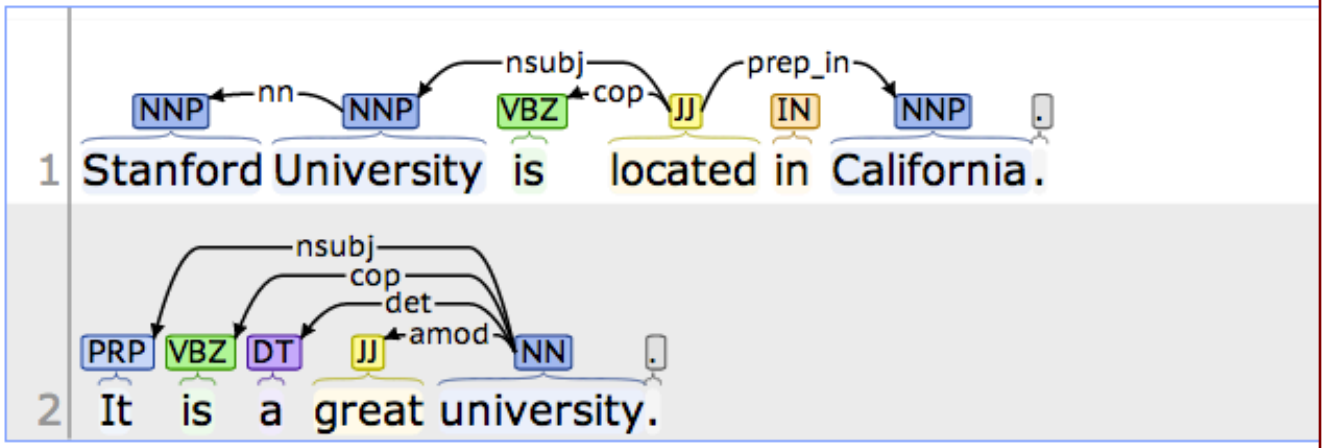
Stanford University is located in California.
It is a great university.



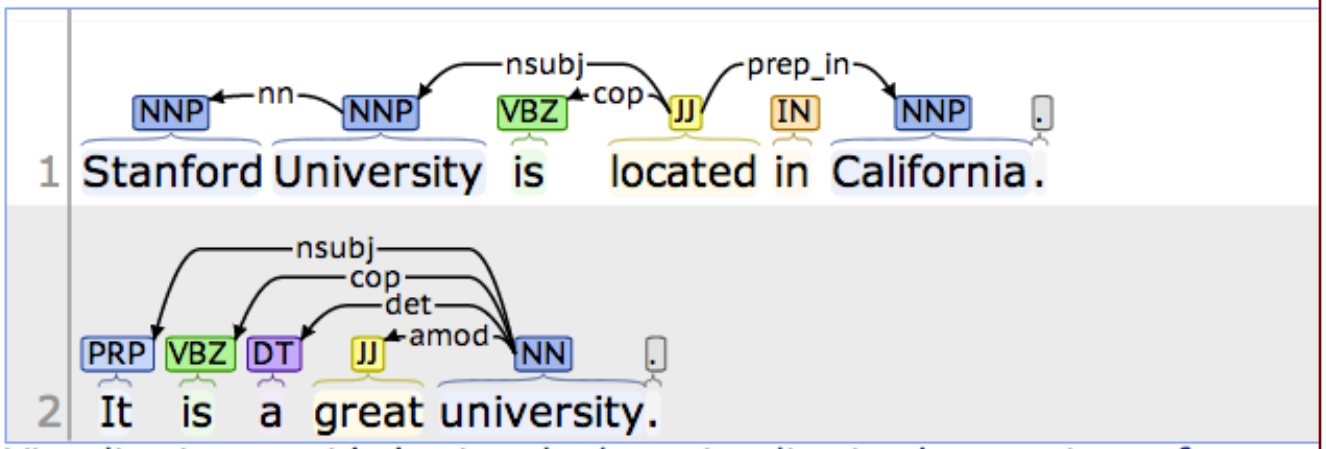
Stanford CoreNLP

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

Collapsed dependencies:



Collapsed CC-processed dependencies:



Visualisation provided using the brat visualisation/annotation software.

Stanford CoreNLP

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

Output format: Pretty print

Please enter your text here:

Stanford University is located in California. It is a great university.

Submit Clear

Stanford CoreNLP XML Output

Document

Document Info

Sentences

Sentence #1

Tokens

Id	Word	Lemma	Char begin	Char end	POS	NER	Normalized NER	Speaker
1	Stanford	Stanford	0	8	NNP	ORGANIZATION		PER0
2	University	University	9	19	NNP	ORGANIZATION		PER0
3	is	be	20	22	VBZ	O		PER0
4	located	located	23	30	JJ	O		PER0
5	in	in	31	33	IN	O		PER0
6	California	California	34	44	NNP	LOCATION		PER0
7	.	.	44	45	.	O		PER0

Parse tree

(ROOT (S (NP (NNP Stanford) (NNP University)) (VP (VBZ is) (ADJP (JJ located) (PP (IN in) (NP (NNP California))))) (. .)))

Stanford CoreNLP

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

Stanford University is located in California.
It is a great university.

Sentence #1

Tokens

Id	Word	Lemma	Char begin	Char end	POS	NER	Normalized NER	Speaker
1	Stanford	Stanford	0	8	NNP	ORGANIZATION		PER0
2	University	University	9	19	NNP	ORGANIZATION		PER0
3	is	be	20	22	VBZ	O		PER0
4	located	located	23	30	JJ	O		PER0
5	in	in	31	33	IN	O		PER0
6	California	California	34	44	NNP	LOCATION		PER0
7	.	.	44	45	.	O		PER0

Parse tree

(ROOT (S (NP (NNP Stanford) (NNP University)) (VP (VBZ is) (ADJP (JJ located) (PP (IN in) (NP (NNP California))))) (. .)))

Stanford CoreNLP

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

Stanford University is located in California.
It is a great university.

Sentence #2

Tokens

Id	Word	Lemma	Char begin	Char end	POS	NER	Normalized NER	Speaker
1	It	it	46	48	PRP	O		PER0
2	is	be	49	51	VBZ	O		PER0
3	a	a	52	53	DT	O		PER0
4	great	great	54	59	JJ	O		PER0
5	university	university	60	70	NN	O		PER0
6	.	.	70	71	.	O		PER0

Parse tree

(ROOT (S (NP (PRP It)) (VP (VBZ is) (NP (DT a) (JJ great) (NN university))) (. .)))

Stanford CoreNLP

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

Stanford University is located in California.
It is a great university.

Coreference resolution graph

1.

Sentence	Head	Text	Context
1	2 (gov)	Stanford University	
2	1	It	
2	5	a great university	

Tokens

Id	Word	Lemma	Char begin	Char end	POS	NER	Normalized NER	Speaker
1	Stanford	Stanford	0	8	NNP	ORGANIZATION		PER0
2	University	University	9	19	NNP	ORGANIZATION		PER0
3	is	be	20	22	VBZ	O		PER0
4	located	located	23	30	JJ	O		PER0
5	in	in	31	33	IN	O		PER0
6	California	California	34	44	NNP	LOCATION		PER0
7	.	.	44	45	.	O		PER0

Parse tree
(ROOT (S (NP (NNP Stanford) (NNP University)) (VP (VBZ is) (ADJP (JJ located) (PP (IN in) (NP (NNP California))))) (. .)))

Uncollapsed dependencies

root (ROOT-0 , located-4)
nn (University-2 , Stanford-1)
nsubj (located-4 , University-2)
cop (located-4 , is-3)
prep (located-4 , in-5)
pobj (in-5 , California-6)
Collapsed dependencies

root (ROOT-0 , located-4)
nn (University-2 , Stanford-1)
nsubj (located-4 , University-2)
cop (located-4 , is-3)
prep_in (located-4 , California-6)
Collapsed dependencies with CC processed

root (ROOT-0 , located-4)
nn (University-2 , Stanford-1)
nsubj (located-4 , University-2)
cop (located-4 , is-3)
prep_in (located-4 , California-6)

Stanford CoreNLP

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

Stanford University is located in California.
It is a great university.

Stanford CoreNLP

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

Output format: XML

Please enter your text here:

Stanford University is located in California. It is a great university.

Submit Clear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            <lemma>Stanford</lemma>
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            <NER>ORGANIZATION</NER>
            <Speaker>PER0</Speaker>
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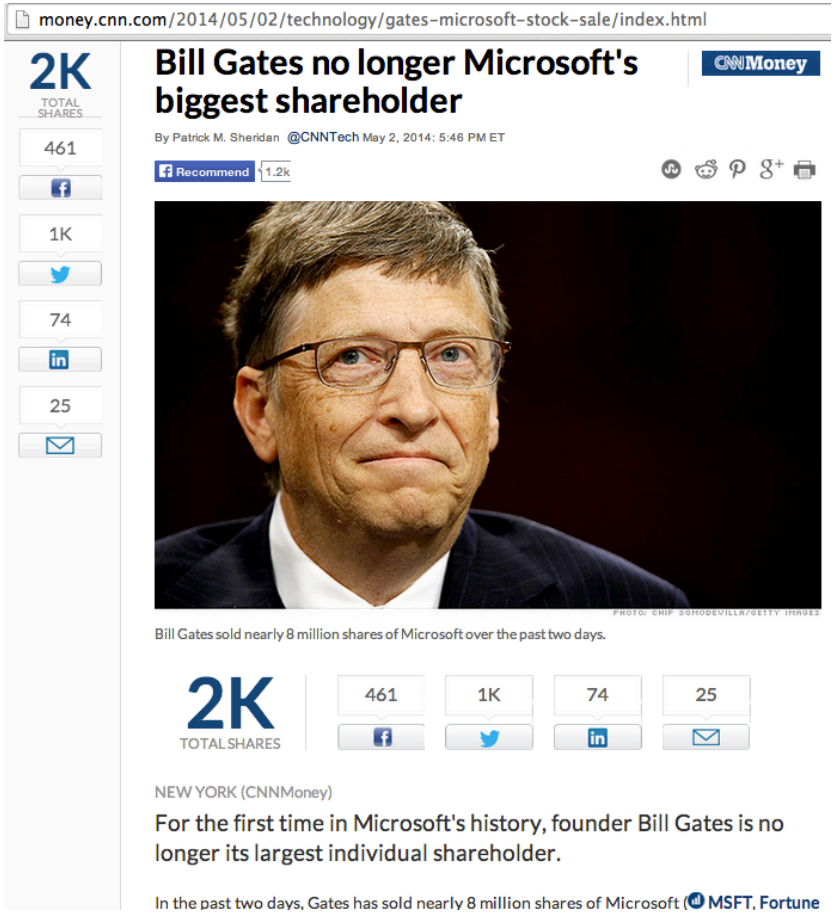
NER for News Article

http://money.cnn.com/2014/05/02/technology/gates-microsoft-stock-sale/index.html



Bill Gates no longer Microsoft's biggest shareholder
By Patrick M. Sheridan @CNNTech May 2, 2014: 5:46 PM ET

Bill Gates sold nearly 8 million shares of Microsoft over the past two days.

NEW YORK (CNNMoney)

For the first time in Microsoft's history, founder Bill Gates is no longer its largest individual shareholder.
In the past two days, Gates has sold nearly 8 million shares of Microsoft (MSFT, Fortune 500), bringing down his total to roughly 330 million.

That puts him behind Microsoft's former CEO Steve Ballmer who owns 333 million shares.
Related: Gates reclaims title of world's richest billionaire
Ballmer, who was Microsoft's CEO until earlier this year, was one of Gates' first hires.
It's a passing of the torch for Gates who has always been the largest single owner of his company's stock. Gates now spends his time and personal fortune helping run the Bill & Melinda Gates foundation.
The foundation has spent $28.3 billion fighting hunger and poverty since its inception back in 1997.

Stanford Named Entity Tagger (NER)

http://nlp.stanford.edu:8080/ner/process

Stanford Named Entity Tagger

Classifier: english.muc.7class.distsim.crf.ser.gz

Output Format: highlighted

Preserve Spacing: yes

Please enter your text here:

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Submit Clear

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Potential tags:

- LOCATION
- TIME
- PERSON
- ORGANIZATION
- MONEY
- PERCENT
- DATE

Stanford Named Entity Tagger (NER)

http://nlp.stanford.edu:8080/ner/process

Stanford Named Entity Tagger

Classifier: english.muc.7class.distsim.crf.ser.gz

Output Format: inlineXML

Preserve Spacing: yes

Please enter your text here:

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Submit Clear

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Stanford Named Entity Tagger (NER)

http://nlp.stanford.edu:8080/ner/process

Stanford Named Entity Tagger

Classifier: english.muc.7class.distsim.crf.ser.gz

Output Format: xml

Preserve Spacing: yes

Please enter your text here:

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By Patrick M. Sheridan @CNNTech May 2, 2014: 5:46 PM ET

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NEW YORK (CNNMoney)

Submit Clear

<wi num="0" entity="O">Bill</wi> <wi num="1" entity="O">Gates</wi> <wi num="2" entity="O">no</wi> <wi num="3" entity="O">longer</wi> <wi num="4" entity="ORGANIZATION">Microsoft</wi><wi num="5" entity="O">'s</wi> <wi num="6" entity="O">biggest</wi> <wi num="7" entity="O">shareholder</wi> <wi num="8" entity="O">By</wi> <wi num="9" entity="PERSON">Patrick</wi> <wi num="10" entity="PERSON">M.</wi> <wi num="11" entity="PERSON">Sheridan</wi> <wi num="12" entity="O">@CNNTech</wi> <wi num="13" entity="DATE">May</wi> <wi num="14" entity="DATE">2</wi><wi num="15" entity="DATE">,</wi> <wi num="16" entity="DATE">2014</wi><wi num="17" entity="O">:</wi> <wi num="18" entity="O">5:46</wi> <wi num="19" entity="O">PM</wi> <wi num="20" entity="O">ET</wi> <wi num="21" entity="O">Bill</wi> <wi num="22" entity="O">Gates</wi> <wi num="23" entity="O">sold</wi> <wi num="24" entity="O">nearly</wi> <wi num="25" entity="O">8</wi> <wi num="26" entity="O">million</wi> <wi num="27" entity="O">shares</wi> <wi num="28" entity="O">of</wi> <wi num="29" entity="ORGANIZATION">Microsoft</wi> <wi num="30" entity="O">over</wi> <wi num="31" entity="O">the</wi> <wi num="32" entity="O">past</wi> <wi num="33" entity="O">two</wi> <wi num="34" entity="O">days</wi><wi num="35" entity="O">.</wi> <wi num="0" entity="LOCATION">NEW</wi> <wi num="1" entity="LOCATION">YORK</wi> <wi num="2" entity="O">-LRB-</wi><wi num="3" entity="O">CNNMoney</wi><wi num="4" entity="O">-RRB-</wi> <wi num="5" entity="O">For</wi> <wi num="6" entity="O">the</wi> <wi num="7" entity="O">first</wi> <wi num="8" entity="O">time</wi> <wi num="9" entity="O">in</wi> <wi num="10" entity="ORGANIZATION">Microsoft</wi><wi num="11" entity="O">'s</wi> <wi num="12" entity="O">history</wi><wi num="13" entity="O">,</wi> <wi num="14" entity="O">founder</wi> <wi num="15" entity="PERSON">Bill</wi> <wi num="16" entity="PERSON">Gates</wi> <wi num="17" entity="O">is</wi> <wi num="18" entity="O">no</wi> <wi num="19" entity="O">longer</wi> <wi num="20" entity="O">its</wi> <wi num="21" entity="O">largest</wi> <wi num="22" entity="O">individual</wi> <wi num="23" entity="O">shareholder</wi><wi num="24" entity="O">.</wi> <wi num="0" entity="O">In</wi> <wi num="1" entity="O">the</wi> <wi num="2" entity="DATE">past</wi> <wi num="3" entity="DATE">two</wi> <wi num="4" entity="DATE">days</wi><wi num="5" entity="O">,</wi> <wi num="6" entity="O">Gates</wi> <wi num="7" entity="O">has</wi> <wi num="8" entity="O">sold</wi>

Stanford Named Entity Tagger (NER)

http://nlp.stanford.edu:8080/ner/process

Stanford Named Entity Tagger

Classifier: english.muc.7class.distsim.crf.ser.gz

Output Format: slashTags

Preserve Spacing: yes

Please enter your text here:

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Submit Clear

Bill/O Gates/O no/O longer/O Microsoft/ORGANIZATION's/O biggest/O shareholder/O By/O Patrick/PERSON M./PERSON Sheridan/PERSON @CNNTech/O May/DATE 2/DATE,/DATE 2014/DATE:/O 5:46/O PM/O ET/O Bill/O Gates/O sold/O nearly/O 8/O million/O shares/O of/O Microsoft/ORGANIZATION over/O the/O past/O two/O days/O./O NEW/LOCATION YORK/LOCATION -LRB-/OCNNMoney/O-RRB-/O For/O the/O first/O time/O in/O Microsoft/ORGANIZATION's/O history/O,/O founder/O Bill/PERSON Gates/PERSON is/O no/O longer/O its/O largest/O individual/O shareholder/O./O In/O the/O past/DATE two/DATE days/DATE,/O Gates/O has/O sold/O nearly/O 8/O million/O shares/O of/O Microsoft/ORGANIZATION -LRB-/OMSFT/ORGANIZATION,/O Fortune/O 500/O-RRB-/O,/O bringing/O down/O his/O total/O to/O roughly/O 330/O million/O./O That/O puts/O him/O behind/O Microsoft/ORGANIZATION's/O former/O CEO/O Steve/PERSON Ballmer/PERSON who/O owns/O 333/O million/O shares/O./O Related/O:/O Gates/O reclaims/O title/O of/O world/O's/O richest/O billionaire/O Ballmer/PERSON,/O who/O was/O Microsoft/ORGANIZATION's/O CEO/O until/O earlier/DATE this/DATE year/DATE,/O was/O one/O of/O Gates/O'/O first/O hires/O./O It/O's/O a/O passing/O of/O the/O torch/O for/O Gates/O who/O has/O always/O been/O the/O largest/O single/O owner/O of/O his/O company/O's/O stock/O./O Gates/O now/O spends/O his/O time/O and/O personal/O fortune/O helping/O run/O the/O Bill/ORGANIZATION &/ORGANIZATION Melinda/ORGANIZATION Gates/ORGANIZATION foundation/O./O The/O foundation/O has/O spent/O $/MONEY28.3/MONEY billion/MONEY fighting/O hunger/O and/O poverty/O since/O its/O inception/O back/O in/O 1997/DATE./O

Stanford Named Entity Tagger (NER)

http://nlp.stanford.edu:8080/ner/process

Stanford Named Entity Tagger

Classifier: english.conll.4class.distsim.crf.ser.gz

Output Format: highlighted

Preserve Spacing: yes

Please enter your text here:

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Submit Clear

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Potential tags:
- LOCATION
- ORGANIZATION
- PERSON
- MISC

Stanford Named Entity Tagger (NER)

http://nlp.stanford.edu:8080/ner/process

Stanford Named Entity Tagger

Classifier: english.all.3class.distsim.crf.ser.gz

Output Format: highlighted

Preserve Spacing: yes

Please enter your text here:

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Potential tags:
LOCATION
ORGANIZATION
PERSON

Classifier: english.muc.**7class**.distsim.crf.ser.gz

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Potential tags:
- LOCATION
- TIME
- PERSON
- ORGANIZATION
- MONEY
- PERCENT
- DATE

Classifier: english.all.**3class**.distsim.crf.ser.gz

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Potential tags:
- LOCATION
- ORGANIZATION
- PERSON

Stanford Named Entity Tagger (NER)

http://nlp.stanford.edu:8080/ner/process

Stanford NER Output Format: inlineXML

Bill Gates no longer <ORGANIZATION>Microsoft</ORGANIZATION>'s biggest shareholder By <PERSON>Patrick M. Sheridan</PERSON> @CNNTech <DATE>May 2, 2014</DATE>: 5:46 PM ET Bill Gates sold nearly 8 million shares of <ORGANIZATION>Microsoft</ORGANIZATION> over the past two days. <LOCATION>NEW YORK</LOCATION> (CNNMoney) For the first time in <ORGANIZATION>Microsoft</ORGANIZATION>'s history, founder <PERSON>Bill Gates</PERSON> is no longer its largest individual shareholder. In the <DATE>past two days</DATE>, Gates has sold nearly 8 million shares of <ORGANIZATION>Microsoft</ORGANIZATION> (<ORGANIZATION>MSFT</ORGANIZATION>, Fortune 500), bringing down his total to roughly 330 million. That puts him behind <ORGANIZATION>Microsoft</ORGANIZATION>'s former CEO <PERSON>Steve Ballmer</PERSON> who owns 333 million shares. Related: Gates reclaims title of world's richest billionaire <PERSON>Ballmer</PERSON>, who was <ORGANIZATION>Microsoft</ORGANIZATION>'s CEO until <DATE>earlier this year</DATE>, was one of Gates' first hires. It's a passing of the torch for Gates who has always been the largest single owner of his company's stock. Gates now spends his time and personal fortune helping run the <ORGANIZATION>Bill & Melinda Gates</ORGANIZATION> foundation. The foundation has spent <MONEY>$28.3 billion</MONEY> fighting hunger and poverty since its inception back in <DATE>1997</DATE>.

Stanford Named Entity Tagger (NER)

http://nlp.stanford.edu:8080/ner/process

Stanford NER Output Format: slashTags

Bill/O Gates/O no/O longer/O Microsoft/ORGANIZATION's/O biggest/O shareholder/O By/O Patrick/PERSON M./PERSON Sheridan/PERSON @CNNTech/O May/DATE 2/DATE,/DATE 2014/DATE:/O 5:46/O PM/O ET/O Bill/O Gates/O sold/O nearly/O 8/O million/O shares/O of/O Microsoft/ORGANIZATION over/O the/O past/O two/O days/O./O NEW/LOCATION YORK/LOCATION -LRB-/OCNNMoney/O-RRB-/O For/O the/O first/O time/O in/O Microsoft/ORGANIZATION's/O history/O,/O founder/O Bill/PERSON Gates/PERSON is/O no/O longer/O its/O largest/O individual/O shareholder/O./O In/O the/O past/DATE two/DATE days/DATE,/O Gates/O has/O sold/O nearly/O 8/O million/O shares/O of/O Microsoft/ORGANIZATION -LRB-/OMSFT/ORGANIZATION,/O Fortune/O 500/O-RRB-/O,/O bringing/O down/O his/O total/O to/O roughly/O 330/O million/O./O That/O puts/O him/O behind/O Microsoft/ORGANIZATION's/O former/O CEO/O Steve/PERSON Ballmer/PERSON who/O owns/O 333/O million/O shares/O./O Related/O:/O Gates/O reclaims/O title/O of/O world/O's/O richest/O billionaire/O Ballmer/PERSON,/O who/O was/O Microsoft/ORGANIZATION's/O CEO/O until/O earlier/DATE this/DATE year/DATE,/O was/O one/O of/O Gates/O'/O first/O hires/O./O It/O's/O a/O passing/O of/O the/O torch/O for/O Gates/O who/O has/O always/O been/O the/O largest/O single/O owner/O of/O his/O company/O's/O stock/O./O Gates/O now/O spends/O his/O time/O and/O personal/O fortune/O helping/O run/O the/O Bill/ORGANIZATION &/ORGANIZATION Melinda/ORGANIZATION Gates/ORGANIZATION foundation/O./O The/O foundation/O has/O spent/O $/MONEY28.3/MONEY billion/MONEY fighting/O hunger/O and/O poverty/O since/O its/O inception/O back/O in/O 1997/DATE./O

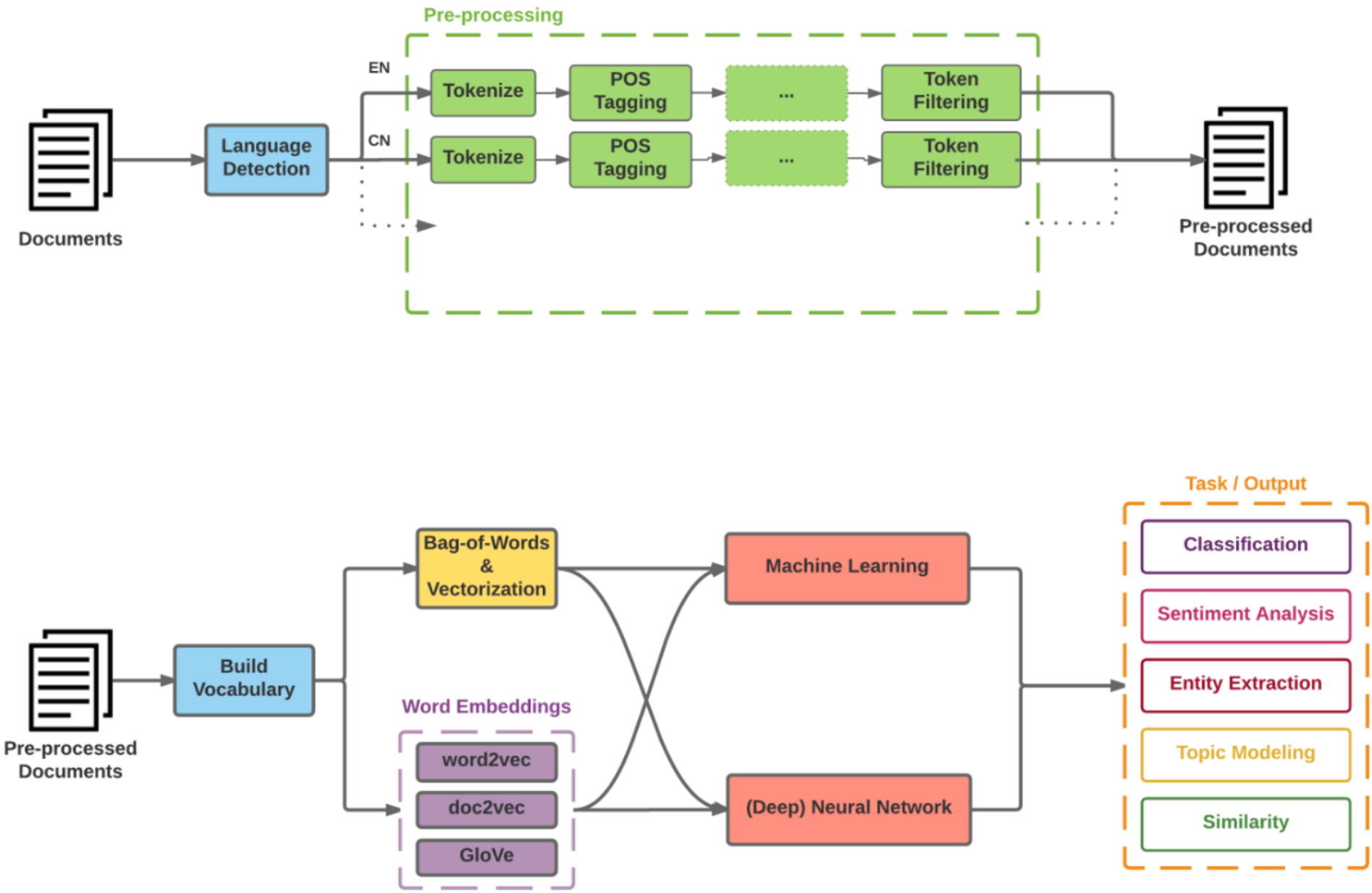
Vector Representations of Words

Word Embeddings

Word2Vec

GloVe

Modern NLP Pipeline



Source: https://github.com/fortiema/talks/blob/master/opendata2016sh/pragmatic-nlp-opendata2016sh.pdf

Facebook Research FastText

Pre-trained word vectors
Word2Vec
wiki.zh.vec (861MB)
332647 word
300 vec

Pre-trained word vectors for 90 languages, trained on Wikipedia using fastText.

These vectors in dimension 300 were obtained using the skip-gram model with default parameters.

https://github.com/facebookresearch/fastText/blob/master/pretrained-vectors.md

Source: Bojanowski, Piotr, Edouard Grave, Armand Joulin, and Tomas Mikolov. "Enriching word vectors with subword information." *arXiv preprint arXiv:1607.04606* (2016).

Facebook Research FastText Word2Vec: wiki.zh.vec

(861MB) (332647 word 300 vec)

wiki.zh.vec

```
31845 yg -0.3978 0.49084 -0.54621 0.078991 0.8584 -0.26163 -0.45787 0.060828 0.36513 -0.03771 0.80791 0.16613 1.4828 -0.89862 0.085965
31846 迴圈 -0.034834 0.71651 -0.4377 0.48344 0.31117 -0.51783 -0.40156 -0.057097 0.31535 -0.088301 0.23436 0.30884 1.2932 -0.6704 0.21
31847 ぶっ -0.23267 0.39349 -0.90806 -0.53805 0.59308 -0.31819 -0.64229 0.16871 0.10086 0.09342 1.0914 -0.16019 1.6954 -0.70604 -0.218
31848 三公 0.54129 0.55641 -0.4348 0.25094 0.1631 -0.10326 -0.54099 0.064742 0.13175 0.10217 0.84938 -0.10287 1.312 -0.74969 0.24025 -
31849 水貨 -0.14451 0.80455 -0.6145 0.55905 0.58307 -0.02559 -0.41088 -0.19056 -0.09178 0.33935 1.1927
31850 剛才 0.19347 0.553 -0.64736 0.26358 0.83816 -0.24098 -0.83997 -0.16232 -0.024786 -0.2483 0.69732
31851 無知 -0.0089777 0.90866 -0.25306 0.72983 0.67791 -0.3285 -0.63835 0.075295 0.4774 -0.04134 0.721
31852 好轉 -0.026068 0.92676 -0.47469 0.50129 0.67343 -0.32509 -0.32917 0.066499 0.3875 0.0011722 0.66
31853 紀事 0.40541 0.67654 -0.5351 0.30329 0.43042 -0.24675 -0.19287 0.34207 0.35516 -0.076331 0.85916
31854 變回 -0.089933 0.88136 -0.43524 0.59963 0.6403 -0.70981 -0.56788 -0.074018 0.16905 -0.086594 0.6
31855 牟尼 -0.26578 0.6434 0.028982 -0.044001 0.88297 -0.17646 -0.64672 0.040483 0.43653 0.084908 0.74
31856 埋藏 -0.0985 0.85082 -0.33363 0.24784 0.71518 -0.59054 -0.73731 0.050949 0.36726 -0.076886 0.817
31857 正大 0.21069 0.27605 -0.83862 -0.099698 0.47894 -0.32196 -0.38288 -0.01892 0.40548 -0.029619 0.7
31858 kis -0.30595 0.18482 -0.71287 -0.314 0.44776 -0.44245 -0.36447 -0.23723 0.00098801 -0.2528 0.608
31859 合奏 0.1841 0.60874 -0.51376 -0.48002 0.21506 -0.55515 -0.71746 0.030735 0.39508 -0.40856 0.6226
31860 精兵 0.25619 0.77186 -0.48847 0.23118 0.27254 0.21305 -0.3517 0.47305 0.24882 -0.34756 1.025 0.1
31861 疲勞 -0.072521 1.0381 -0.51933 0.19421 0.67573 -0.45204 -0.20126 0.22704 0.44196 0.018401 0.3473
31862 襯 -0.11771 1.4272 -1.0849 0.77532 0.87026 -0.6892 -0.3521 0.036517 0.42727 -0.1871 0.82789 -0.0
31863 小貓 -0.21554 0.73988 -0.39628 0.044656 1.0602 -0.67047 -0.54102 0.11888 0.1693 0.19343 1.0841 0.
31864 lai -0.25451 0.31596 -0.29228 -0.19144 0.99059 -0.24459 -0.66342 0.063093 -0.061142 -0.22749 0.6
31865 偏東 -0.50835 1.0943 0.043918 0.29173 1.0161 -0.32493 -0.27305 0.026946 0.46811 -0.3874 1.4049 0.
31866 大约是 -0.35726 -0.03476 -0.28672 0.075447 0.18175 -0.39421 -0.32088 0.025225 0.34808 0.074744 0.
31867 franch -0.6046 -0.3235 0.024041 -0.2756 0.74761 -0.14654 0.0082566 -0.10071 0.53593 -0.17374 0.2
31868 brazilian -0.54029 -0.63905 -0.094006 -0.68768 0.33263 -0.1583 -0.060424 0.20644 0.46234 -0.0764
31869 夾竹桃 -0.4361 0.011429 -0.078896 -0.078186 0.37747 -0.052101 -0.096683 0.10769 0.62661 -0.37252
31870 continent -0.37761 -0.72151 -0.42248 -0.81768 0.5016 -0.48569 0.13464 0.12644 0.32292 0.18099 0.
31871 我还是 0.097443 0.28929 -0.14202 0.034027 0.50621 -0.1647 -0.45849 -0.16198 0.13965 -0.33451 0.61
31872 vienna -0.25827 -0.050966 0.050502 -0.63466 0.4949 -0.17448 -0.59978 0.20269 0.37532 0.059419 0.
31873 固态 -0.12678 0.4556 -0.27108 0.12506 0.52106 -0.058477 -0.69296 0.12162 0.26508 -0.089028 0.752
31874 吉普 -0.33693 0.48335 -0.58455 0.13722 0.74856 -0.24529 -0.41125 -0.13832 0.33871 -0.12051 0.864
31875 實物 0.030096 0.65756 -0.67982 0.2203 0.38492 -0.19001 -0.53136 -0.10322 0.24523 0.15287 0.92591
31876 教职 0.11559 0.67087 -0.5111 0.14955 0.61417 -0.51571 -0.47901 0.29445 0.37629 -0.24232 0.4608 -
31877 惕 0.50469 1.5357 -0.64393 0.48668 0.69479 -0.23443 -0.47863 0.16288 0.3347 -0.51673 0.86777 0.0
31878 岸上 0.088323 0.85815 -0.485 0.30383 0.75965 -0.25031 -0.76678 0.12805 0.37641 -0.088752 0.65012
31879 议和 0.26835 0.94854 -0.27972 0.097623 0.43305 -0.031361 -0.57406 0.21608 0.3324 -0.36823 0.6987
31880 aka -0.21332 0.11216 -0.48872 -0.18531 0.79093 -0.34221 -0.51122 0.10067 0.29963 -0.075253 0.642
31881 滑鐵盧 -0.28726 0.88014 -0.39751 -0.056992 0.37408 -0.16967 -0.20673 -0.048533 -0.1978 -0.13107 0
```

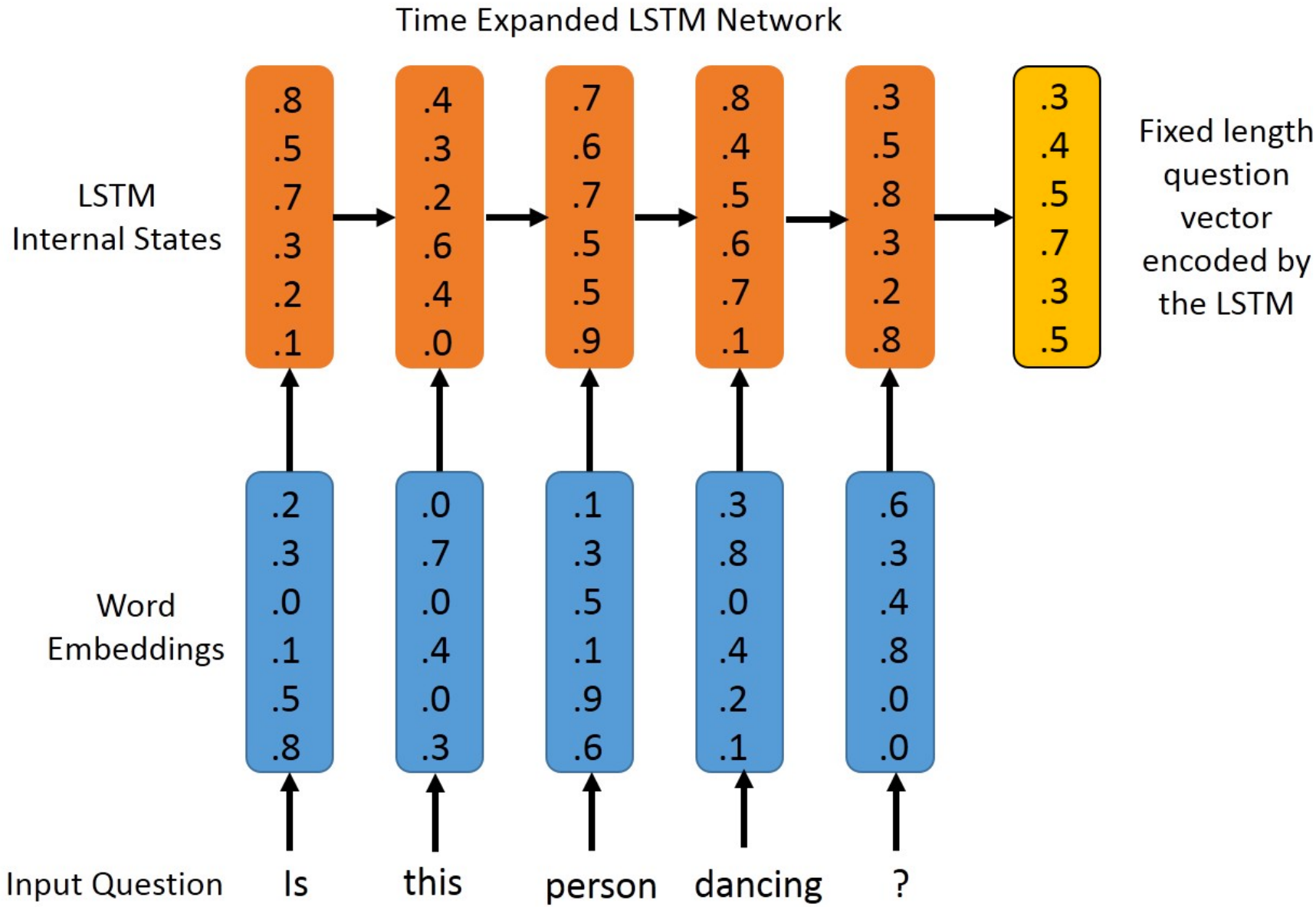
Models

The models can be downloaded from:

- Afrikaans: *bin+text*, *text*
- Albanian: *bin+text*, *text*
- Arabic: *bin+text*, *text*
- Armenian: *bin+text*, *text*
- Asturian: *bin+text*, *text*
- Azerbaijani: *bin+text*, *text*
- Bashkir: *bin+text*, *text*
- Basque: *bin+text*, *text*
- Belarusian: *bin+text*, *text*
- Bengali: *bin+text*, *text*
- Bosnian: *bin+text*, *text*
- Breton: *bin+text*, *text*
- Bulgarian: *bin+text*, *text*
- Burmese: *bin+text*, *text*
- Catalan: *bin+text*, *text*
- Cebuano: *bin+text*, *text*
- Chechen: *bin+text*, *text*
- Chinese: *bin+text*, *text*
- Chuvash: *bin+text*, *text*
- Croatian: *bin+text*, *text*
- Czech: *bin+text*, *text*

https://github.com/facebookresearch/fastText/blob/master/pretrained-vectors.md

Word Embeddings in LSTM RNN



Source: https://avisingh599.github.io/deeplearning/visual-qa/

自然語言處理與資訊檢索研究資源

http://mail.tku.edu.tw/myday/resources/

淡江大學資訊管理學系
(Department of Information Management, Tamkang University)
自然語言處理與資訊檢索研究資源
(Resources of Natural Language Processing and Information Retrieval)

1. 中央研究院CKIP中文斷詞系統
   授權單位：中央研究院詞庫小組
   授權金額：免費授權學術使用。
   授權日期：2011.03.31。
   CKIP: http://ckipsvr.iis.sinica.edu.tw/

2. 「中央研究院中英雙語詞網」(The Academia Sinica Bilingual Wordnet)
   「中央研究院中英雙語詞網」(The Academia Sinica Bilingual Wordnet)，
   授權「淡江大學資訊管理學系」(Department of Information Management, Tamkang University)學術使用。
   授權單位：中央研究院，中華民國計算語言學學會
   授權金額：「中央研究院中英雙語詞網」(The Academia Sinica Bilingual Wordnet) 國內非營利機構(1-10人使用) 非會員：NT$61,000元，
   授權日期：2011.05.16。
   Sinica BOW: http://bow.ling.sinica.edu.tw/

自然語言處理與資訊檢索研究資源

http://mail.tku.edu.tw/myday/resources/

3. 開放式中研院專名問答系統 (OpenASQA)
   授權單位：中央研究院資訊科學研究所智慧型代理人系統實驗室
   授權金額：免費授權學術使用。
   授權日期：2011.05.05。
   ASQA: http://asqa.iis.sinica.edu.tw/

自然語言處理與資訊檢索研究資源

http://mail.tku.edu.tw/myday/resources/

4. 哈工大資訊檢索研究中心(HIT-CIR)語言技術平臺

語料資源

哈工大資訊檢索研究中心漢語依存樹庫〔HIT-CIR Chinese Dependency Treebank〕

哈工大資訊檢索研究中心同義詞詞林擴展版〔HIT-CIR Tongyici Cilin (Extended)〕

語言處理模組

斷句 (SplitSentence: Sentence Splitting)

詞法分析 (IRLAS: Lexical Analysis System)

基於SVMTool的詞性標注 (PosTag: Part-of-speech Tagging)

命名實體識別 (NER: Named Entity Recognition)

基於動態局部優化的依存句法分析 (Parser: Dependency Parsing)

基於圖的依存句法分析 (GParser: Graph-based DP)

全文詞義消歧 (WSD: Word Sense Disambiguation)

淺層語義標注模組 (SRL: hallow Semantics Labeling)

資料表示

語言技術置標語言 (LTML: Language Technology Markup Language)

視覺化工具

LTML視覺化XSL

授權單位：哈工大資訊檢索研究中心(HIT-CIR)

授權金額：免費授權學術使用。

授權日期：2011.05.03。

HIT IR: http://ir.hit.edu.cn/

NLP Tools: spaCy vs. NLTK

	SPACY	SYNTAXNET	NLTK	CORENLP
Easy installation	+	−	+	+
Python API	+	−	+	−
Multi-language support	○	+	+	+
Tokenization	+	+	+	+
Part-of-speech tagging	+	+	+	+
Sentence segmentation	+	+	+	+
Dependency parsing	+	+	−	+
Entity Recognition	+	−	+	+
Integrated word vectors	+	−	−	−
Sentiment analysis	+	−	+	+
Coreference resolution	−	−	−	+

Source: https://spacy.io/docs/api/

Natural Language Processing (NLP) spaCy

1. Tokenization
2. Part-of-speech tagging
3. Sentence segmentation
4. Dependency parsing
5. Entity Recognition
6. Integrated word vectors
7. Sentiment analysis
8. Coreference resolution

Source: https://spacy.io/docs/api/

spaCy:
Fastest Syntactic Parser

SYSTEM	LANGUAGE	ACCURACY	SPEED (WPS)
spaCy	**Cython**	**91.8**	**13,963**
ClearNLP	Java	91.7	10,271
CoreNLP	Java	89.6	8,602
MATE	Java	**92.5**	550
Turbo	C++	92.4	349

Source: https://spacy.io/docs/api/

Processing Speed of NLP libraries

	ABSOLUTE (MS PER DOC)			RELATIVE (TO SPACY)		
SYSTEM	TOKENIZE	TAG	PARSE	TOKENIZE	TAG	PARSE
spaCy	**0.2ms**	**1ms**	**19ms**	**1x**	**1x**	**1x**
CoreNLP	2ms	10ms	49ms	10x	10x	2.6x
ZPar	1ms	8ms	850ms	5x	8x	44.7x
NLTK	4ms	443ms	n/a	20x	443x	n/a

Source: https://spacy.io/docs/api/

Google SyntaxNet (2016): Best Syntactic Dependency Parsing Accuracy

SYSTEM	NEWS	WEB	QUESTIONS
spaCy	92.8	n/a	n/a
Parsey McParseface	94.15	89.08	94.77
Martins et al. (2013)	93.10	88.23	94.21
Zhang and McDonald (2014)	93.32	88.65	93.37
Weiss et al. (2015)	93.91	89.29	94.17
Andor et al. (2016)	**94.44**	**90.17**	**95.40**

Source: https://spacy.io/docs/api/

Named Entity Recognition (NER)

SYSTEM	PRECISION	RECALL	F-MEASURE
spaCy	0.7240	0.6514	0.6858
CoreNLP	**0.7914**	**0.7327**	**0.7609**
NLTK	0.5136	0.6532	0.5750
LingPipe	0.5412	0.5357	0.5384

Natural Language Processing with NLTK in Python

python™

Source: https://www.python.org/community/logos/

NLTK (Natural Language Toolkit)

NLTK 3.0 documentation

NEXT | MODULES | INDEX

Natural Language Toolkit

NLTK is a leading platform for building Python programs to work with human language data. It provides easy-to-use interfaces to over 50 corpora and lexical resources such as WordNet, along with a suite of text processing libraries for classification, tokenization, stemming, tagging, parsing, and semantic reasoning, wrappers for industrial-strength NLP libraries, and an active discussion forum.

Thanks to a hands-on guide introducing programming fundamentals alongside topics in computational linguistics, plus comprehensive API documentation, NLTK is suitable for linguists, engineers, students, educators, researchers, and industry users alike. NLTK is available for Windows, Mac OS X, and Linux. Best of all, NLTK is a free, open source, community-driven project.

NLTK has been called "a wonderful tool for teaching, and working in, computational linguistics using Python," and "an amazing library to play with natural language."

Natural Language Processing with Python provides a practical introduction to programming for language processing. Written by the creators of NLTK, it guides the reader through the fundamentals of writing Python programs, working with corpora, categorizing text, analyzing linguistic structure, and more. The book is being updated for Python 3 and NLTK 3. (The original Python 2 version is still available at http://nltk.org/book_1ed.)

Some simple things you can do with NLTK

Tokenize and tag some text:

```
>>> import nltk
```

TABLE OF CONTENTS

SEARCH

Go

Enter search terms or a module, class or function name.

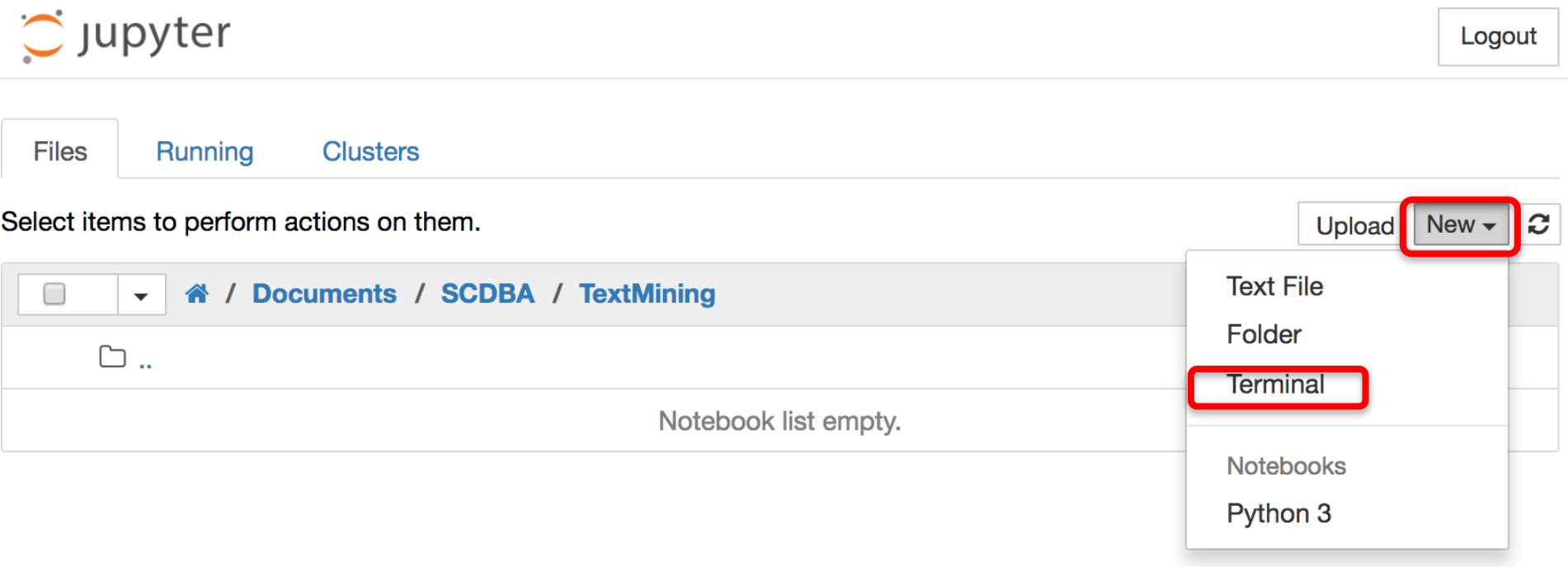
http://www.nltk.org/

jupyter notebook

imyday — jupyter-notebook — 90×7

```
iMydaytekiMacBook-Pro:~ imyday$ jupyter notebook
[I 05:00:21.870 NotebookApp] Serving notebooks from local directory: /Users/imyday
[I 05:00:21.870 NotebookApp] 0 active kernels
[I 05:00:21.870 NotebookApp] The Jupyter Notebook is running at: http://localhost:8888/
[I 05:00:21.870 NotebookApp] Use Control-C to stop this server and shut down all kernels (
twice to skip confirmation).
```

Jupyter New Terminal



conda list

localhost:8888/terminals/1

jupyter

Logout

```
bash-3.2$ conda list
# packages in environment at /Users/imyday/anaconda:
#
_license                  1.1                      py36_1
alabaster                 0.7.9                    py36_0
anaconda                  4.3.1                np111py36_0
anaconda-client           1.6.0                    py36_0
anaconda-navigator        1.5.0                    py36_0
anaconda-project          0.4.1                    py36_0
appnope                   0.1.0                    py36_0
appscript                 1.0.1                    py36_0
astroid                   1.4.9                    py36_0
astropy                   1.3                  np111py36_0
babel                     2.3.4                    py36_0
backports                 1.0                      py36_0
beautifulsoup4            4.5.3                    py36_0
bitarray                  0.8.1                    py36_0
blaze                     0.10.1                   py36_0
bokeh                     0.12.4                   py36_0
boto                      2.45.0                   py36_0
bottleneck                1.2.0                np111py36_0
cffi                      1.9.1                    py36_0
chardet                   2.3.0                    py36_0
chest                     0.2.3                    py36_0
click                     6.7                      py36_0
cloudpickle               0.2.2                    py36_0
clyent                    1.2.2                    py36_0
colorama                  0.3.7                    py36_0
conda                     4.3.14                   py36_0
conda-env                 2.6.0                         0
configobj                 5.0.6                    py36_0
contextlib2               0.5.4                    py36_0
cryptography              1.7.1                    py36_0
curl                      7.52.1                        0
cycler                    0.10.0                   py36_0
cython                    0.25.2                   py36_0
```

conda list

jupyter

nltk 3.2.2 py36_0

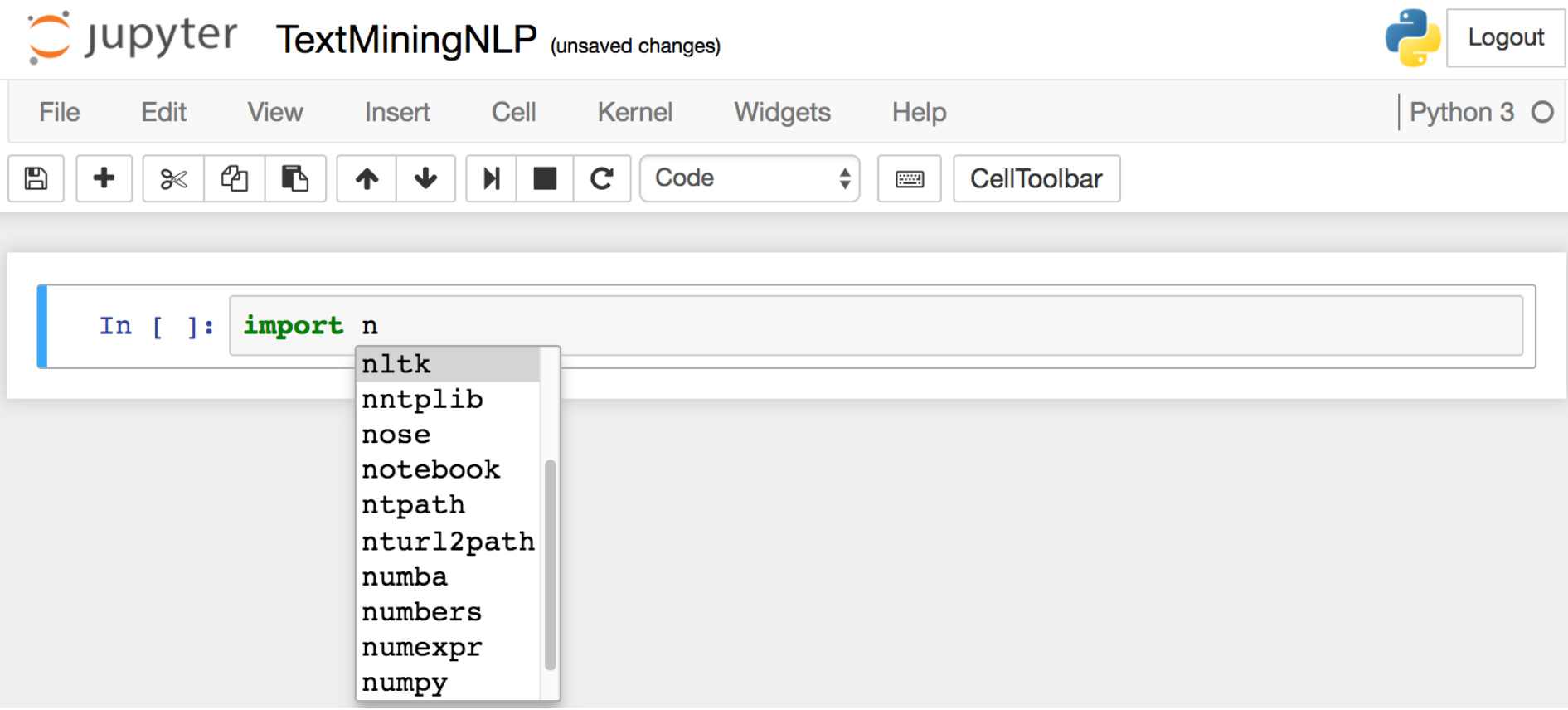
```
matplotlib                2.0.0                 np111py36_0
mistune                   0.7.3                      py36_1
mkl                       2017.0.1                        0
mkl-service               1.1.2                      py36_3
mpmath                    0.19                       py36_1
multipledispatch          0.4.9                      py36_0
nbconvert                 4.2.0                      py36_0
nbformat                  4.2.0                      py36_0
networkx                  1.11                       py36_0
nltk                      3.2.2                      py36_0
nose                      1.3.7                      py36_1
notebook                  4.3.1                      py36_0
numba                     0.30.1                np111py36_0
numexpr                   2.6.1                 np111py36_2
numpy                     1.11.3                     py36_0
numpydoc                  0.6.0                      py36_0
odo                       0.5.0                      py36_1
openpyxl                  2.4.1                      py36_0
openssl                   1.0.2k                          1
pandas                    0.19.2                np111py36_1
pandas-datareader         0.2.1                      py36_0
partd                     0.3.7                      py36_0
path.py                   10.0                       py36_0
pathlib2                  2.2.0                      py36_0
patsy                     0.4.1                      py36_0
pep8                      1.7.0                      py36_0
pexpect                   4.2.1                      py36_0
pickleshare               0.7.4                      py36_0
pillow                    4.0.0                      py36_0
pip                       9.0.1                      py36_1
plotly                    1.12.9                     py36_0
ply                       3.9                        py36_0
prompt_toolkit            1.0.9                      py36_0
psutil                    5.0.1                      py36_0
```

help('modules')

```
In [2]: help('modules')
```

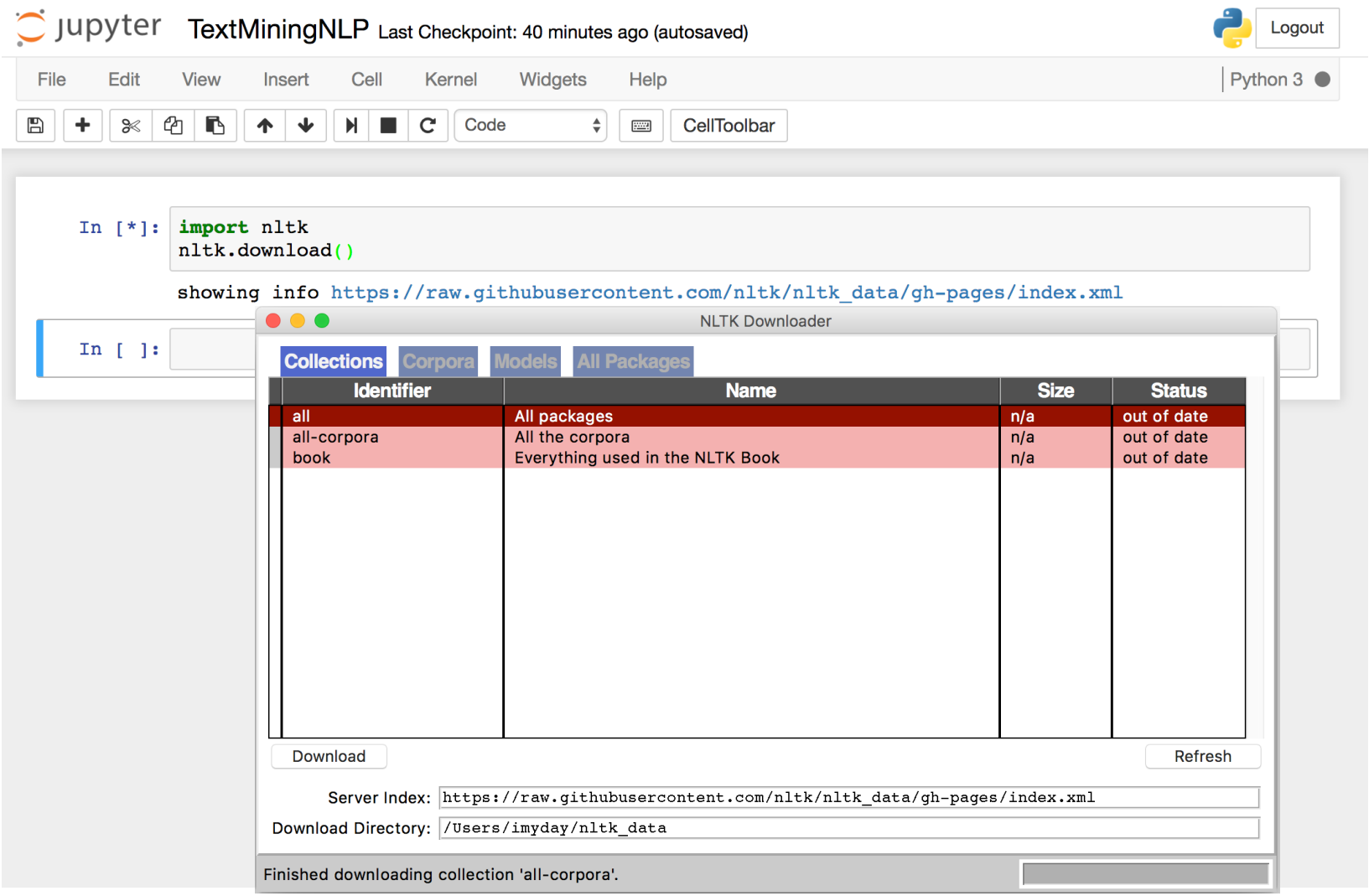
```
_Qt                 copy                nltk                tarfile
_Res                copy_reg            nntplib             telnetlib
_Scrap              copyreg             nose                tempfile
_Snd                crypt               notebook            terminado
_TE                 cryptography        ntpath              terminalcommand
_Win                csv                 nturl2path          termios
__builtin__         ctypes              numba               test_path
__future__          curl                numbers             test_pycosat
_abcoll             curses              numexpr             tests
_ast                cycler              numpy               textwrap
_bisect             cython              odo                 this
_builtinSuites      cythonmagic         opcode              thread
_cffi_backend       cytoolz             openpyxl            threading
_codecs             datashape           operator            time
_codecs_cn          datetime            optparse            timeit
_codecs_hk          dateutil            os                  tkColorChooser
_codecs_iso2022     dbhash              os2emxpath          tkCommonDialog
_codecs_jp          dbm                 osax                tkFileDialog
_codecs_kr          decimal             pandas              tkFont
_codecs_tw          decorator           parser              tkMessageBox
```

import nltk



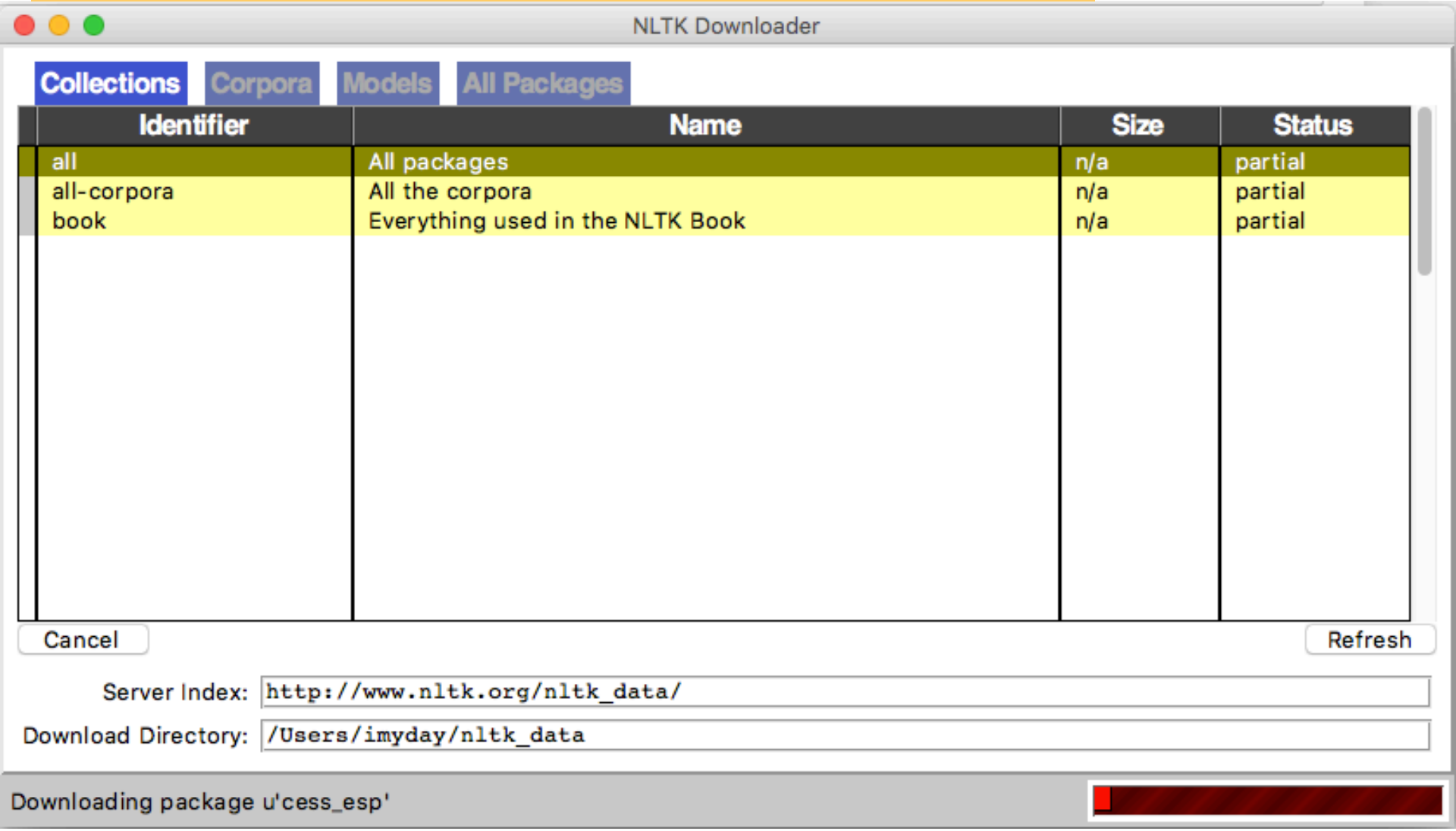
Source: http://www.nltk.org/

import nltk
nltk.download()



Source: http://www.nltk.org/

```
import nltk
nltk.download()
```



Source: http://www.nltk.org/

import nltk
nltk.download()

```
In [*]: import nltk
        nltk.download()
```

```
In [ ]:
```

NLTK Downloader

Collections | Corpora | Models | All Packages

Identifier	Name	Size	Status
all	All packages	n/a	partial
all-corpora	All the corpora	n/a	partial
book	Everything used in the NLTK Book	n/a	installed

Cancel | Refresh

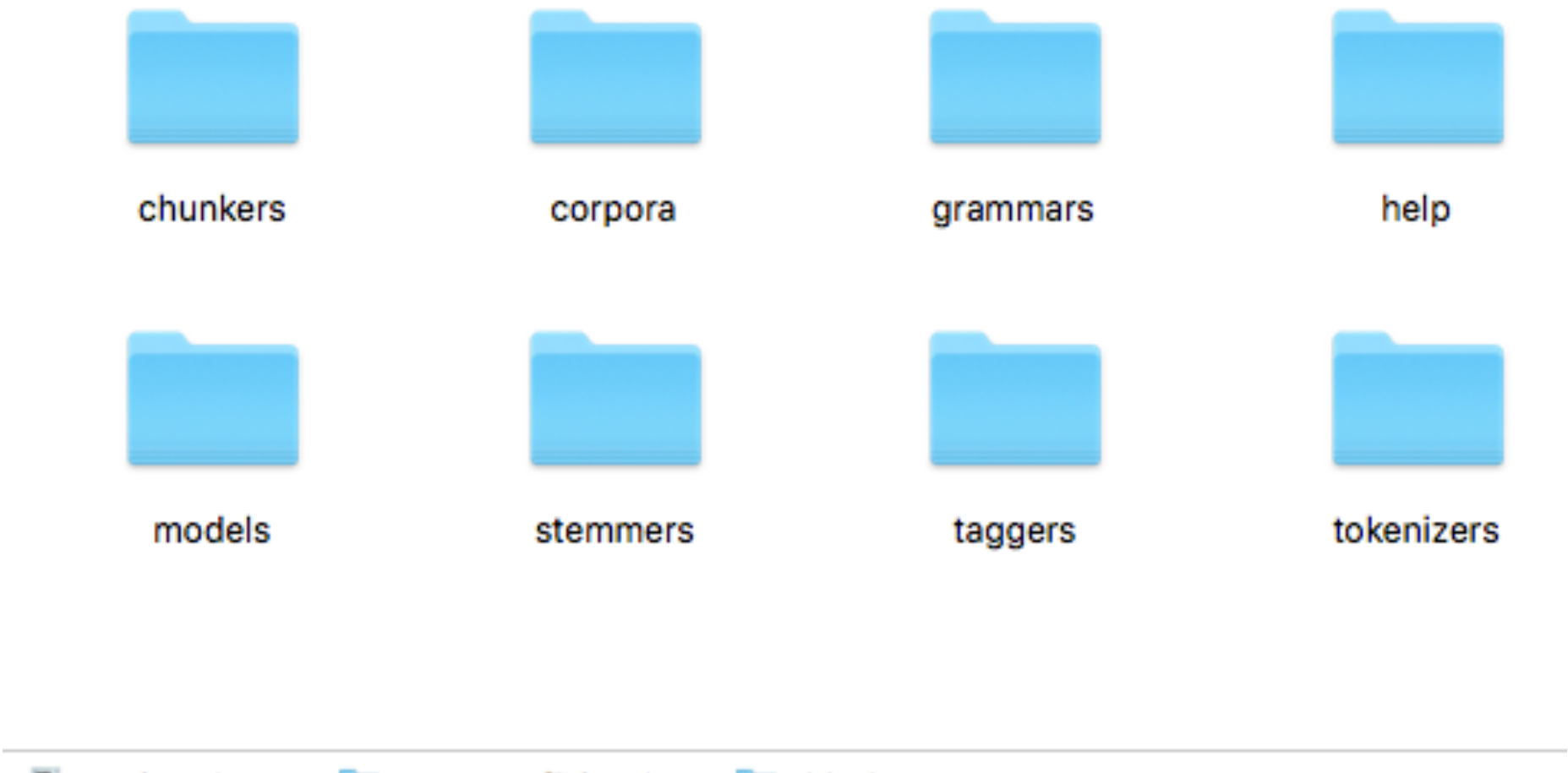
Server Index: http://www.nltk.org/nltk_data/

Download Directory: /Users/imyday/nltk_data

Downloading package u'panlex_lite'

Source: http://www.nltk.org/

nltk_data


chunkers
corpora
grammars
help
models
stemmers
taggers
tokenizers
Macintosh HD › Users › imyday › nltk_data

At eight o'clock on Thursday morning Arthur didn't feel very good.

Source: http://www.nltk.org/

```
[('At', 'IN'),
('eight', 'CD'),
("o'clock", 'NN'),
('on', 'IN'),
('Thursday', 'NNP'),
('morning', 'NN'),
('Arthur', 'NNP'),
('did', 'VBD'),
("n't", 'RB'),
('feel', 'VB'),
('very', 'RB'),
('good', 'JJ'),
('.', '.')]
```

Source: http://www.nltk.org/

```
import nltk
sentence = "At eight o'clock on Thursday morning Arthur didn't feel very good."
tokens = nltk.word_tokenize(sentence)
tokens
```

```
print(tokens)
```

In [1]:
```
import nltk
sentence = "At eight o'clock on Thursday morning Arthur didn't feel very good."
tokens = nltk.word_tokenize(sentence)
tokens
```

Out[1]:
```
['At',
 'eight',
 "o'clock",
 'on',
 'Thursday',
 'morning',
 'Arthur',
 'did',
 "n't",
 'feel',
 'very',
 'good',
 '.']
```

In [2]:
```
print(tokens)
```

```
['At', 'eight', "o'clock", 'on', 'Thursday', 'morning', 'Arthur', 'did', "n't", 'feel', 'ver
y', 'good', '.']
```

Source: http://www.nltk.org/

```
tagged = nltk.pos_tag(tokens)
tagged[0:6]
```

```
In [3]: tagged = nltk.pos_tag(tokens)
        tagged[0:6]

Out[3]: [('At', 'IN'),
         ('eight', 'CD'),
         ("o'clock", 'NN'),
         ('on', 'IN'),
         ('Thursday', 'NNP'),
         ('morning', 'NN')]
```

Source: http://www.nltk.org/

tagged

```
In [4]: tagged

Out[4]: [('At', 'IN'),
         ('eight', 'CD'),
         ("o'clock", 'NN'),
         ('on', 'IN'),
         ('Thursday', 'NNP'),
         ('morning', 'NN'),
         ('Arthur', 'NNP'),
         ('did', 'VBD'),
         ("n't", 'RB'),
         ('feel', 'VB'),
         ('very', 'RB'),
         ('good', 'JJ'),
         ('.', '.')]
```

Source: http://www.nltk.org/

print(tagged)

```
In [5]: print(tagged)

[('At', 'IN'), ('eight', 'CD'), ("o'clock", 'NN'), ('on', 'IN'), ('Thursday', 'NNP'), ('morni
ng', 'NN'), ('Arthur', 'NNP'), ('did', 'VBD'), ("n't", 'RB'), ('feel', 'VB'), ('very', 'RB'),
('good', 'JJ'), ('.', '.')]
```

```
[('At', 'IN'), ('eight', 'CD'), ("o'clock", 'NN'), ('on', 'IN'),
('Thursday', 'NNP'), ('morning', 'NN'), ('Arthur', 'NNP'), ('did',
'VBD'), ("n't", 'RB'), ('feel', 'VB'), ('very', 'RB'), ('good',
'JJ'), ('.', '.')]
```

At eight o'clock on Thursday morning Arthur didn't feel very good.

Source: http://www.nltk.org/

```
entities = nltk.chunk.ne_chunk(tagged)
entities
```

```
entities = nltk.chunk.ne_chunk(tagged)
entities
```

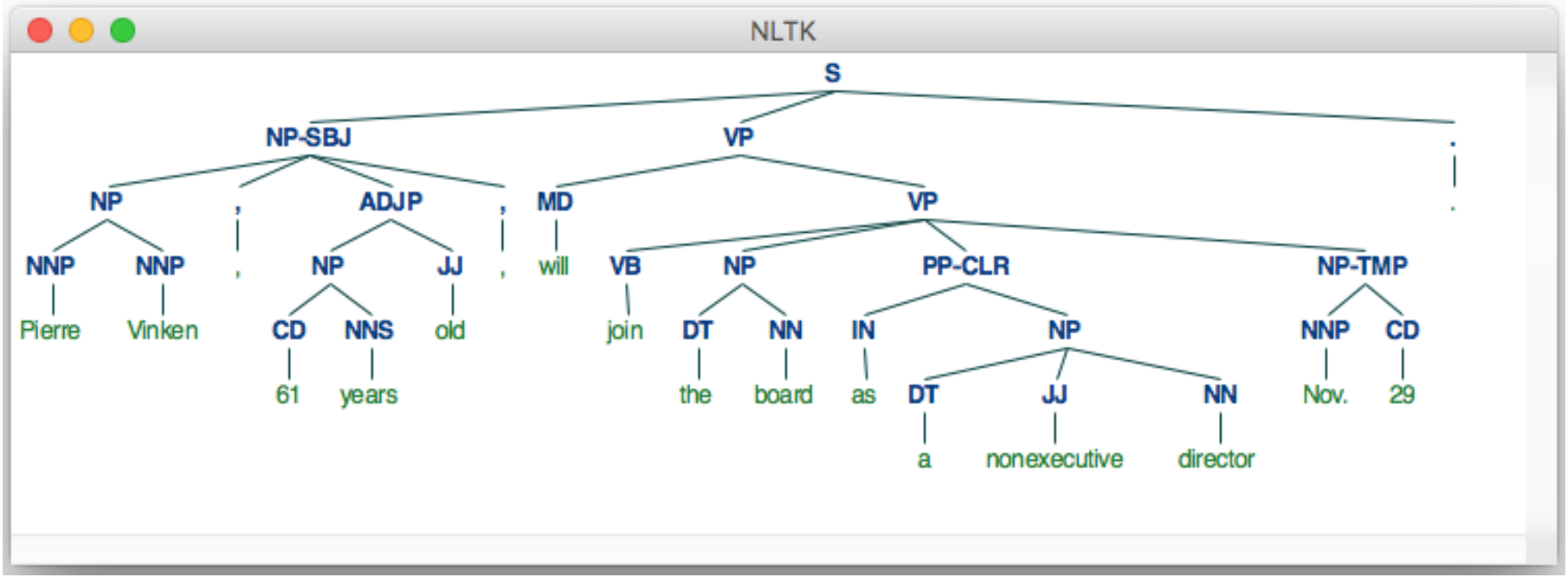
```
Tree('S', [('At', 'IN'), ('eight', 'CD'), ("o'clock", 'NN'), ('on', 'IN'), ('Thursday', 'NN
P'), ('morning', 'NN'), Tree('PERSON', [('Arthur', 'NNP')]), ('did', 'VBD'), ("n't", 'RB'),
('feel', 'VB'), ('very', 'RB'), ('good', 'JJ'), ('.', '.')])
```

```
Tree('S', [('At', 'IN'), ('eight', 'CD'), ("o'clock", 'JJ'),
           ('on', 'IN'), ('Thursday', 'NNP'), ('morning', 'NN'),
      Tree('PERSON', [('Arthur', 'NNP')]),
           ('did', 'VBD'), ("n't", 'RB'), ('feel', 'VB'),
           ('very', 'RB'), ('good', 'JJ'), ('.', '.')])
```

Source: http://www.nltk.org/

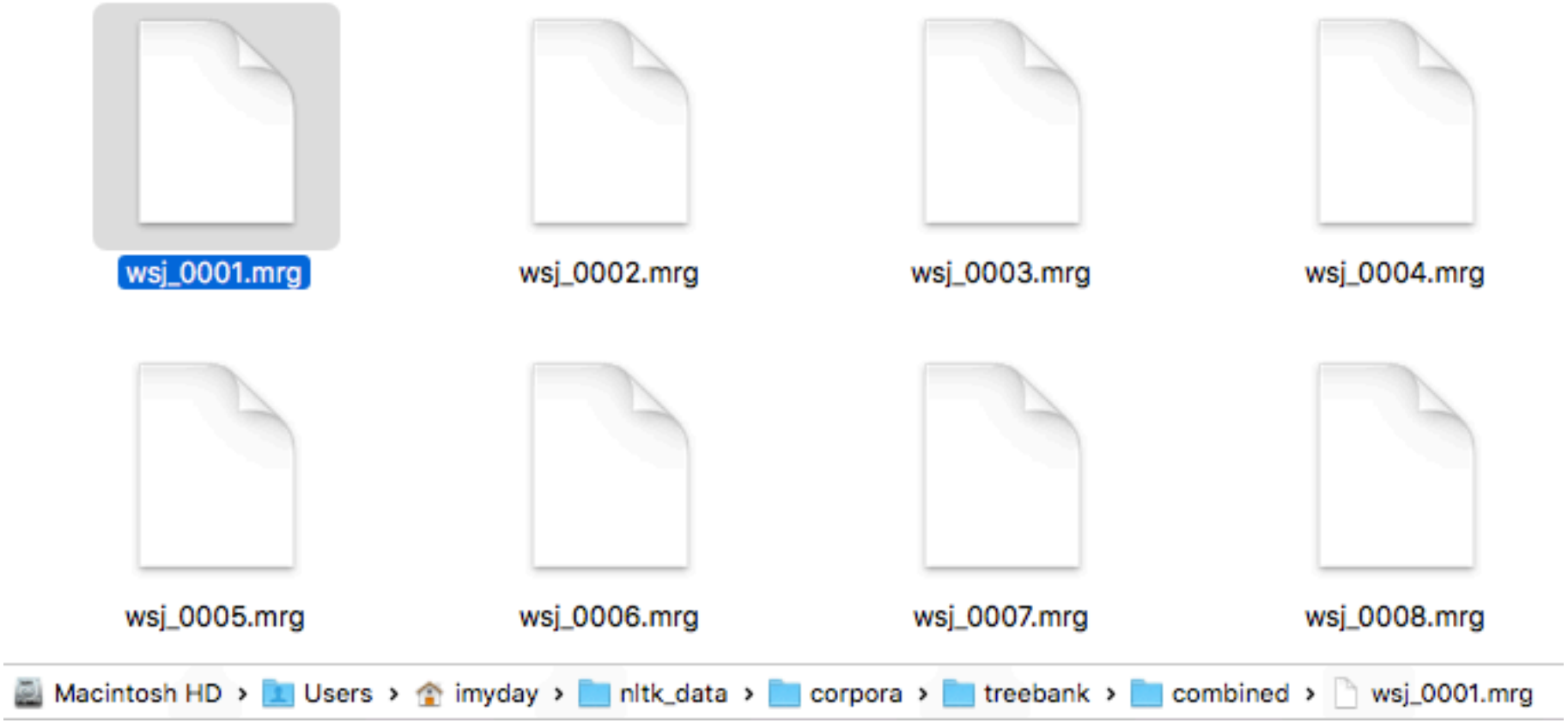
```
from nltk.corpus import treebank
t = treebank.parsed_sents('wsj_0001.mrg')[0]
t.draw()
```


```
from nltk.corpus import treebank
t = treebank.parsed_sents('wsj_0001.mrg')[0]
t.draw()
```

Source: http://www.nltk.org/

wsj_0001.mrg


wsj_0001.mrg
wsj_0002.mrg
wsj_0003.mrg
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wsj_0007.mrg
wsj_0008.mrg
Macintosh HD › Users › imyday › nltk_data › corpora › treebank › combined › wsj_0001.mrg

wsj_0001.mrg

wsj_0001.mrg

```
1
2  ( (S
3      (NP-SBJ
4        (NP (NNP Pierre) (NNP Vinken) )
5        (, ,)
6        (ADJP
7          (NP (CD 61) (NNS years) )
8          (JJ old) )
9        (, ,) )
10     (VP (MD will)
11       (VP (VB join)
12         (NP (DT the) (NN board) )
13         (PP-CLR (IN as)
14           (NP (DT a) (JJ nonexecutive) (NN director) ))
15         (NP-TMP (NNP Nov.) (CD 29) )))
16     (. .) ))
17 ( (S
18     (NP-SBJ (NNP Mr.) (NNP Vinken) )
19     (VP (VBZ is)
20       (NP-PRD
21         (NP (NN chairman) )
22         (PP (IN of)
23           (NP
24             (NP (NNP Elsevier) (NNP N.V.) )
25             (, ,)
26             (NP (DT the) (NNP Dutch) (VBG publishing) (NN group) )))))
27     (. .) ))
28
```

Source: http://www.nltk.org/

Pragmatic NLP

Pragmatic NLP - Live Demo

Dataset: CNN Facebook Posts 2012-2016

Source: https://data.world/martinchek/2012-2016-facebook-posts

In [1]:
```
%matplotlib inline
import matplotlib
import matplotlib.pyplot as plt
matplotlib.style.use('ggplot')

import pandas as pd
import numpy as np
from sklearn.feature_extraction.text import CountVectorizer, TfidfTransformer
from textblob import TextBlob
# Don't forget to fetch necesarry models for TextBlob's NLTK hooks to function > 'python -m textbl
ob.download_corpora'

import json
import multiprocessing
import regex as re
```

In [2]:
```
fname_data = '/Volumes/SD/datasets/facebook-news/cnn-5550296508.csv-cnn-5550296508.csv'
```

1. Ingest Data

In [3]:
```
pd_data = pd.read_csv(fname_data, encoding='utf-16', na_values='NULL', quoting=1)
```

In [ ]:
```
pd_data.id = pd_data['id'].map(lambda x : x.replace('"',''))
```

https://github.com/fortiema/notebooks/blob/master/Pragmatic%20NLP.ipynb

Python Jieba “结巴”中文分词

GitHub, Inc. [US] https://github.com/fxsjy/jieba

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fxsjy / jieba

Watch 761 Star 7,187 Fork 2,252

Code Issues 226 Pull requests 14 Projects 0 Wiki Pulse Graphs

结巴中文分词

485 commits 2 branches 23 releases 31 contributors MIT

Branch: master New pull request Find file Clone or download

fxsjy committed on GitHub Merge pull request #382 from huntzhan/master ... Latest commit 8ba26cf on Aug 5, 2016

extra_dict	update to v0.33	2 years ago
jieba	Bugfix for HMM=False in parallelism.	6 months ago
test	Bugfix for HMM=False in parallelism.	6 months ago
.gitattributes	first commit	4 years ago
.gitignore	update jieba3k	2 years ago
Changelog	version change 0.38	a year ago
LICENSE	add a license file	4 years ago
MANIFEST.in	include Changelog & README.md in the distribution package	4 years ago
README.md	Update README.md	8 months ago

https://github.com/fxsjy/jieba

Python Jieba “结巴”中文分词

```
import jieba
import jieba.posseg as pseg
sentence = "銀行產業正在改變，金融機構欲挖角科技人才"
words = jieba.cut(sentence)
print(sentence)
print(" ".join(words))
wordspos = pseg.cut(sentence)
result = ''
for word, pos in wordspos:
    print(word + ' (' + pos + ')')
    result = result + ' ' + word + '(' + pos + ')'
print(result.strip())
```

import jieba
words = jieba.cut(sentence)

```
import jieba
import jieba.posseg as pseg
sentence = "銀行產業正在改變，金融機構欲挖角科技人才"
words = jieba.cut(sentence)
print(sentence)
print(" ".join(words))    #銀行 產業 正在 改變 ， 金融 機構 欲 挖角 科技人才

wordspos = pseg.cut(sentence)
result = ''
for word, pos in wordspos:
    print(word + ' (' + pos + ')')
    result = result + ' ' + word + '(' + pos + ')'
print(result.strip())    #銀行(n) 產業(n) 正在(t) 改變(v) ，(x) 金融(n) 機構(n) 欲(d) 挖角(n) 科技人才(n)
```

```
銀行產業正在改變，金融機構欲挖角科技人才
銀行 產業 正在 改變 ， 金融 機構 欲 挖角 科技人才
銀行 (n)
產業 (n)
正在 (t)
改變 (v)
， (x)
金融 (n)
機構 (n)
欲 (d)
挖角 (n)
科技人才 (n)
銀行(n) 產業(n) 正在(t) 改變(v) ，(x) 金融(n) 機構(n) 欲(d) 挖角(n) 科技人才(n)
```

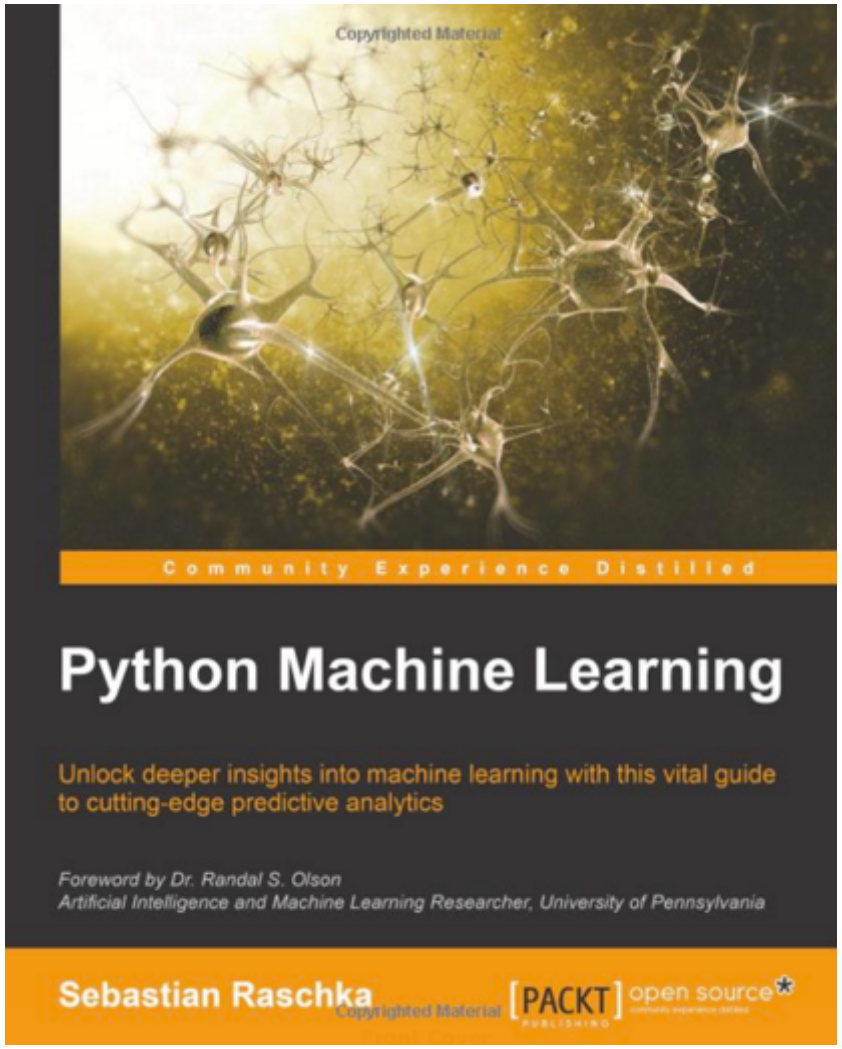
Python Jieba “结巴”中文分词

- https://github.com/fxsjy/jieba
- jieba.set_dictionary('data/dict.txt.big')
  - #/anaconda/lib/python3.5/site-packages/jieba
  - dict.txt (5.4MB)(349,046)
  - dict.txt.big.txt (8.6MB)(584,429)
  - dict.txt.small.txt (1.6MB)(109,750)
  - dict.tw.txt (4.2MB)(308,431)
- https://github.com/ldkrsi/jieba-zh_TW
  - 結巴中文斷詞台灣繁體版本

Sebastian Raschka (2015),

Python Machine Learning,

Packt Publishing

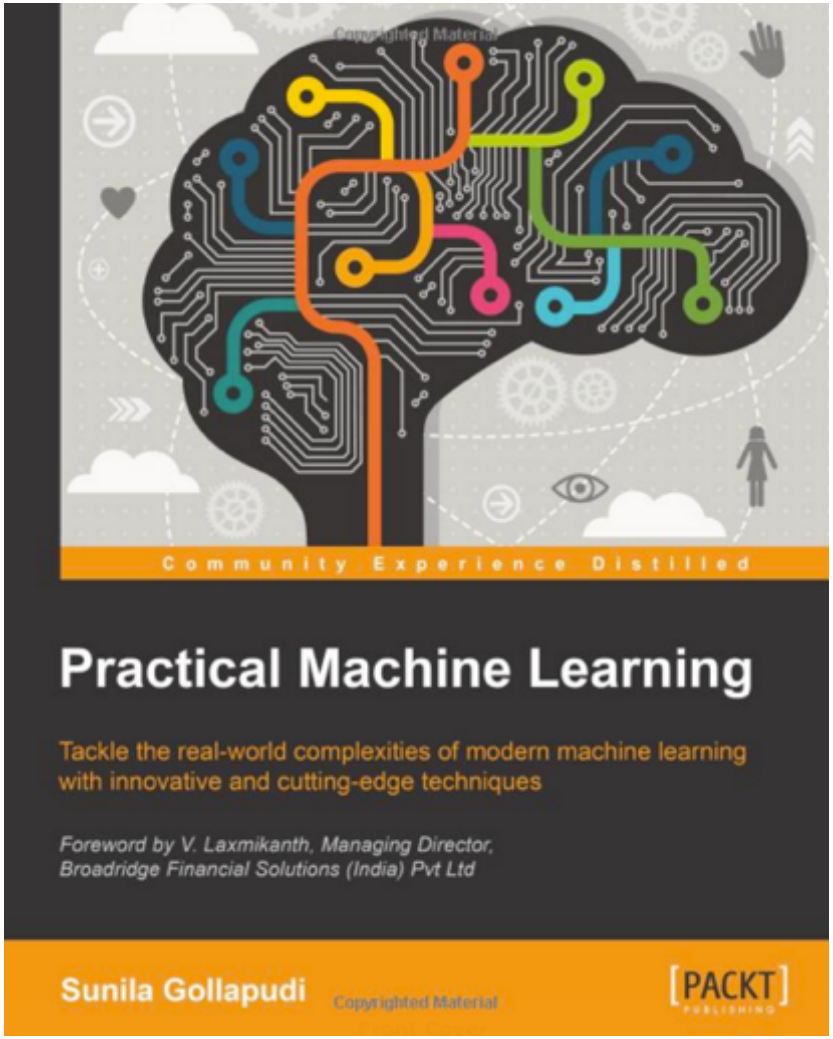


Source: http://www.amazon.com/Python-Machine-Learning-Sebastian-Raschka/dp/1783555130

Sunila Gollapudi (2016),

Practical Machine Learning,

Packt Publishing



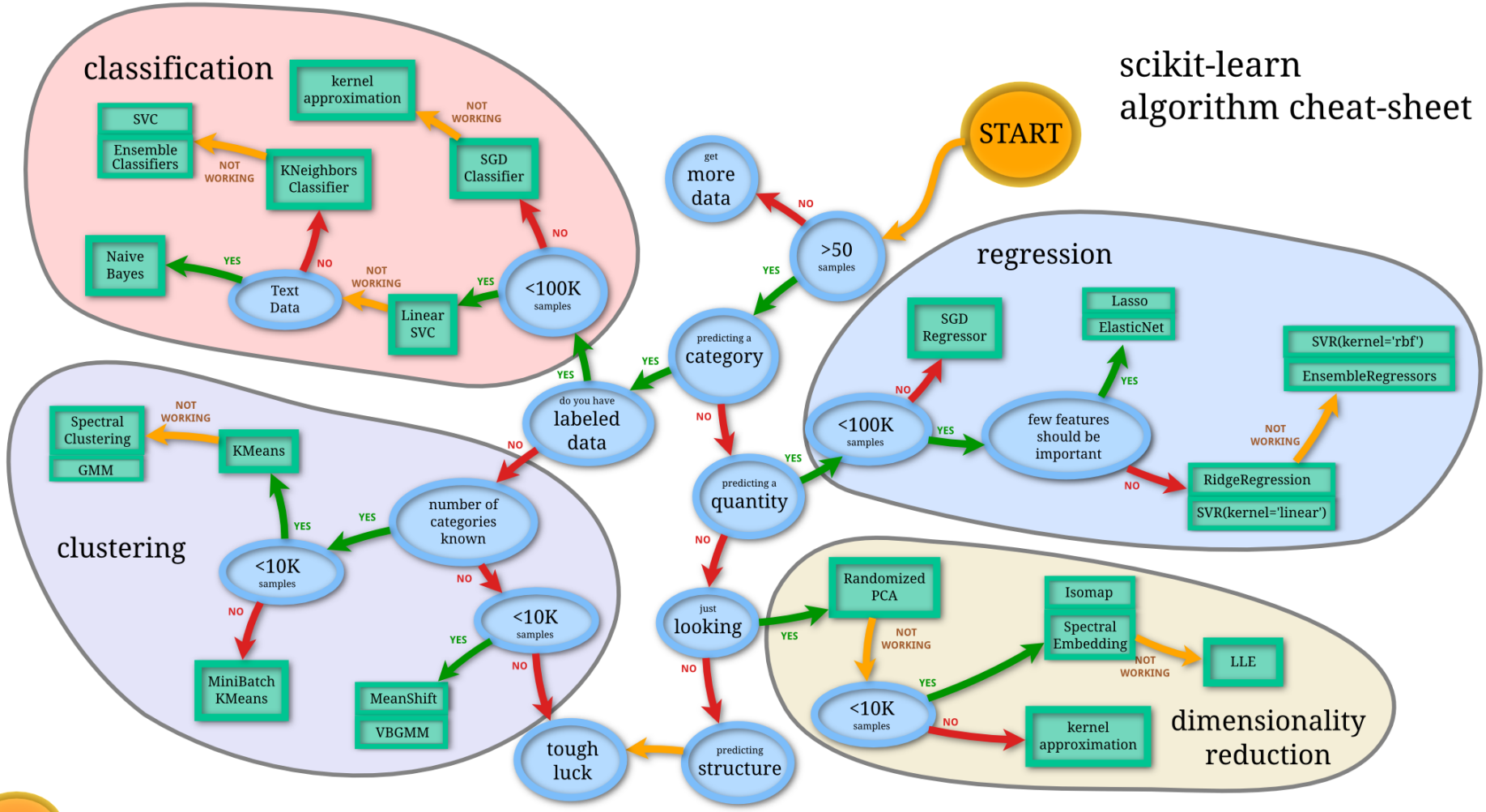
Source: http://www.amazon.com/Practical-Machine-Learning-Sunila-Gollapudi/dp/178439968X

Machine Learning Models

- Deep Learning
- Kernel
- Association rules
- Ensemble
- Decision tree
- Dimensionality reduction
- Clustering
- Regression Analysis
- Bayesian
- Instance based

Source: Sunila Gollapudi (2016), Practical Machine Learning, Packt Publishing

Scikit-learn Machine Learning



Source: http://scikit-learn.org/stable/tutorial/machine_learning_map/

AI and Deep Machine Learning

- Artificial Intelligence (AI)
  - AI is the broadest term, applying to any technique that enables computers to mimic human intelligence, using logic, if-then rules, decision trees, and machine learning (including deep learning).
- Machine Learning (ML)
  - The subset of AI that includes abstruse statistical techniques that enable machines to improve at tasks with experience. The category includes deep learning.
- Deep Learning (DL)
  - The subset of machine learning composed of algorithms that permit software to train itself to perform tasks, like speech and image recognition, by exposing multilayered neural networks to vast amounts of data.

Source: http://fortune.com/ai-artificial-intelligence-deep-machine-learning/

Summary

- Differentiate between text mining, Web mining and data mining
- Text mining
- Web mining
  - Web content mining
  - Web structure mining
  - Web usage mining
- Natural Language Processing (NLP)
- Natural Language Processing with NLTK in Python

References

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