Tamkang University
淡江大學

商業智慧實務
Practices of Business Intelligence

Tamkang University

自然語言處理
(Natural Language Processing)

1071BI11
MI4 (M2084) (2888)
Wed, 7, 8 (14:10-16:00) (B217)

Min-Yuh Day
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Assistant Professor
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2018-12-12

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容(Subject/Topics)
1	2018/09/12	商業智慧實務課程介紹 (Course Orientation for Practices of Business Intelligence)
2	2018/09/19	商業智慧、分析與資料科學 (Business Intelligence, Analytics, and Data Science)
3	2018/09/26	人工智慧、大數據與雲端運算 (ABC: AI, Big Data, and Cloud Computing)
4	2018/10/03	描述性分析I：數據的性質、統計模型與可視化 (Descriptive Analytics I: Nature of Data, Statistical Modeling, and Visualization)
5	2018/10/10	國慶紀念日 (放假一天) (National Day) (Day off)
6	2018/10/17	描述性分析II：商業智慧與資料倉儲 (Descriptive Analytics II: Business Intelligence and Data Warehousing)

課程大綱 (Syllabus)

週次 (Week)　日期 (Date)　內容(Subject/Topics)

7　2018/10/24　預測性分析I：資料探勘流程、方法與演算法
(Predictive Analytics I: Data Mining Process, Methods, and Algorithms)

8　2018/10/31　預測性分析II：文本、網路與社群媒體分析
(Predictive Analytics II: Text, Web, and Social Media Analytics)

9　2018/11/07　期中報告 (Midterm Project Report)

10　2018/11/14　期中考試 (Midterm Exam)

11　2018/11/21　處方性分析：最佳化與模擬
(Prescriptive Analytics: Optimization and Simulation)

12　2018/11/28　社會網絡分析
(Social Network Analysis)

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容(Subject/Topics)
13	2018/12/05	機器學習與深度學習 (Machine Learning and Deep Learning)
14	2018/12/12	自然語言處理 (Natural Language Processing)
15	2018/12/19	AI交談機器人與對話式商務 (AI Chatbots and Conversational Commerce)
16	2018/12/26	商業分析的未來趨勢、隱私與管理考量 (Future Trends, Privacy and Managerial Considerations in Analytics)
17	2019/01/02	期末報告 (Final Project Presentation)
18	2019/01/09	期末考試 (Final Exam)

Business Intelligence (BI)

1. Introduction to BI and Data Science
2. Descriptive Analytics
3. Predictive Analytics
4. Prescriptive Analytics
5. Big Data Analytics
6. Future Trends

Natural Language Processing (NLP)

Outline

- Natural Language Processing (NLP)
- NLP Libraries and Tools
- NLP and Text Analytics with Python

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**.

+Positive Opinion

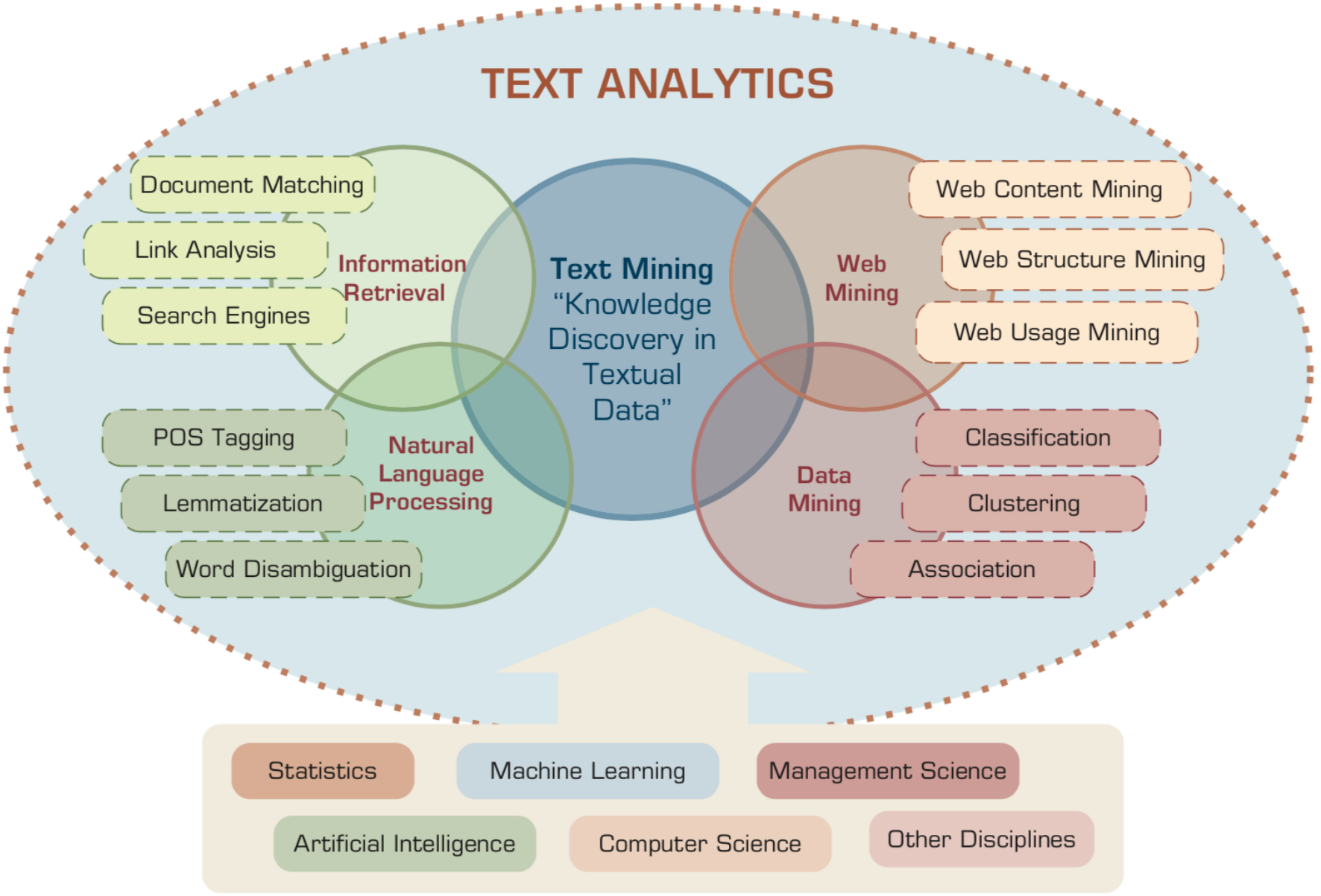
(4) The voice quality was **clear** too.

(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

Text Analytics and Text Mining

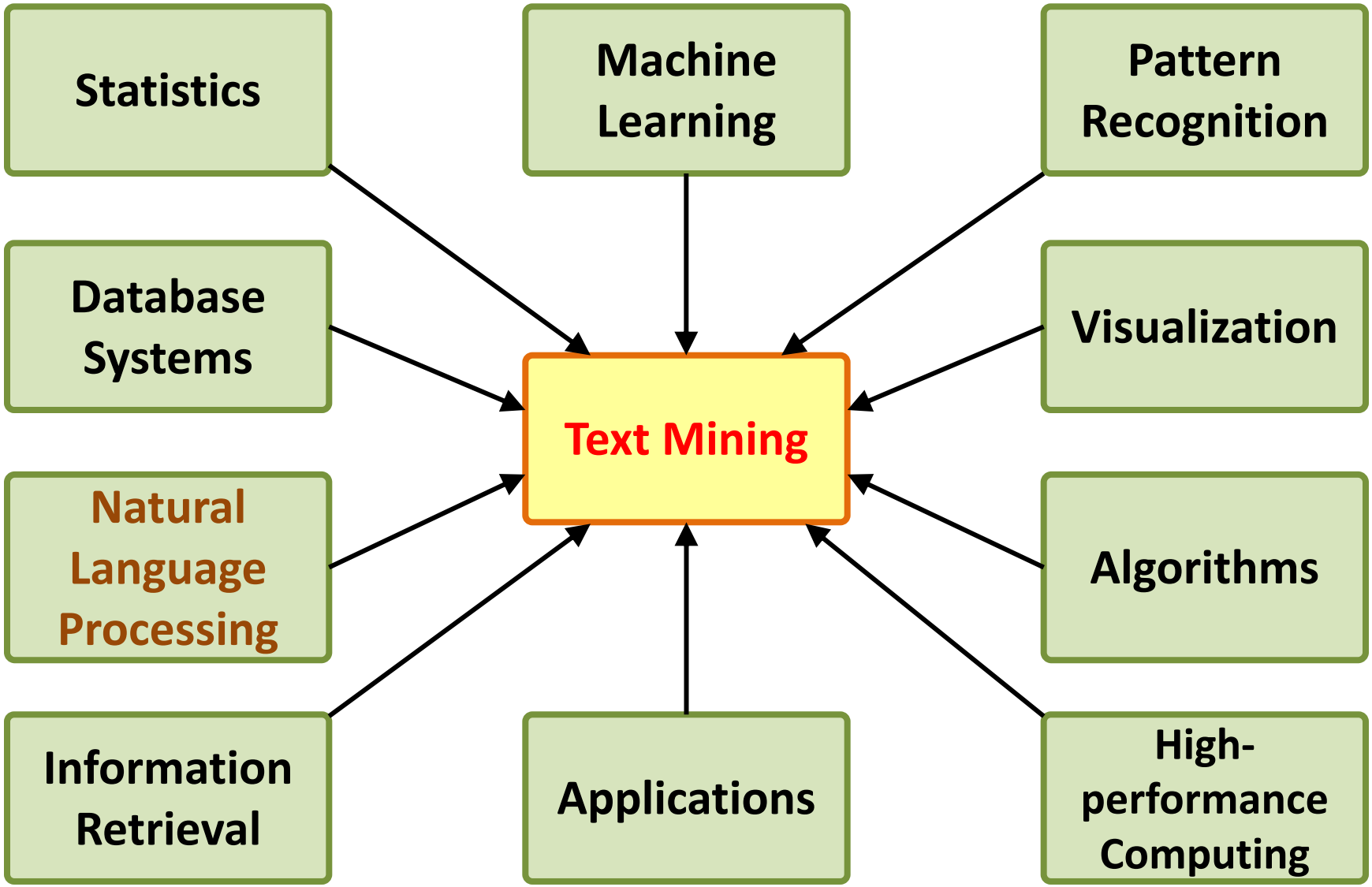


Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Natural Language Processing (NLP)

- **Natural language processing (NLP)** is an important component of **text mining** and is a subfield of **artificial intelligence** and **computational linguistics**.

Text Mining Technologies



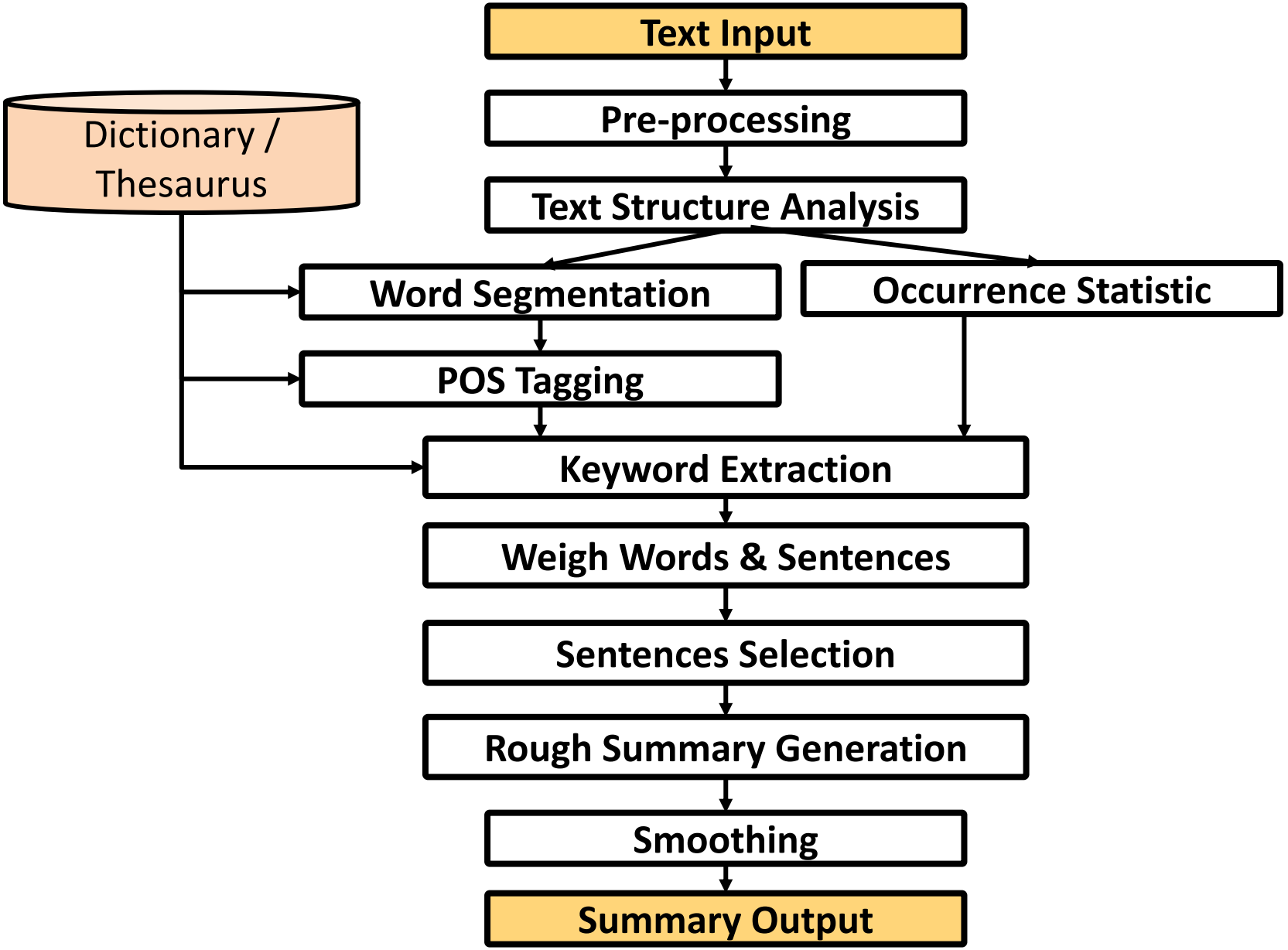
Natural Language Processing (NLP) and Text Mining

- **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

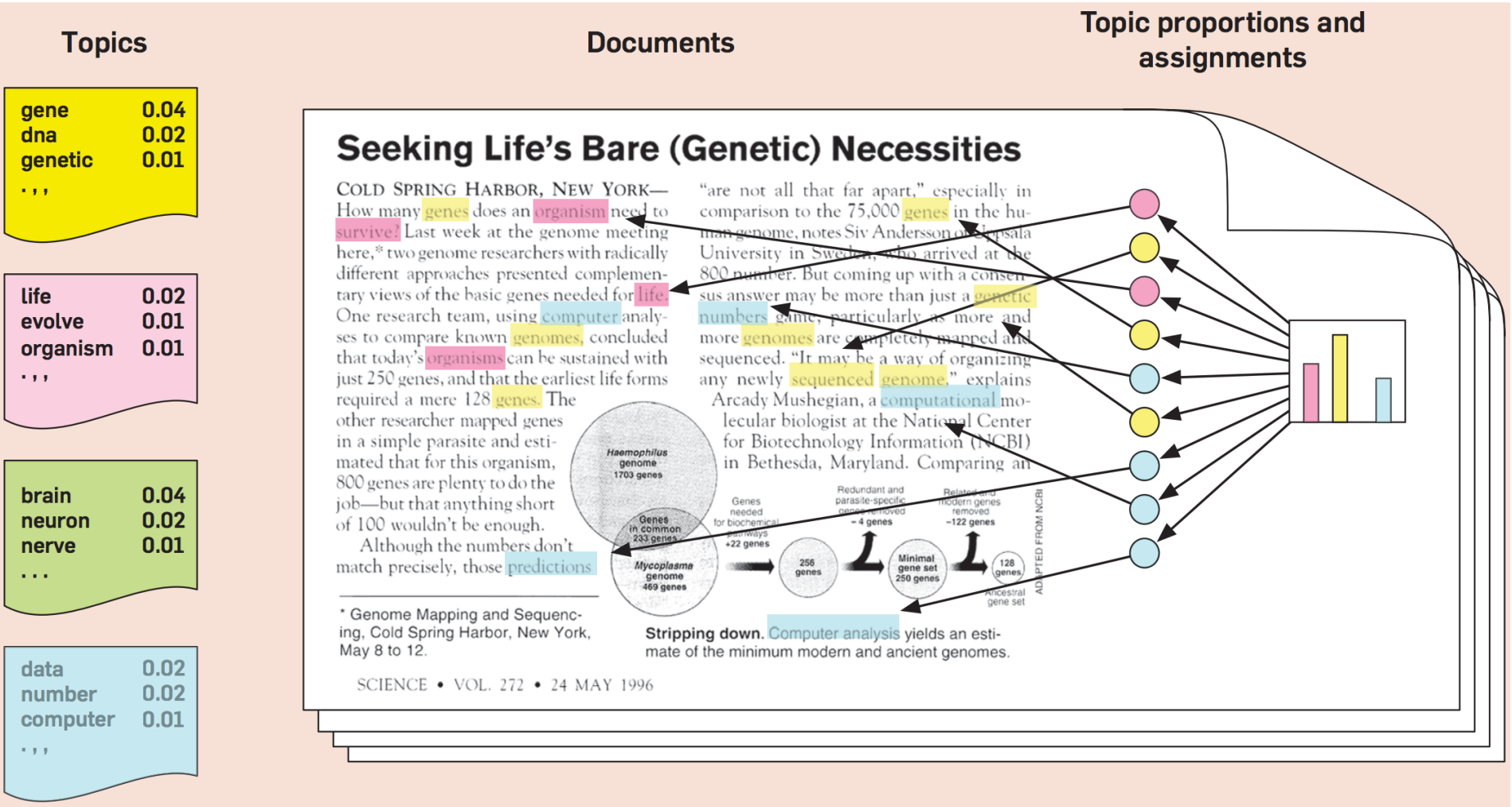
Source: Nitin Hardeniya (2015), NLTK Essentials, Packt Publishing; Florian Leitner (2015), Text mining - from Bayes rule to dependency parsing

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



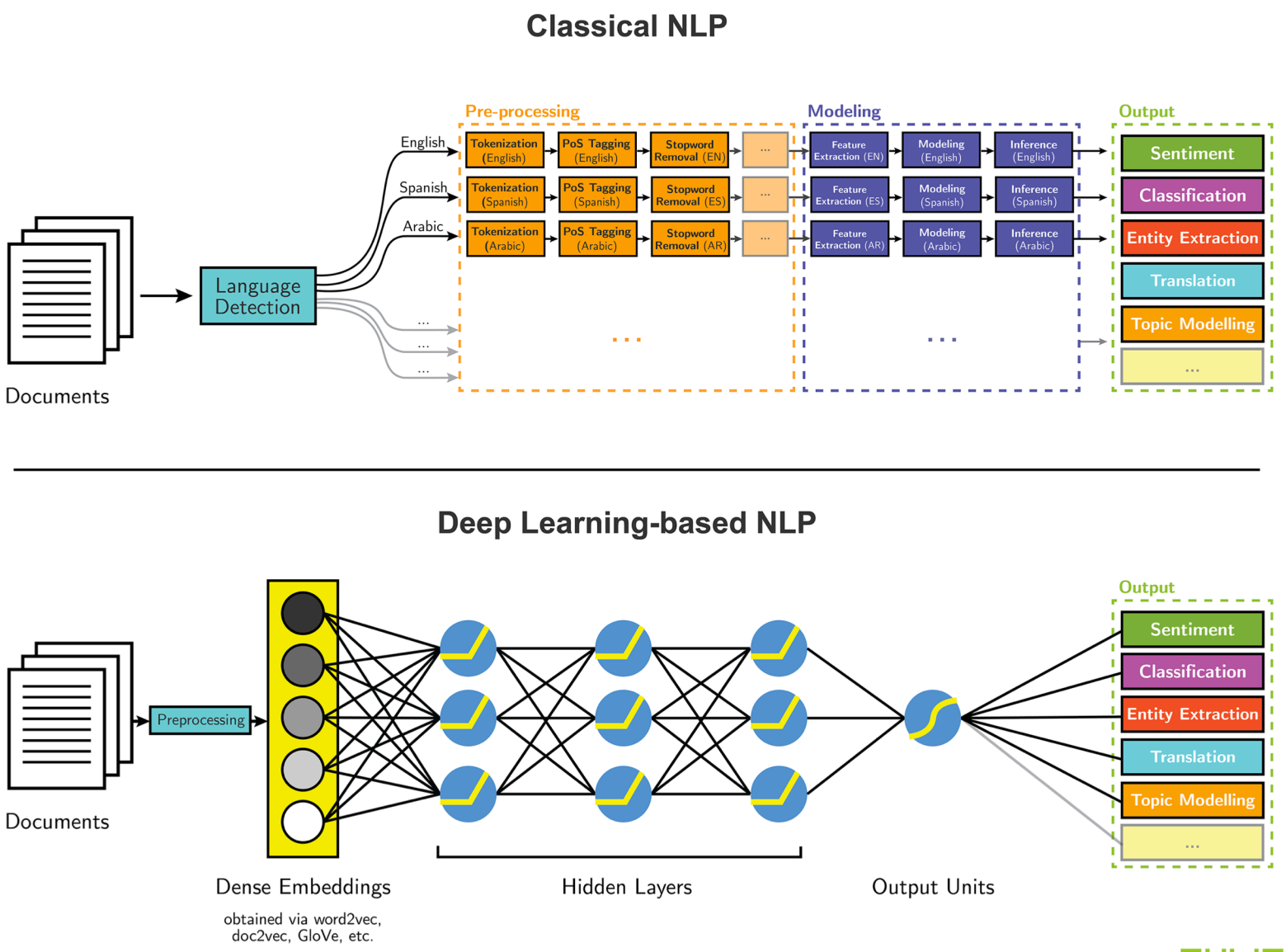
Natural Language Processing (NLP)

- Part-of-speech tagging
- Text segmentation
- Word sense disambiguation
- Syntactic ambiguity
- Imperfect or irregular input
- Speech acts

NLP Tasks

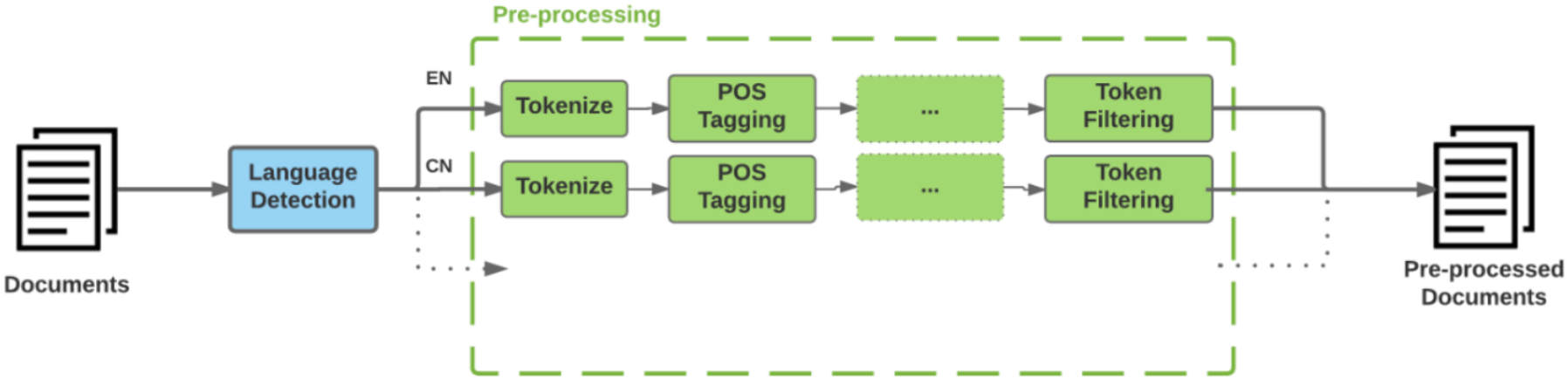
- Question answering
- Automatic summarization
- Natural language generation
- Natural language understanding
- Machine translation
- Foreign language reading
- Foreign language writing.
- Speech recognition
- Text-to-speech
- Text proofing
- Optical character recognition

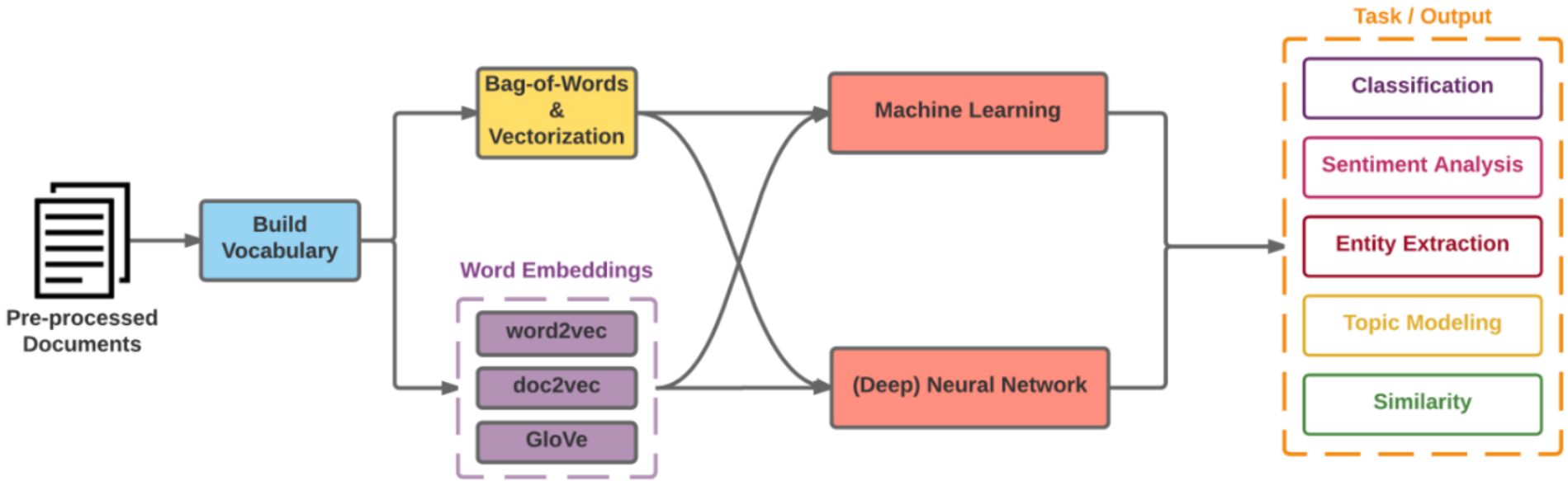
NLP



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

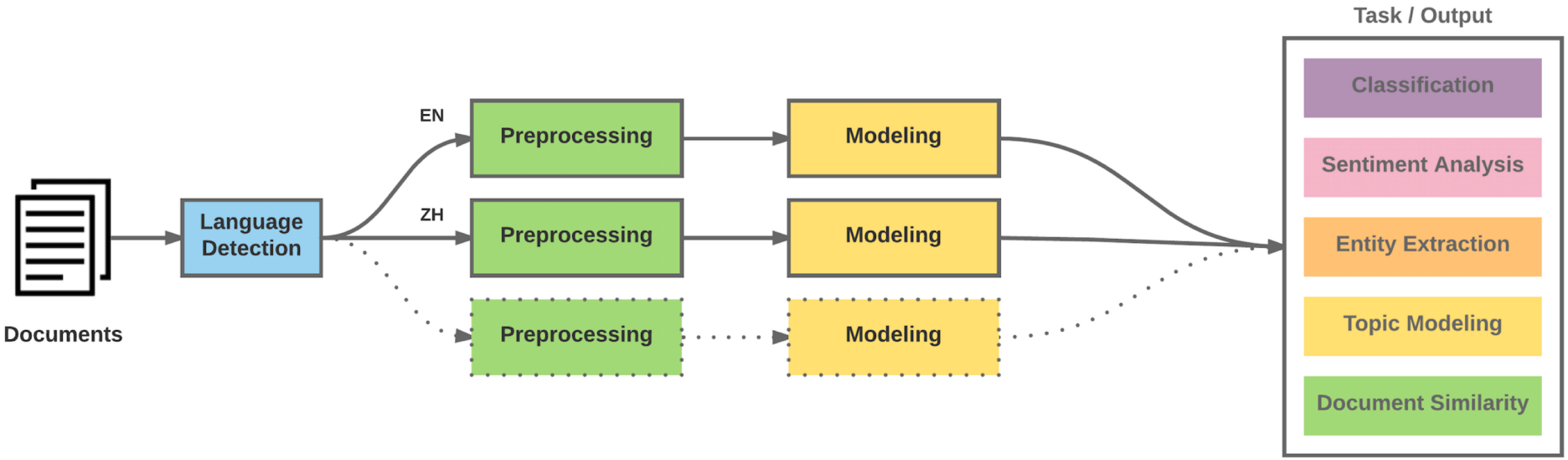
Modern NLP Pipeline





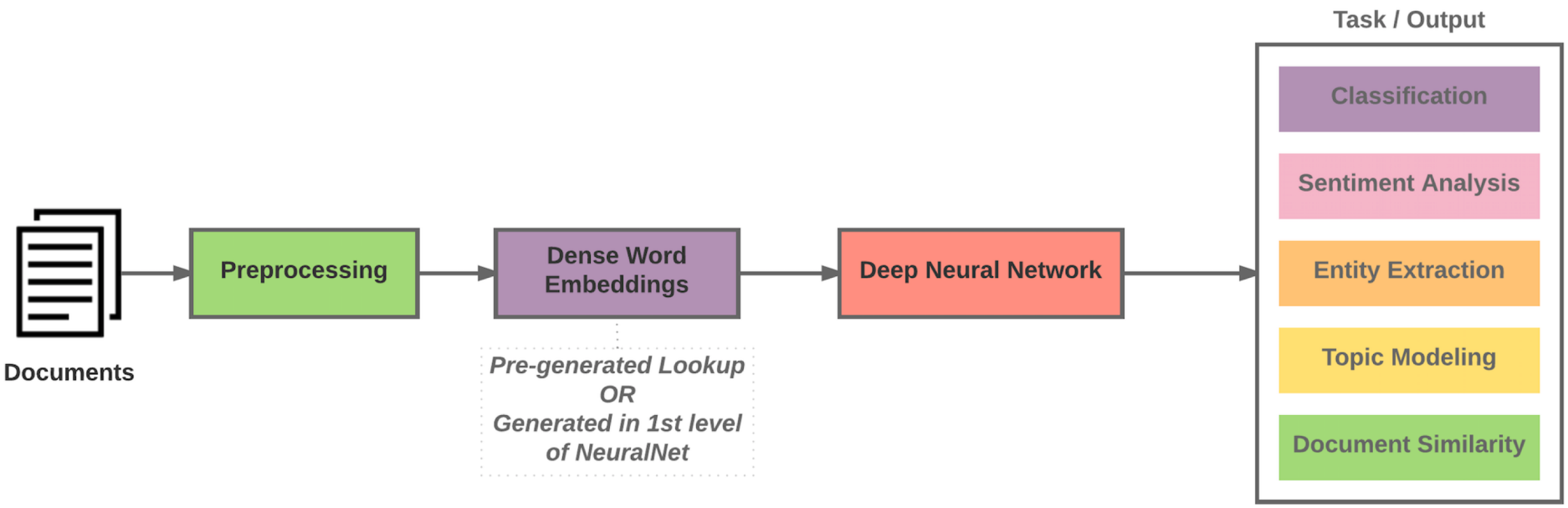
Source: https://github.com/fortiema/talks/blob/master/opendata2016sh/pragmatic-nlp-opendata2016sh.pdf

Modern NLP Pipeline



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

Deep Learning NLP



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

BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding

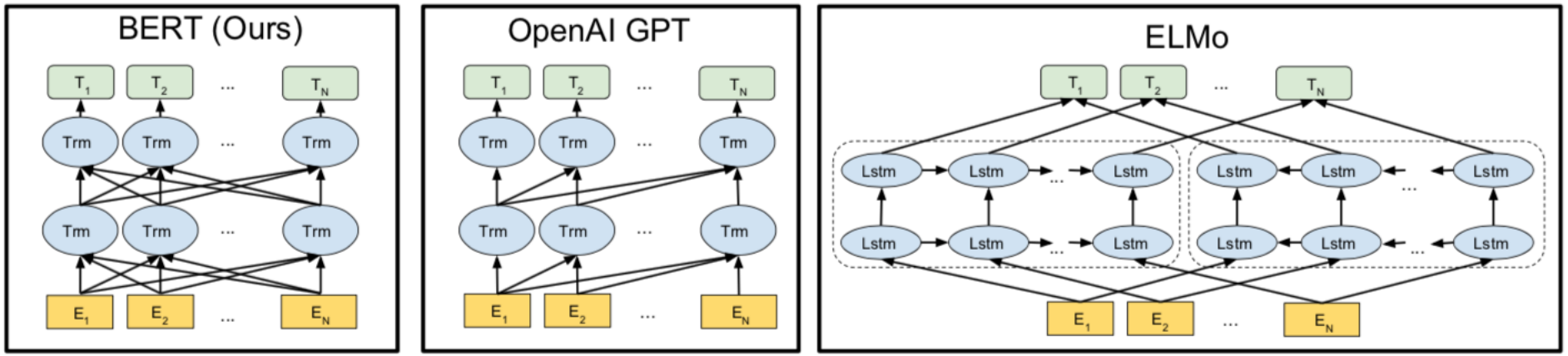
BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding

Jacob Devlin **Ming-Wei Chang** **Kenton Lee** **Kristina Toutanova**
Google AI Language
{jacobdevlin,mingweichang,kentonl,kristout}@google.com

Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018).
"BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding." arXiv preprint arXiv:1810.04805

BERT

Bidirectional Encoder Representations from Transformers

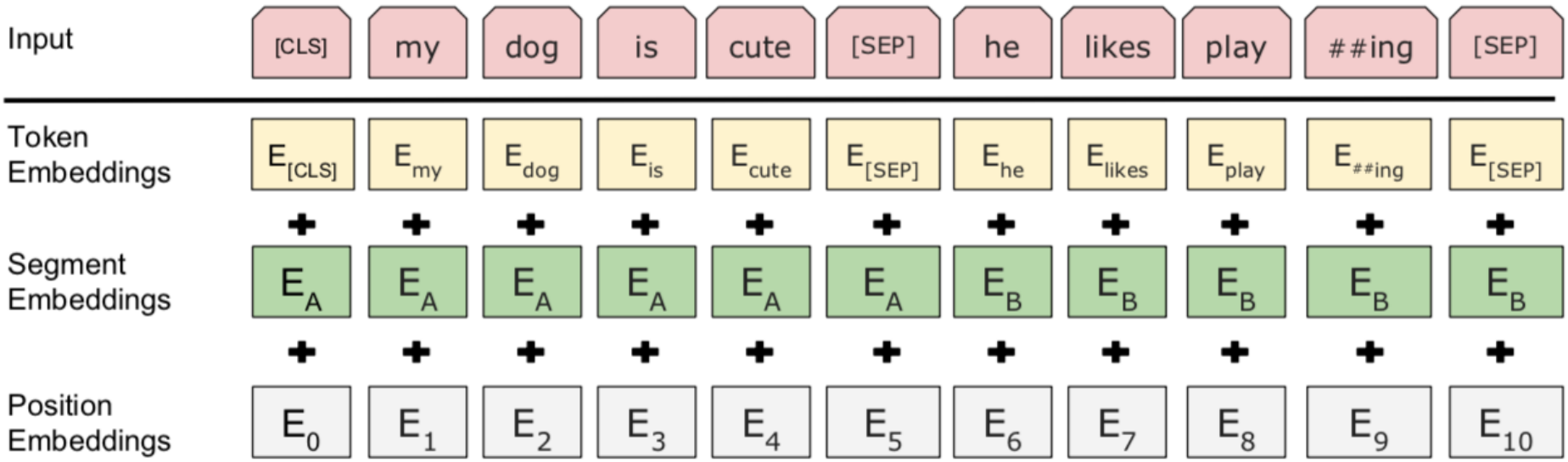


Pre-training model architectures

BERT uses a bidirectional Transformer.
OpenAI GPT uses a left-to-right Transformer.
ELMo uses the concatenation of independently trained left-to-right and right- to-left LSTM to generate features for downstream tasks.
Among three, only BERT representations are jointly conditioned on both left and right context in all layers.

Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018).
"BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding." arXiv preprint arXiv:1810.04805

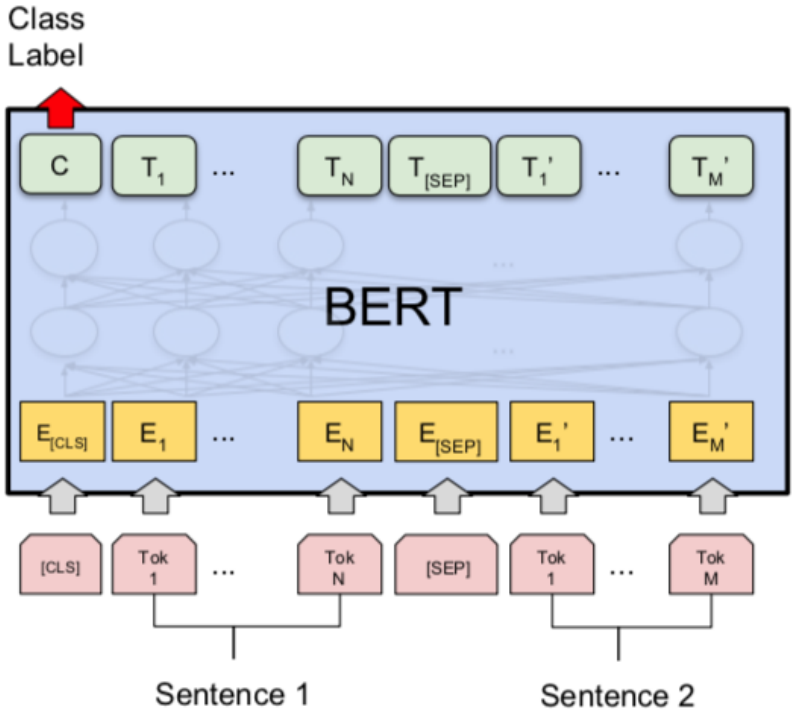
BERT input representation



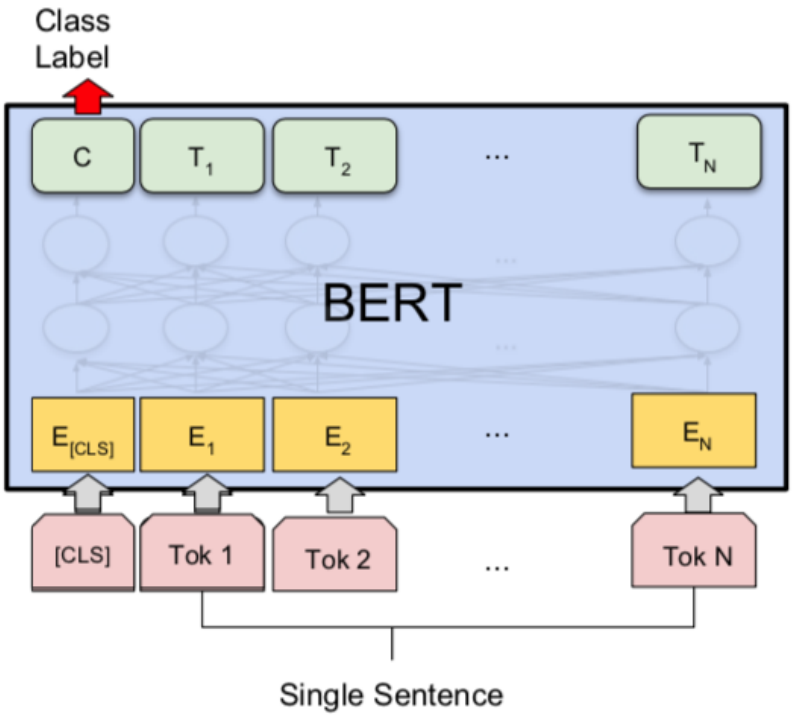
The input embeddings is the sum of the token embeddings, the segmentation embeddings and the position embeddings.

Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018).
"BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding." arXiv preprint arXiv:1810.04805

BERT Sequence-level tasks



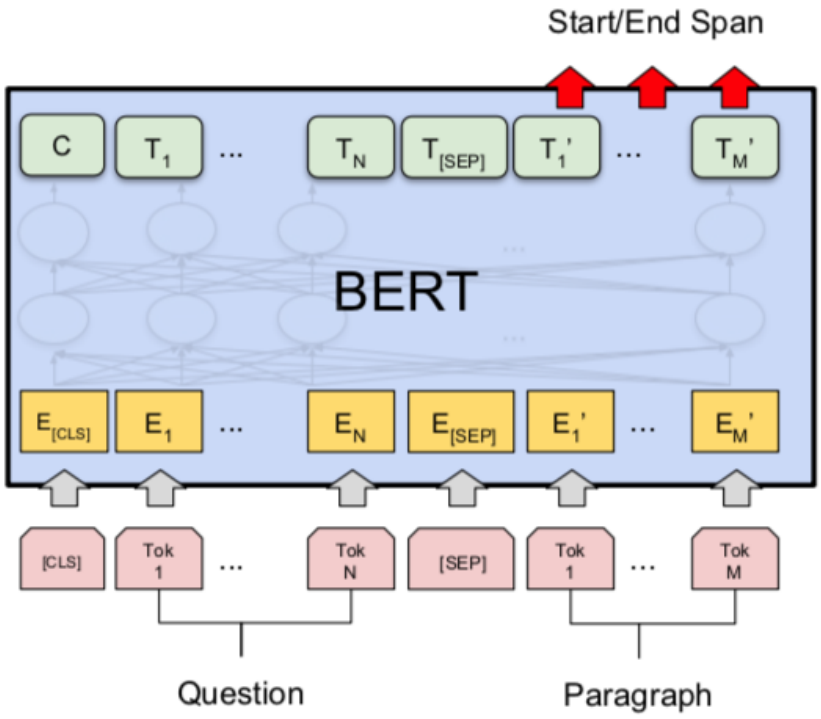
(a) Sentence Pair Classification Tasks: MNLI, QQP, QNLI, STS-B, MRPC, RTE, SWAG



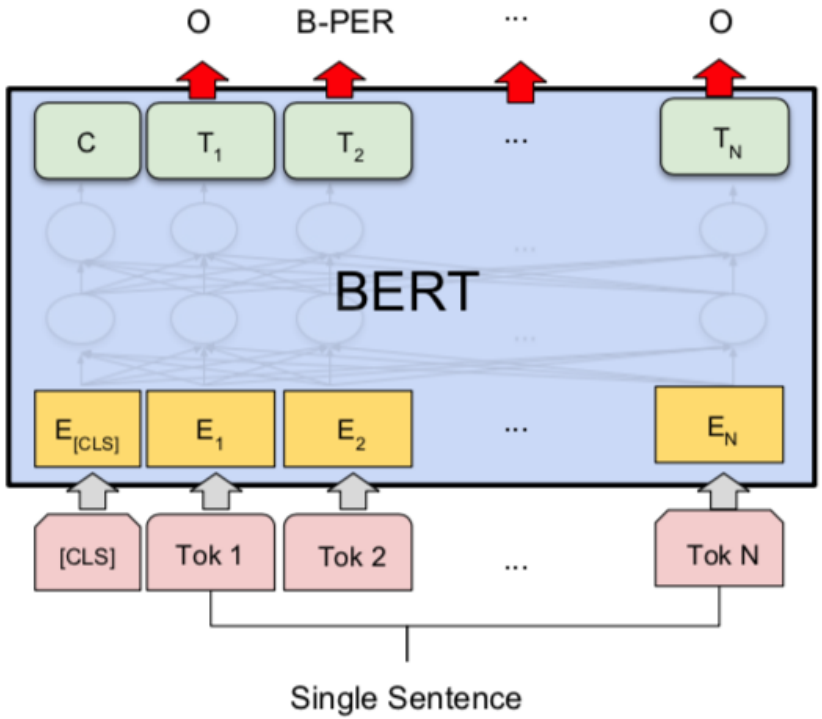
(b) Single Sentence Classification Tasks: SST-2, CoLA

Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018). "BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding." arXiv preprint arXiv:1810.04805

BERT Token-level tasks



(c) Question Answering Tasks: SQuAD v1.1



(d) Single Sentence Tagging Tasks: CoNLL-2003 NER

Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018). "BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding." arXiv preprint arXiv:1810.04805

General Language Understanding Evaluation (GLUE) benchmark

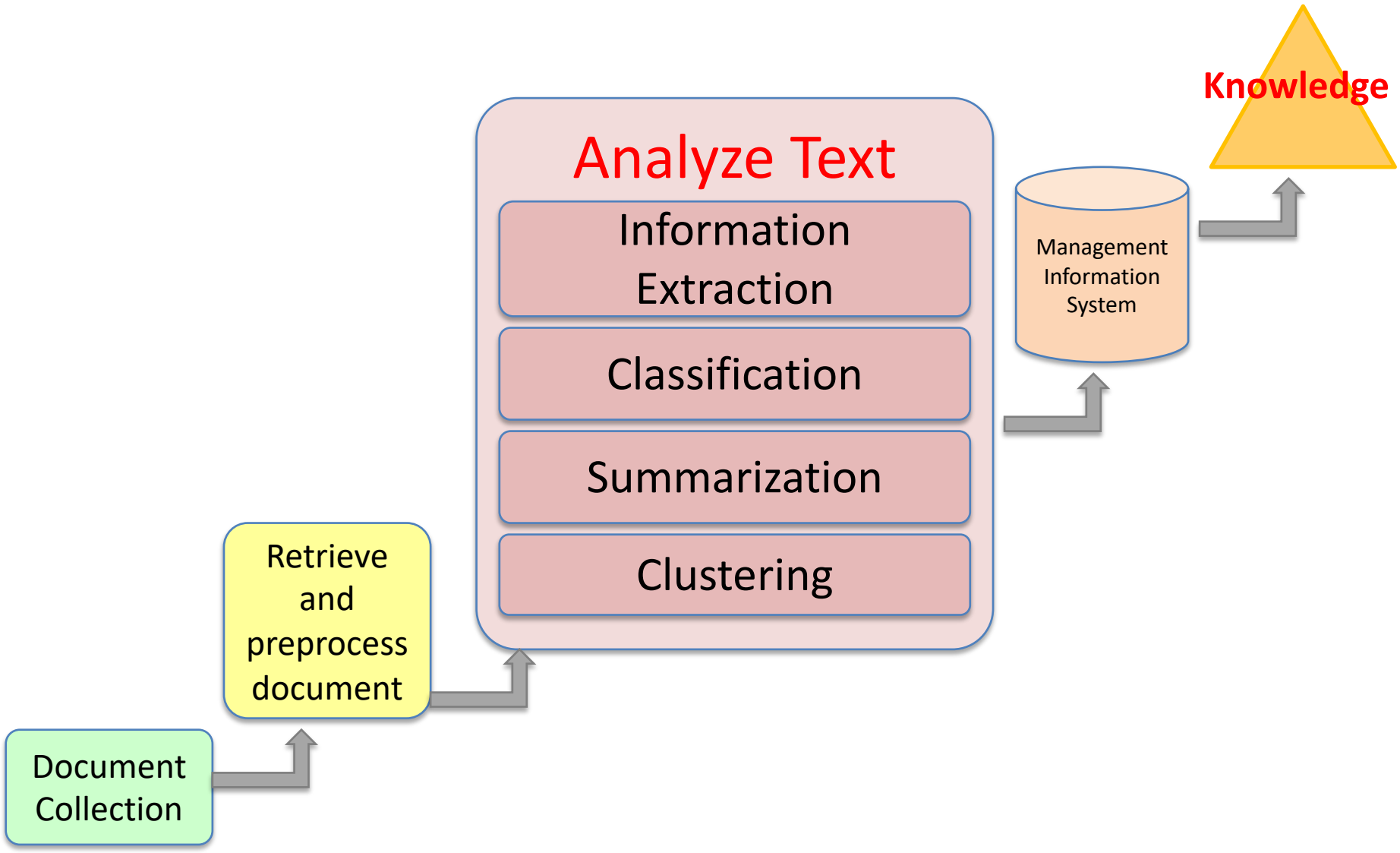
GLUE Test results

System	MNLI-(m/mm) 392k	QQP 363k	QNLI 108k	SST-2 67k	CoLA 8.5k	STS-B 5.7k	MRPC 3.5k	RTE 2.5k	**Average** -
Pre-OpenAI SOTA	80.6/80.1	66.1	82.3	93.2	35.0	81.0	86.0	61.7	74.0
BiLSTM+ELMo+Attn	76.4/76.1	64.8	79.9	90.4	36.0	73.3	84.9	56.8	71.0
OpenAI GPT	82.1/81.4	70.3	88.1	91.3	45.4	80.0	82.3	56.0	75.2
$BERT_{BASE}$	84.6/83.4	71.2	90.1	93.5	52.1	85.8	88.9	66.4	79.6
$BERT_{LARGE}$	**86.7/85.9**	**72.1**	**91.1**	**94.9**	**60.5**	**86.5**	**89.3**	**70.1**	**81.9**

MNLI: Multi-Genre Natural Language Inference
QQP: Quora Question Pairs
QNLI: Question Natural Language Inference
SST-2: The Stanford Sentiment Treebank
CoLA: The Corpus of Linguistic Acceptability
STS-B:The Semantic Textual Similarity Benchmark
MRPC: Microsoft Research Paraphrase Corpus
RTE: Recognizing Textual Entailment

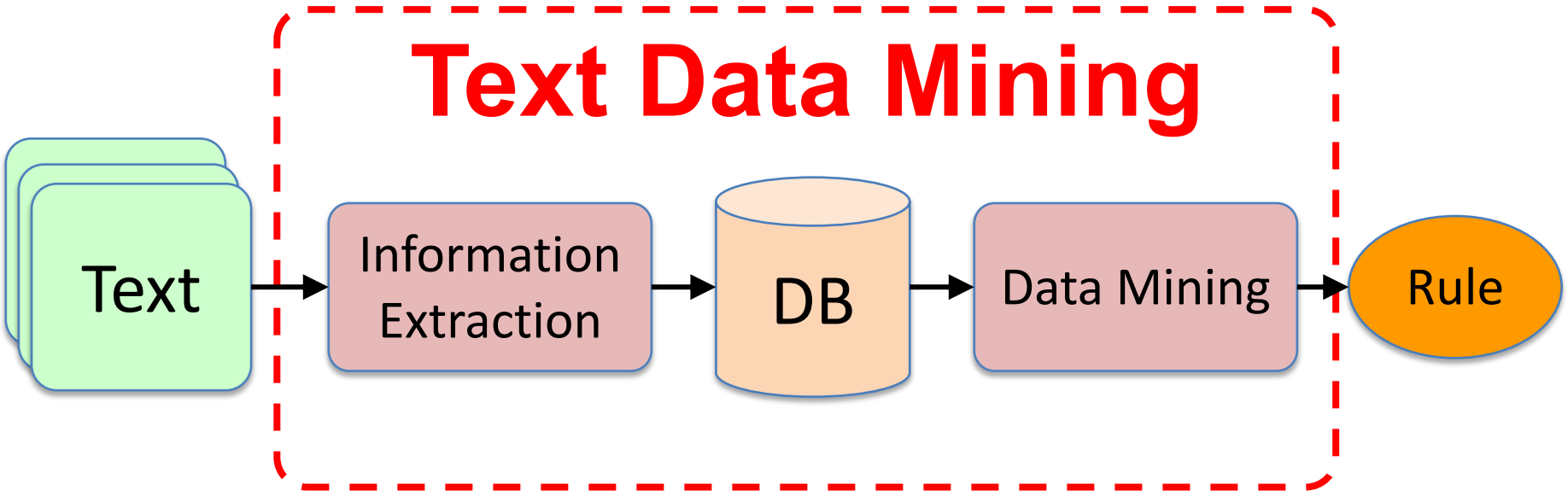
Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018).
"BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding." arXiv preprint arXiv:1810.04805

An example of Text Mining



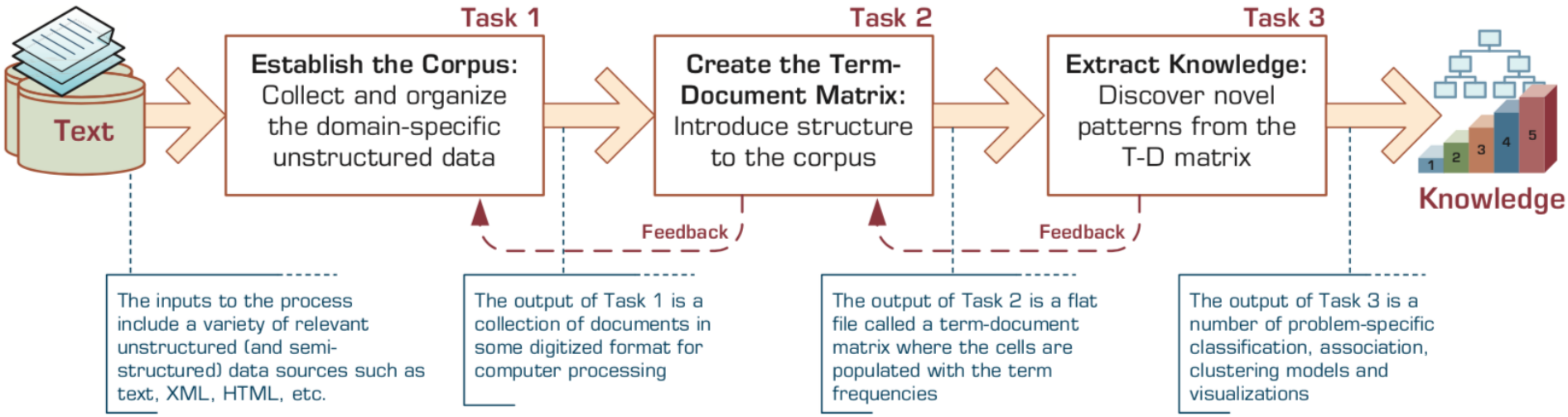
Source: Vishal Gupta and Gurpreet S. Lehal (2009), "A survey of text mining techniques and applications," Journal of emerging technologies in web intelligence, vol. 1, no. 1, pp. 60-76.

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.

The Three-Step/Task Text Mining Process



Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Term–Document Matrix

Documents \ Terms	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: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

NLP Libraries and Tools

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

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.)

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

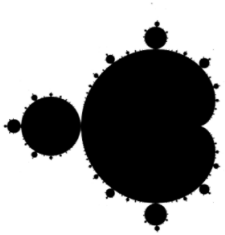
spaCy

https://spacy.io/

gensim

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

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If you find TextBlob useful,

TextBlob: Simplified Text Processing

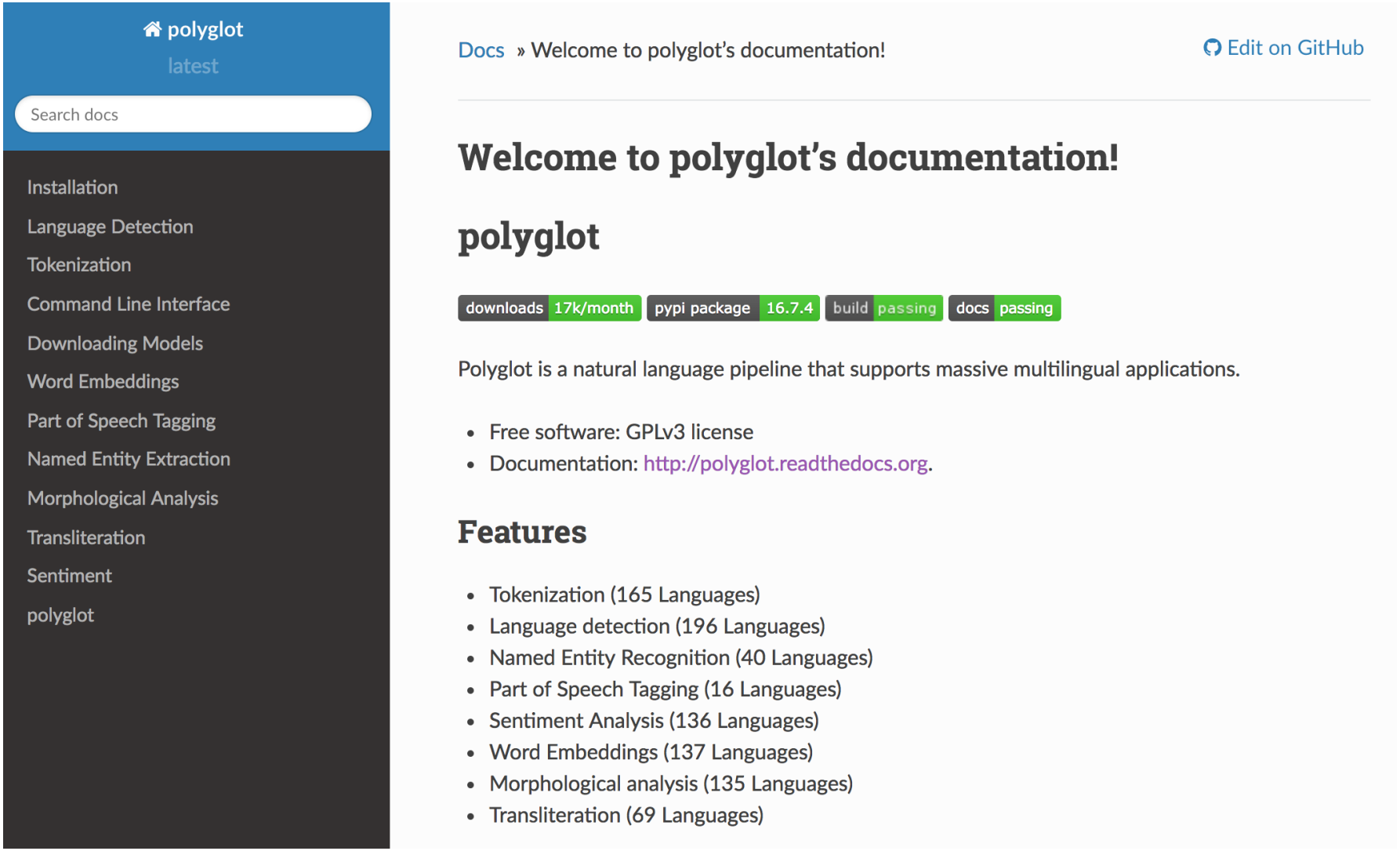
Release v0.12.0. (Changelog)

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

Polyglot



https://polyglot.readthedocs.io/

scikit-learn

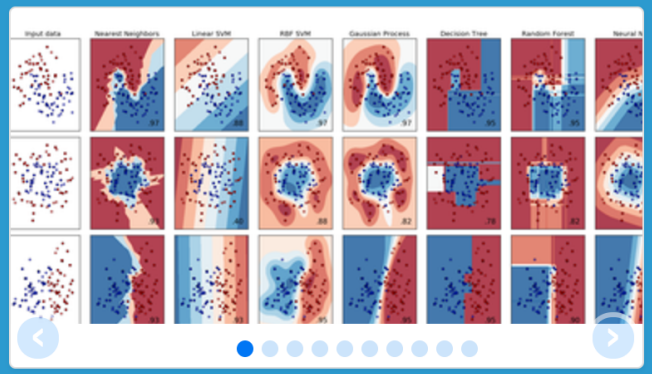
scikit learn

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/

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

The Stanford Natural Language Processing Group

home · people · teaching · research · publications · software · events · local

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.

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.

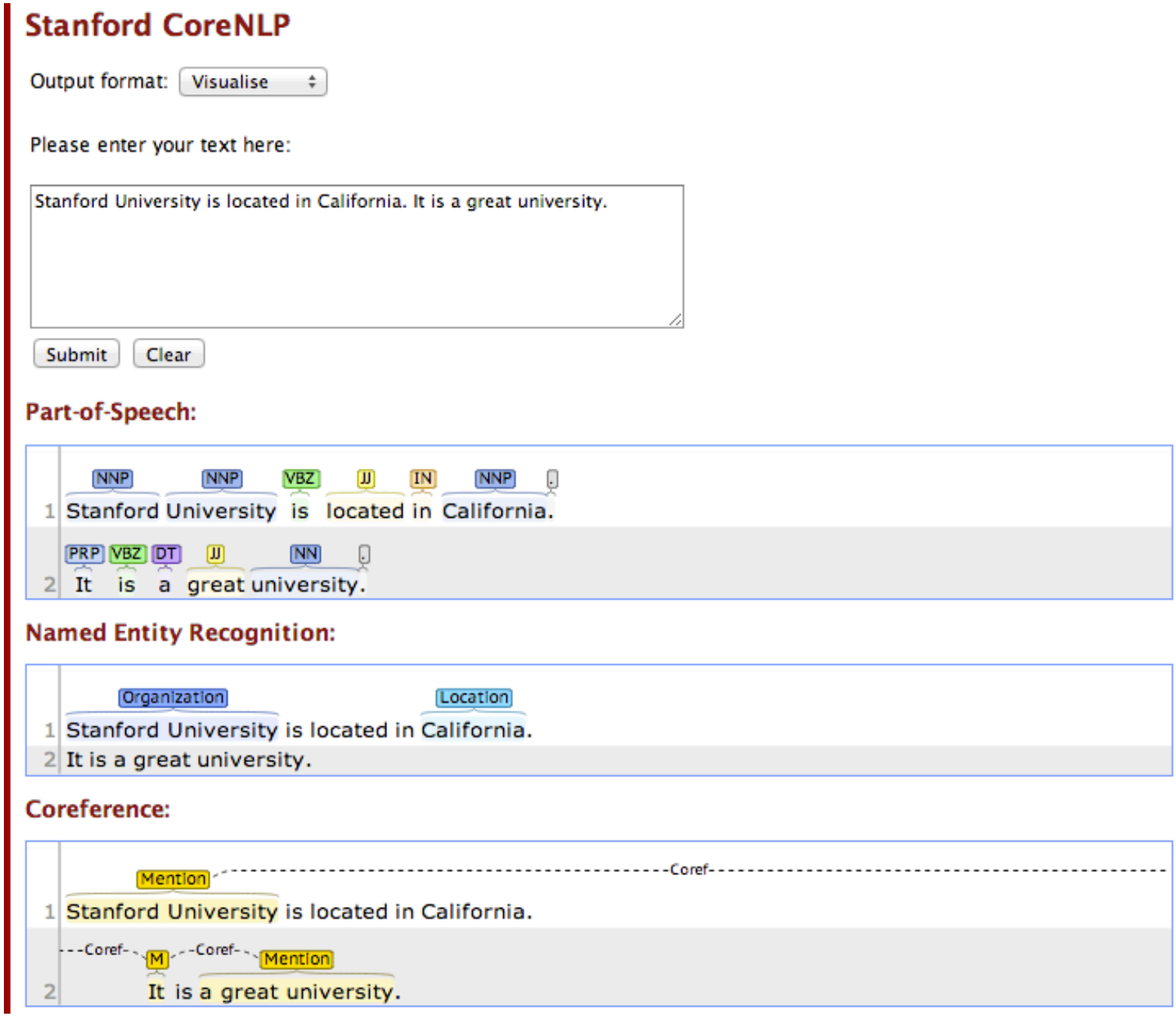
Stanford CoreNLP
: An integrated suite of natural language processing tools for English and (mainland) Chinese in Java, including tokenization, part-of-speech tagging, named entity recognition, parsing, and coreference. See also: Stanford Deterministic Coreference Resolution, and the online CoreNLP demo,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

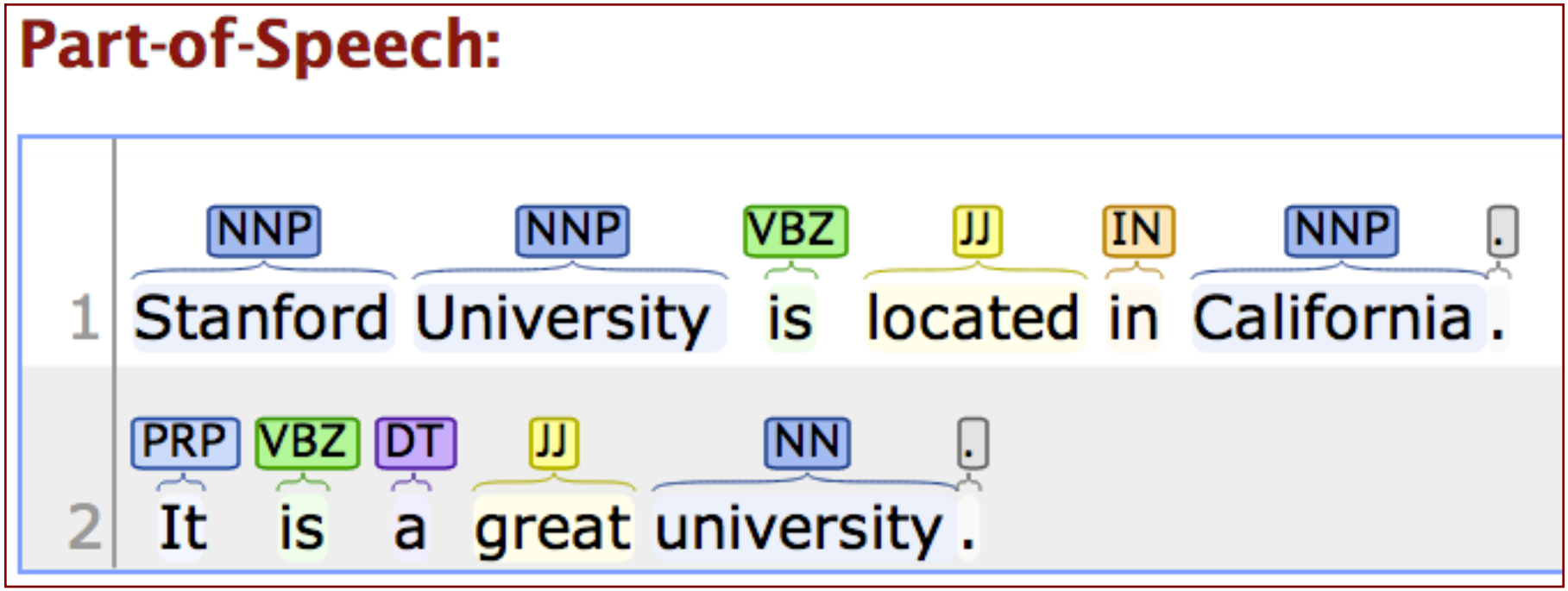
Stanford CoreNLP http://nlp.stanford.edu:8080/corenlp/process



Stanford CoreNLP

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

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



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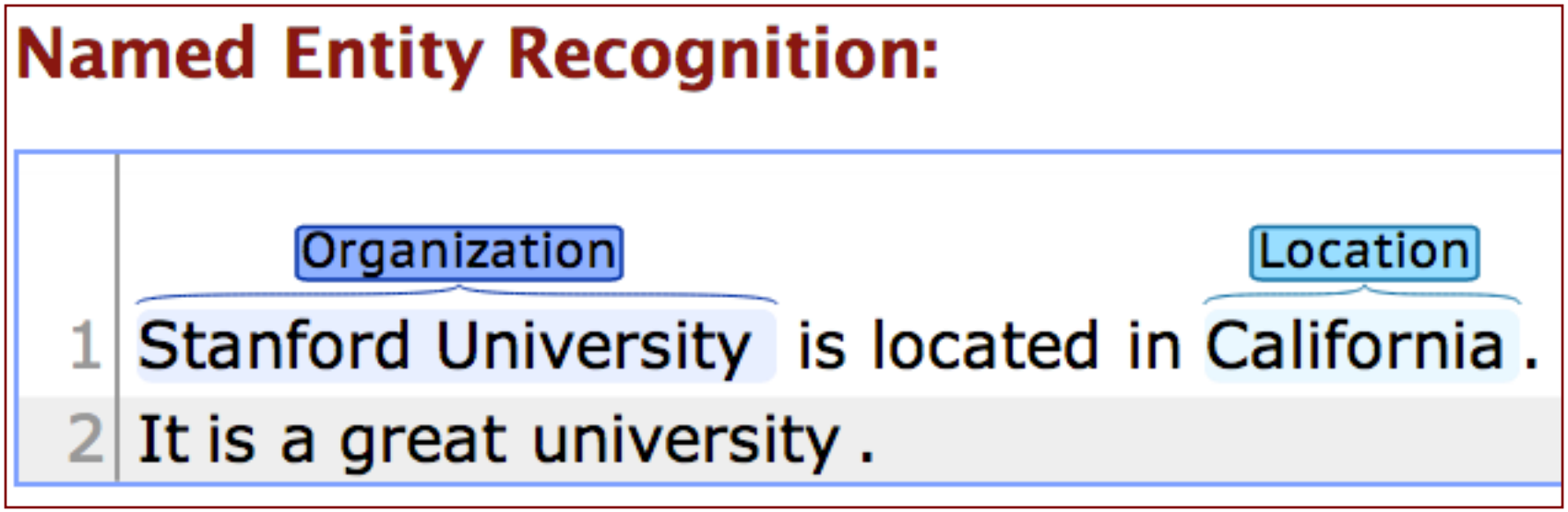

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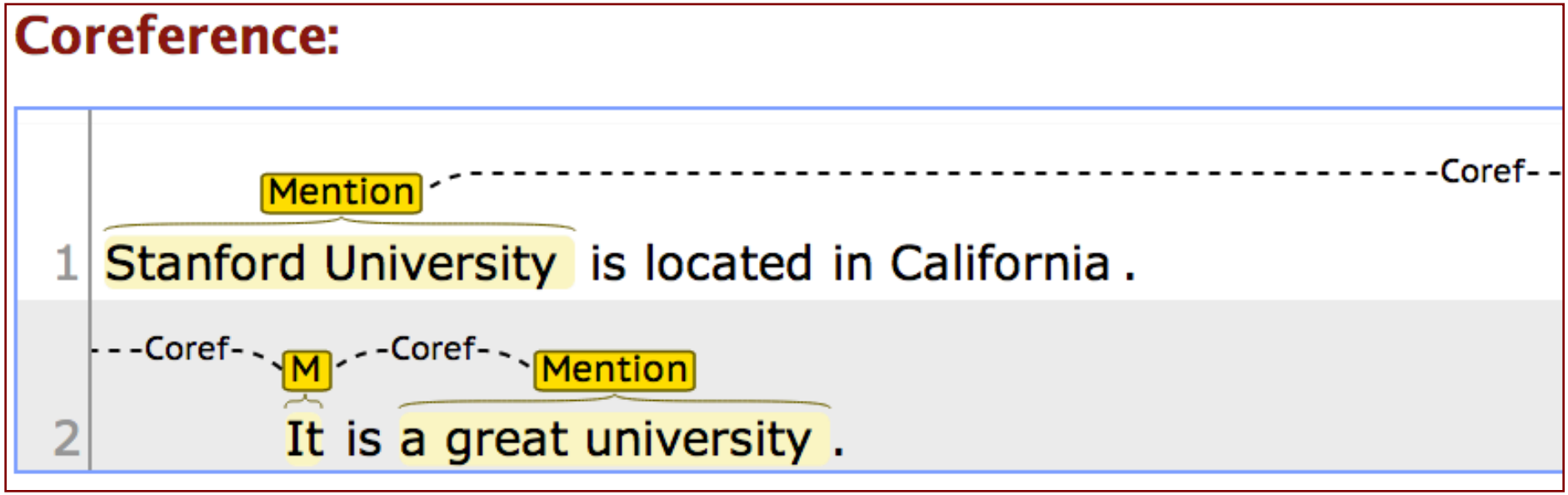
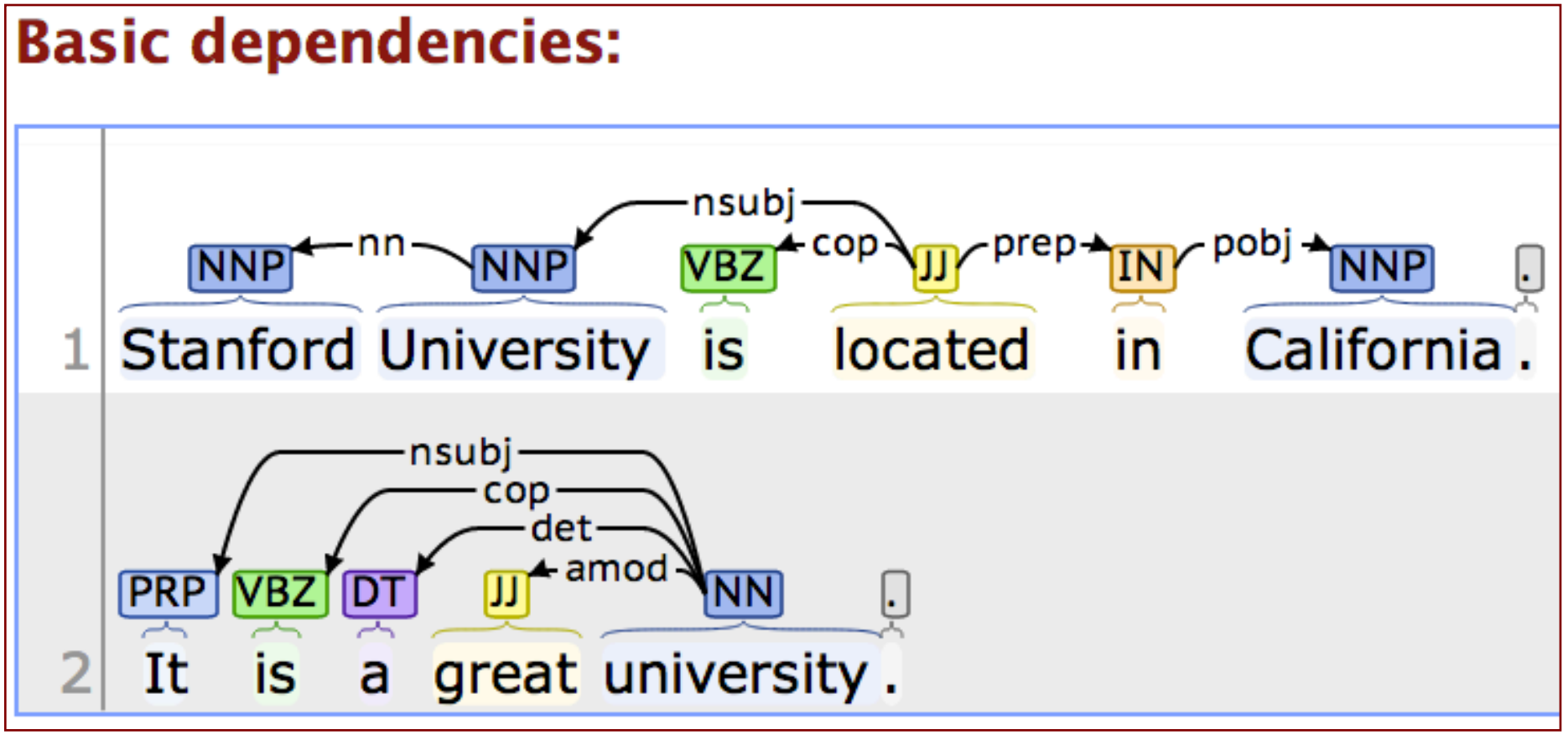
Stanford University is located in California.
It is a great university.



Stanford CoreNLP

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

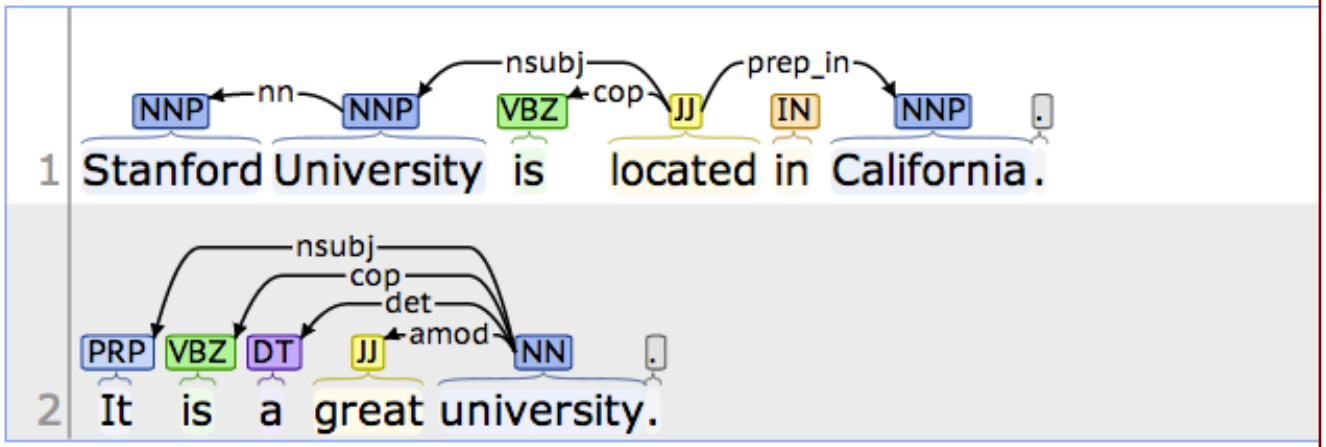
Stanford University is located in California.
It is a great university.



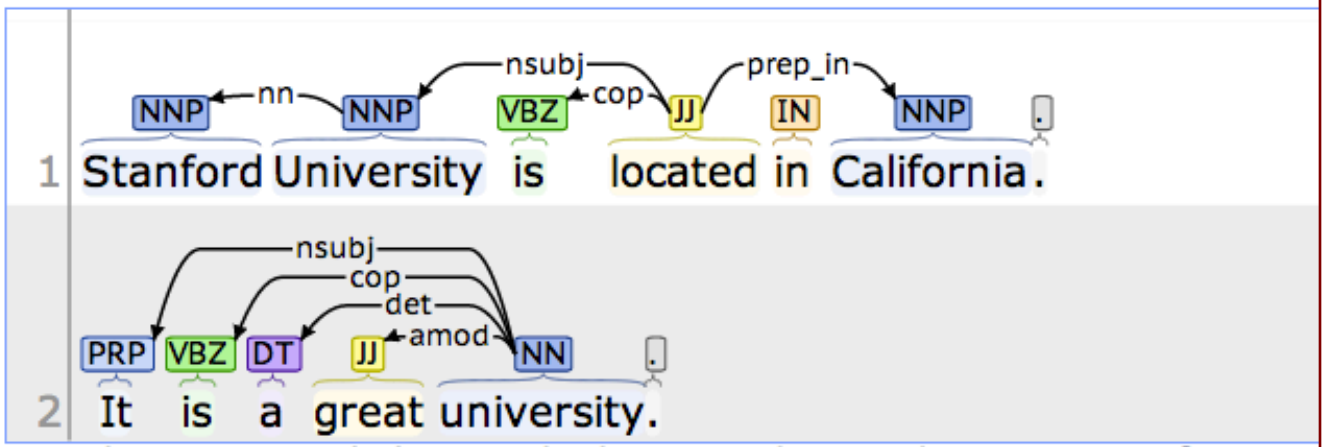
Stanford CoreNLP

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.
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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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            <Speaker>PER0</Speaker>
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            <NER>ORGANIZATION</NER>
            <Speaker>PER0</Speaker>
          </token>
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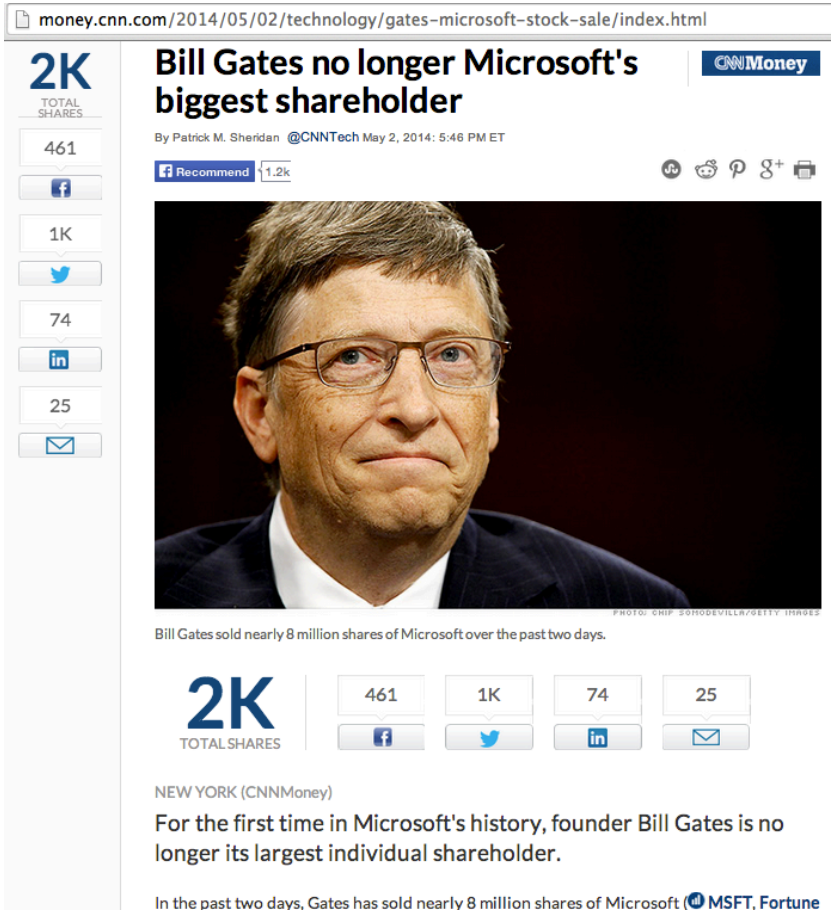
NER for News Article

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.

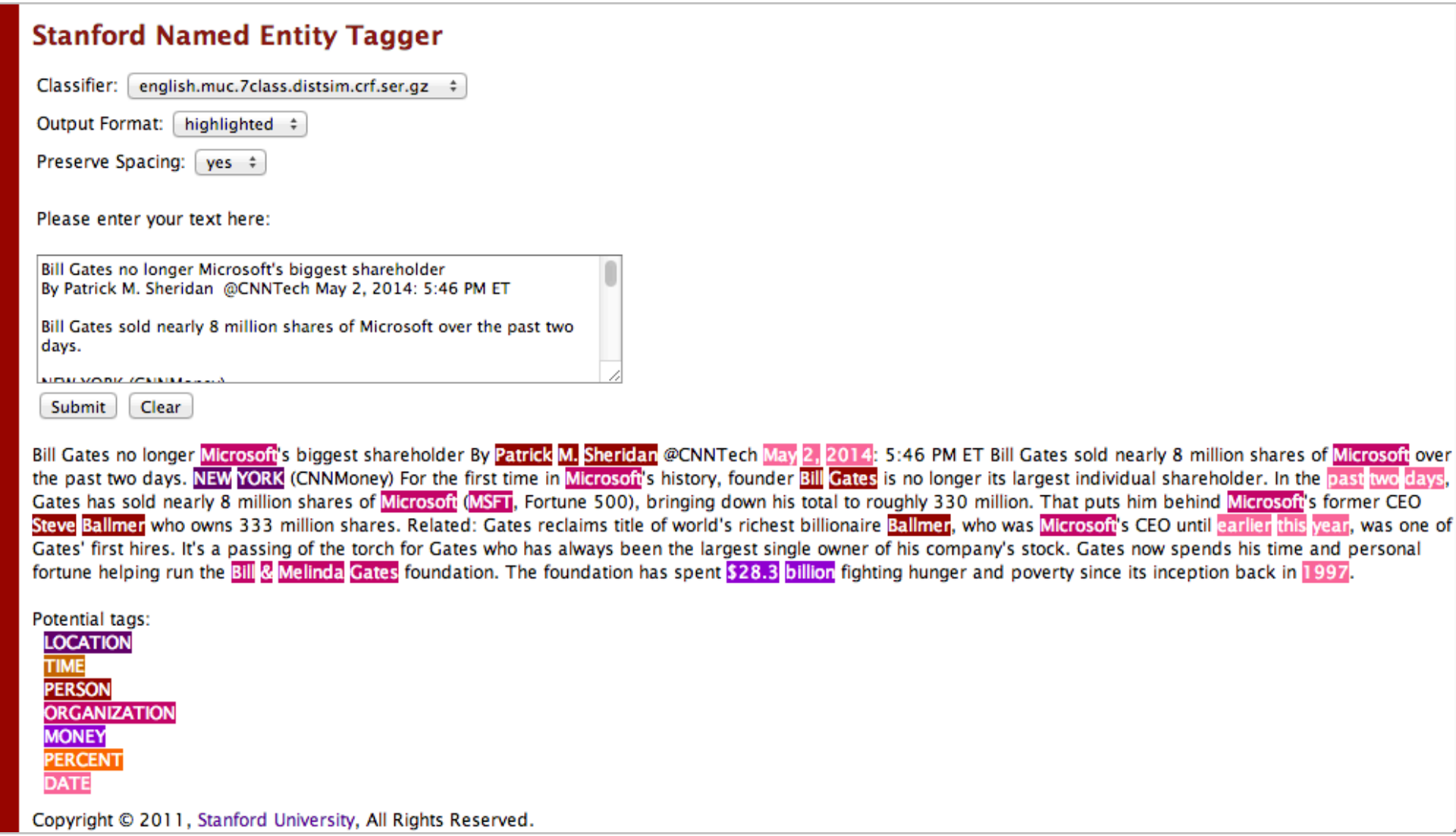
NEW YORK (CNNMoney)

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 (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:

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

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Submit Clear

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 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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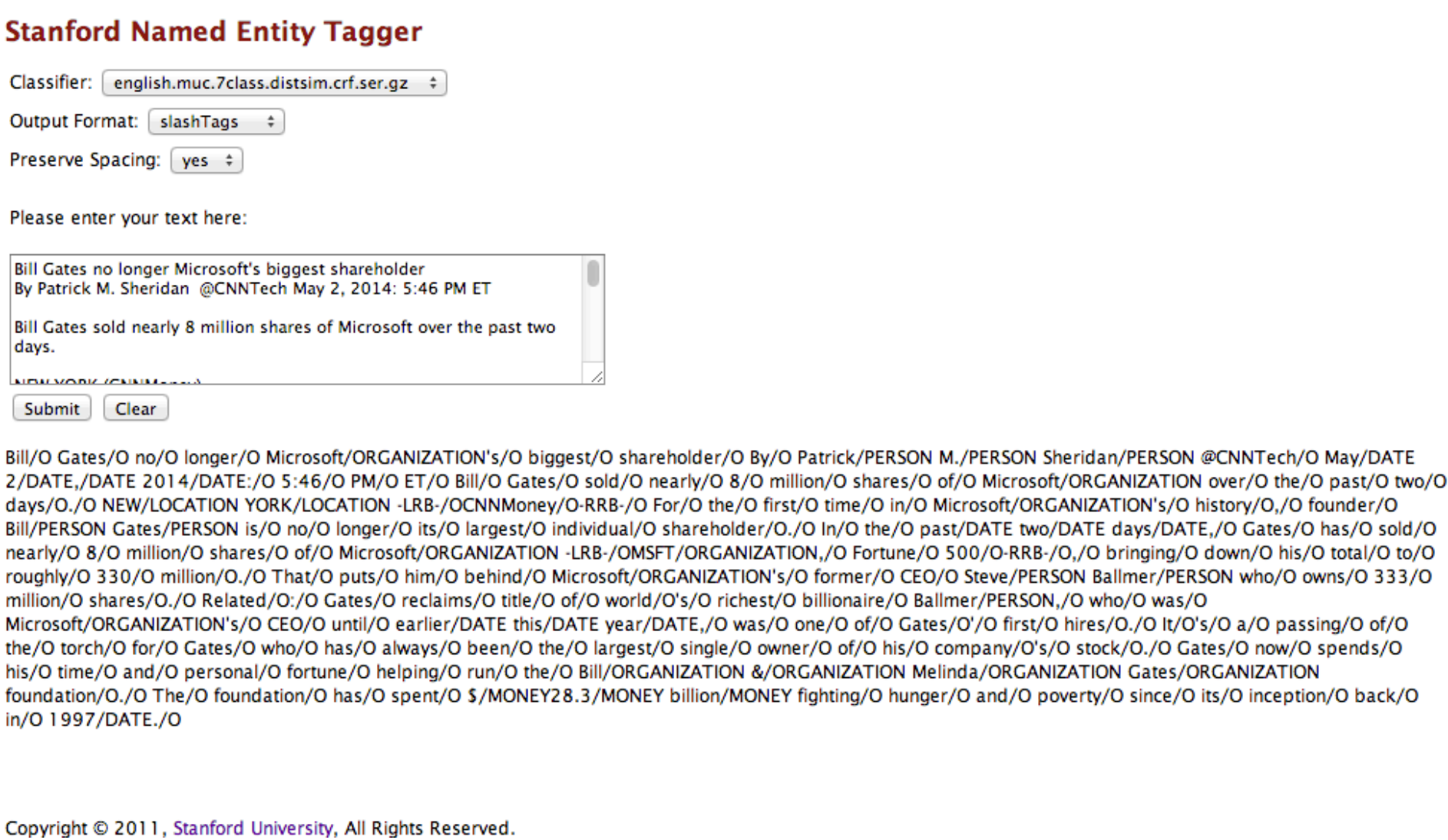
NEW YORK (CNNMoney)

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:

Bill Gates no longer Microsoft's biggest shareholder
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NEW YORK (CNNMoney)

Submit Clear

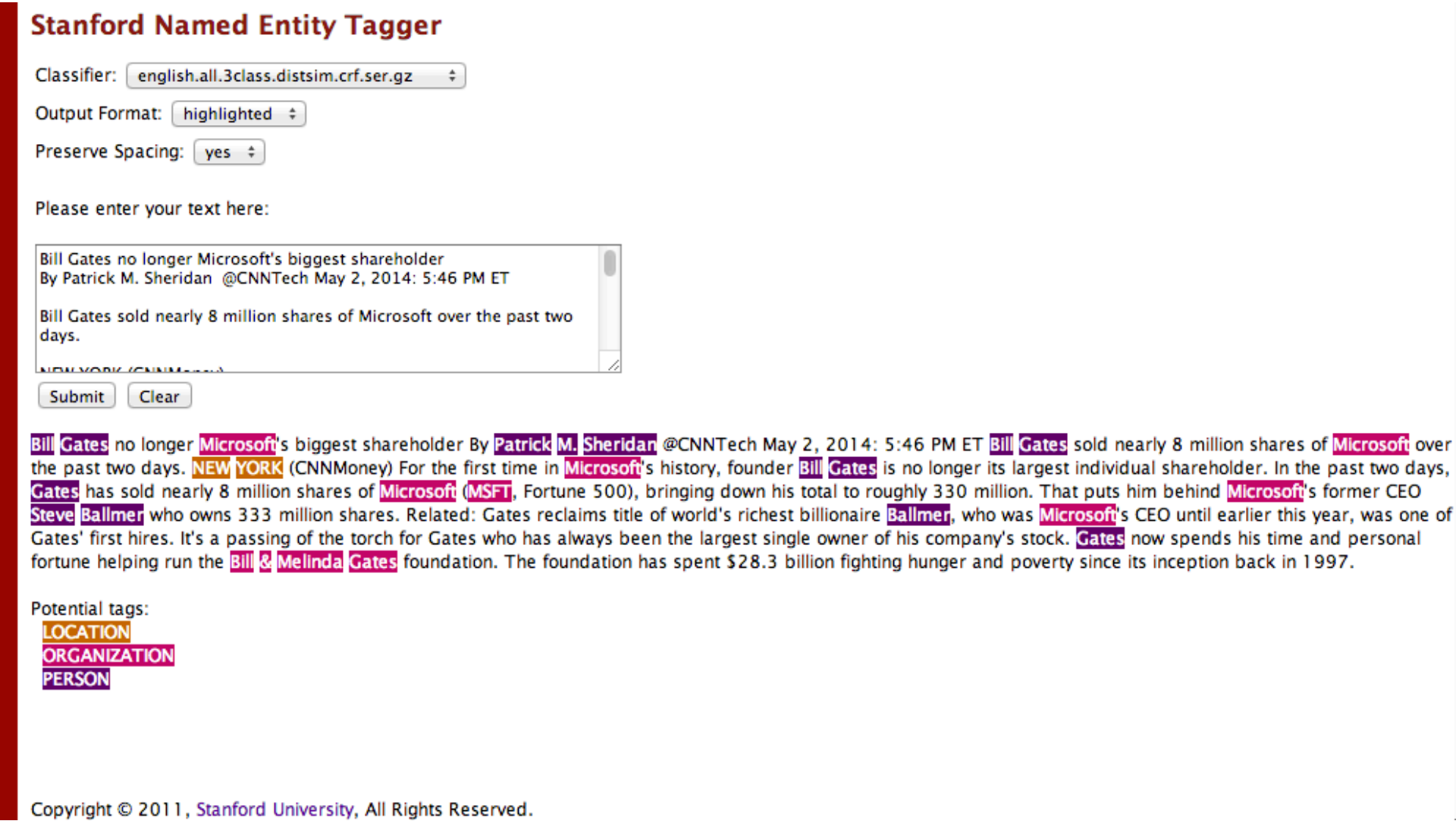
Bill/O Gates/O no/O longer/O Microsoft/ORGANIZATION's/O biggest/O shareholder/O By/O Patrick/PERSON M./PERSON Sheridan/PERSON @CNNTech/O May/DATE 2/DATE,/DATE 2014/DATE:/O 5:46/O PM/O ET/O Bill/O Gates/O sold/O nearly/O 8/O million/O shares/O of/O Microsoft/ORGANIZATION over/O the/O past/O two/O days/O./O 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 (NER)

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



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

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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

CKIP 中研院中文斷詞系統

http://ckipsvr.iis.sinica.edu.tw/

歐巴馬(Nb) 是(SHI) 美國(Nc) 的(DE) 一(Neu) 位(Nf) 總統(Na)

中文文字處理:中文斷詞

即時 要聞 娛樂 運動 全球 社會 產經 股市 健康 生活 文教 評論 地方 兩岸

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

莎士比亞在淡江 遇見賽萬提斯
2016-04-26 02:27 聯合報 記者徐葳倫／淡水報導

分享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」作者賽萬提斯逝世之日。英專起家的淡江大學舉辦「當莎士比亞遇見賽萬提斯」活動，規畫主題書展、彩繪活動，並添購新書，拉近學生與經典文學的距離。

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英語系四年級學生陳彥伶說，讀英語系接觸莎士比亞作品，但過去沒有舉辦書展時，這些作品都放在圖書館8樓，現在搬到1樓大廳陳列，不僅有很多莎士比亞、賽萬提斯的經典新書，還可藉由電子書、電影理解兩位作家，是以前沒有過的體驗。

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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

CKIP 中研院中文斷詞系統

http://ckipsvr.iis.sinica.edu.tw/

中文斷詞系統

相關系統： 斷詞系統 | 剖析系統 | 詞首詞尾 | 平衡語料庫 | 廣義知網 | 句結構樹庫 | 錯字偵測

- 簡介
- 未知詞擷取做法
- 詞類標記列表
- 線上展示
- 線上服務申請
- 線上資源
- 公告
- 聯絡我們

自 2014/01/06 起，本斷詞系統已經處理過 28270134 篇文章

送出 清除

莎士比亞在淡江 遇見賽萬提斯
2016-04-26 02:27 聯合報 記者徐葳倫 / 淡水報導

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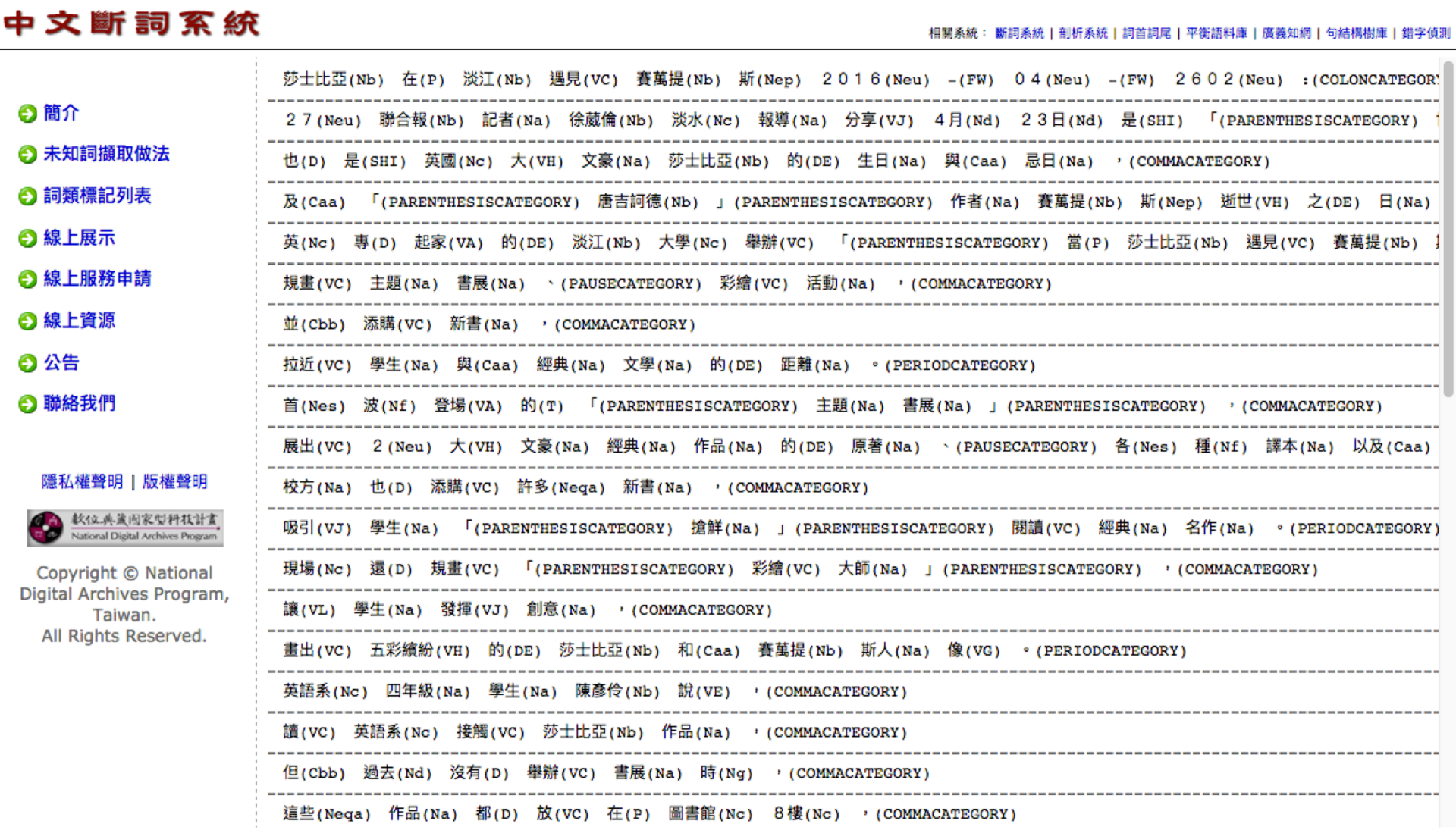

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莎士比亞(Nb)　在(P)　淡江(Nb)　遇見(VC)　賽萬提(Nb)　斯(Nep)　２０１６(Neu)　-(FW)　０４(Neu)　-(FW)　２６０２(Neu)　:(COLONCATEGORY)
　２７(Neu)　聯合報(Nb)　記者(Na)　徐葳倫(Nb)　淡水(Nc)　報導(Na)　分享(VJ)　４月(Nd)　２３日(Nd)　是(SHI)　「(PARENTHESISCATEGORY)　世界(Nc)　閱讀日(Na)　」(PARENTHESISCATEGORY)　，(COMMACATEGORY)
　也(D)　是(SHI)　英國(Nc)　大(VH)　文豪(Na)　莎士比亞(Nb)　的(DE)　生日(Na)　與(Caa)　忌日(Na)　，(COMMACATEGORY)
　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)　。(PERIODCATEGORY)
　英(Nc)　專(D)　起家(VA)　的(DE)　淡江(Nb)　大學(Nc)　舉辦(VC)　「(PARENTHESISCATEGORY)　當(P)　莎士比亞(Nb)　遇見(VC)　賽萬提(Nb)　斯(Nep)　」(PARENTHESISCATEGORY)　活動(Na)　，(COMMACATEGORY)
　規畫(VC)　主題(Na)　書展(Na)　、(PAUSECATEGORY)　彩繪(VC)　活動(Na)　，(COMMACATEGORY)
　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)

中文斷詞系統

- CKIP
- Jieba
- THULAC
- CoreNLP
- pyLTP
- SnowNLP
- PyNLPIR
- HanLP

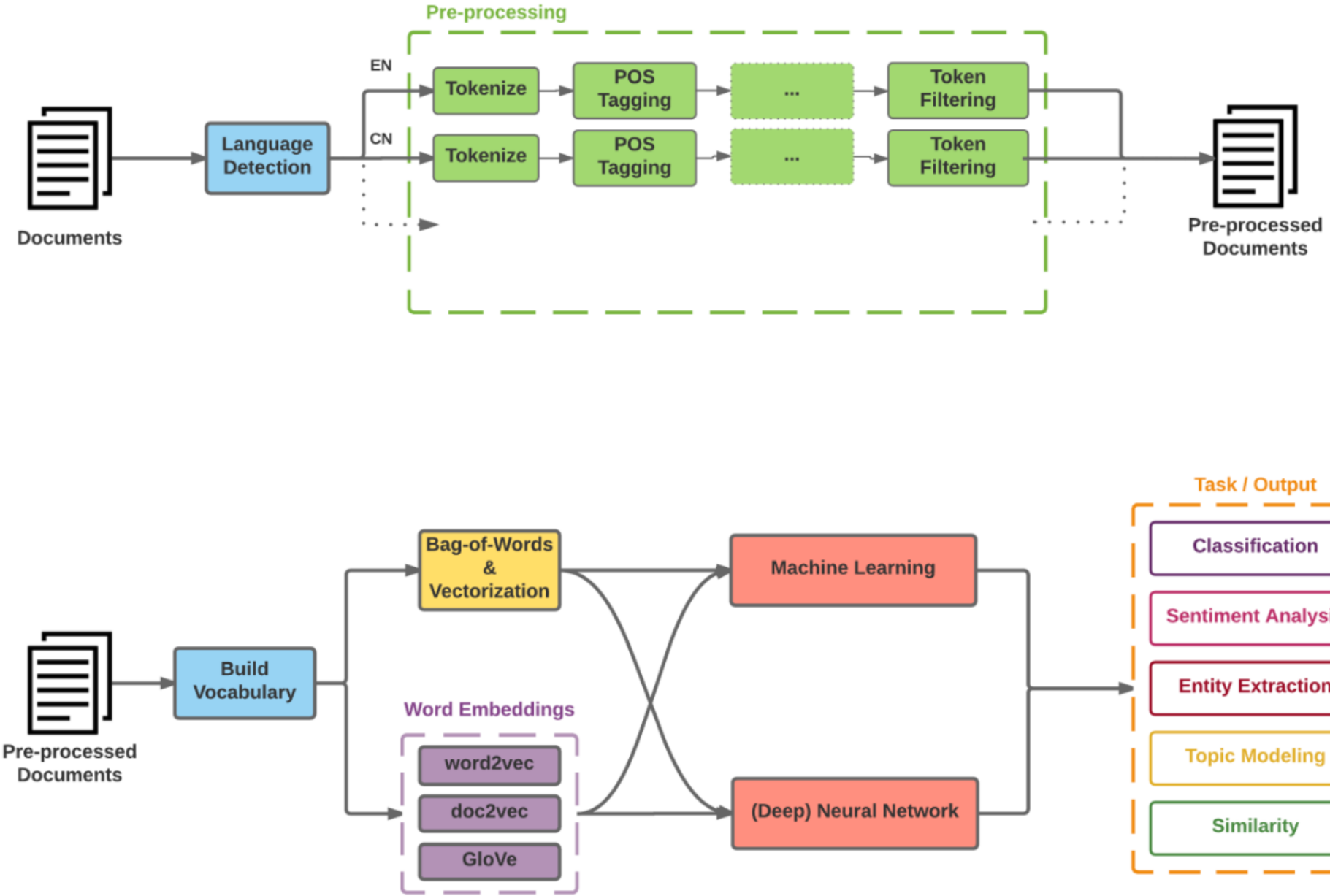
Vector Representations of Words

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 刚才 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 0.18
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
```

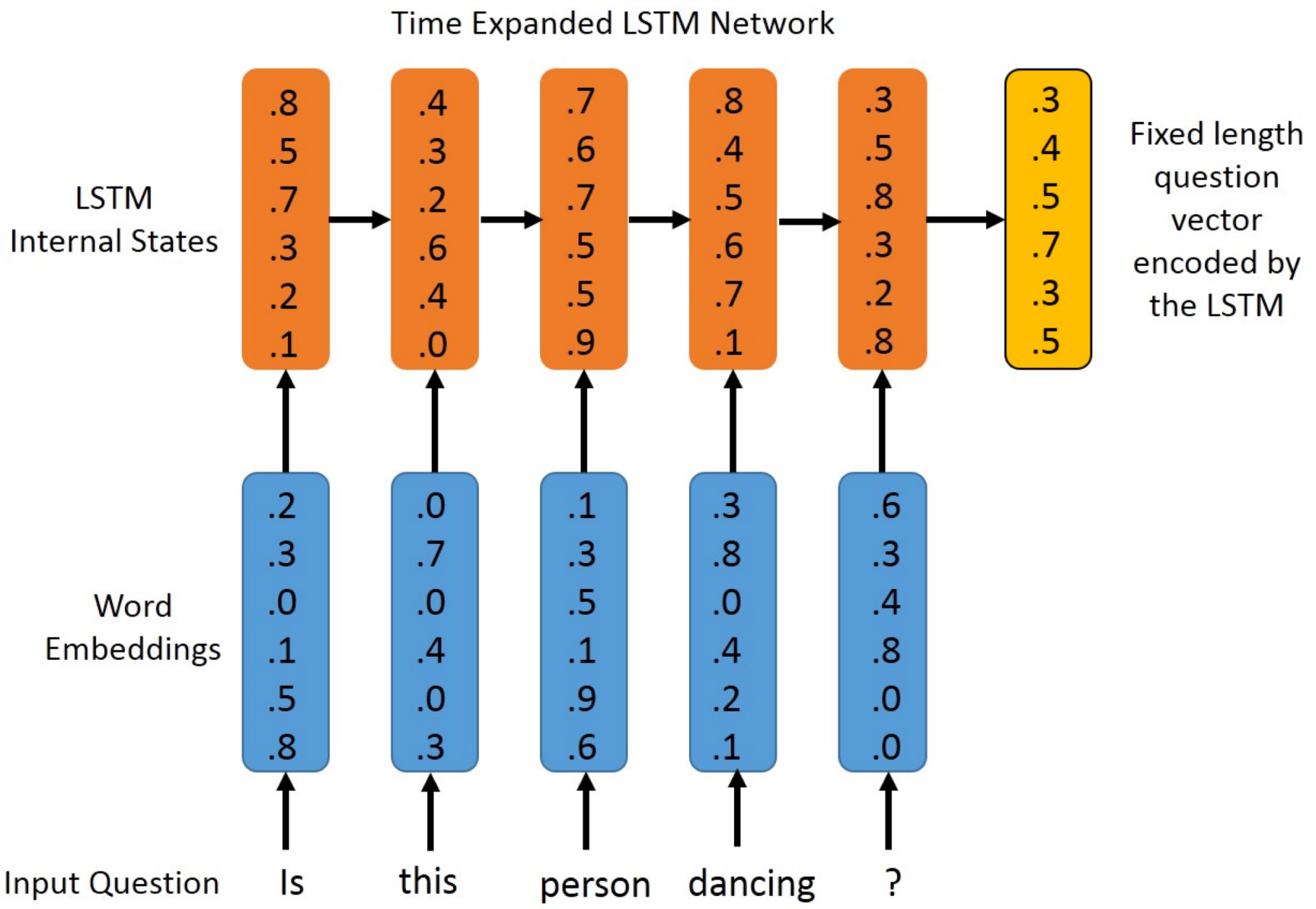
Models

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

NLP and Text Analytics with Python

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

Python in Google Colab

https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT

python101.ipynb

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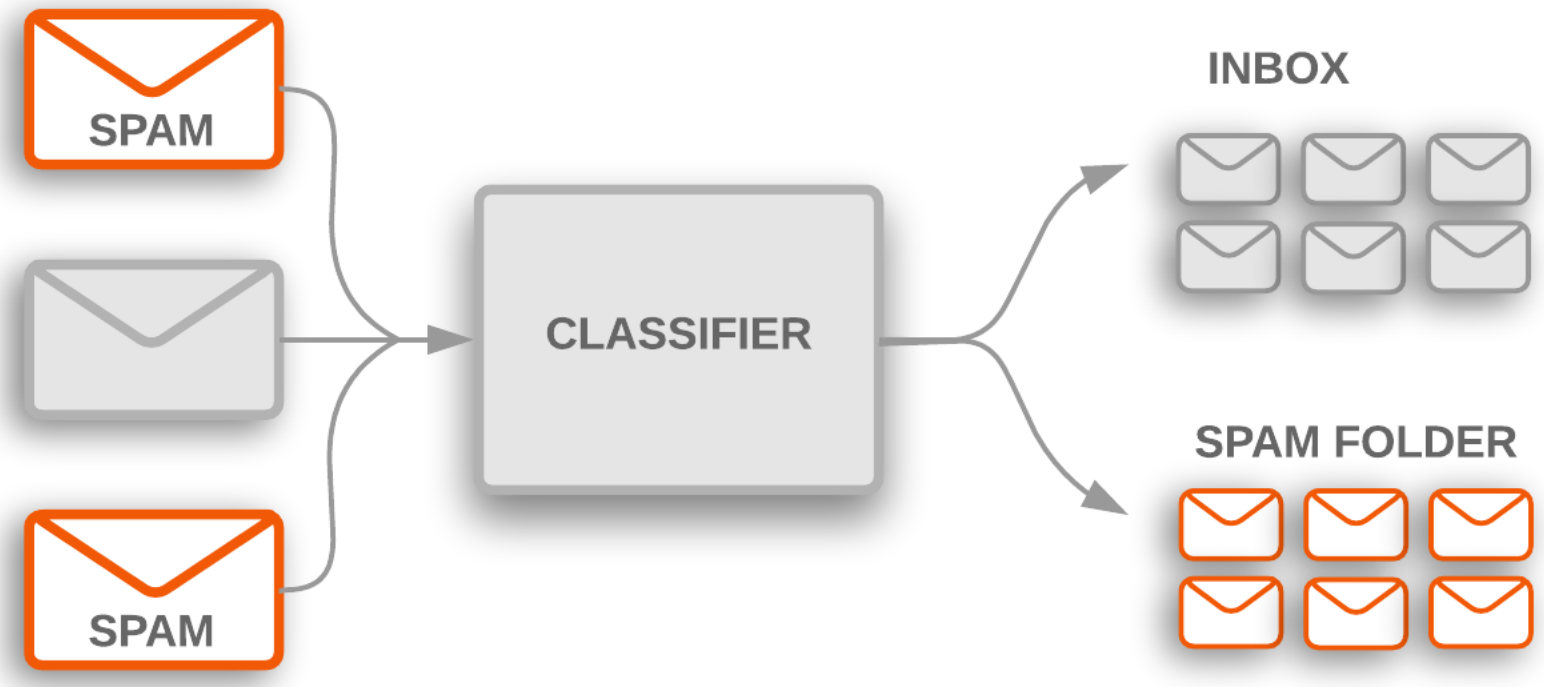
CODE TEXT CELL CELL CONNECT EDITING

Keras preprocessing text

```
# keras.preprocessing.text Tokenizer
from keras.preprocessing.text import Tokenizer
# define 5 documents
docs = ['Well done!', 'Good work', 'Great effort', 'nice work', 'Excellent!']
# create the tokenizer
t = Tokenizer()
# fit the tokenizer on the documents
t.fit_on_texts(docs)
print('docs:', docs)
print('word_counts:', t.word_counts)
print('document_count:', t.document_count)
print('word_index:', t.word_index)
print('word_docs:', t.word_docs)
# integer encode documents
texts_to_matrix = t.texts_to_matrix(docs, mode='count')
print('texts_to_matrix:')
print(texts_to_matrix)
```

```
Using TensorFlow backend.
docs: ['Well done!', 'Good work', 'Great effort', 'nice work', 'Excellent!']
word_counts: OrderedDict([('well', 1), ('done', 1), ('good', 1), ('work', 2), ('great', 1), ('effort', 1), ('nice', 1), ('excellent', 1
document_count: 5
word_index: {'work': 1, 'well': 2, 'done': 3, 'good': 4, 'great': 5, 'effort': 6, 'nice': 7, 'excellent': 8}
word_docs: {'done': 1, 'well': 1, 'work': 2, 'good': 1, 'great': 1, 'effort': 1, 'nice': 1, 'excellent': 1}
texts_to_matrix:
[[0. 0. 1. 1. 0. 0. 0. 0. 0.]
 [0. 1. 0. 0. 1. 0. 0. 0. 0.]
 [0. 0. 0. 0. 0. 1. 1. 0. 0.]
 [0. 1. 0. 0. 0. 0. 0. 1. 0.]
 [0. 0. 0. 0. 0. 0. 0. 0. 1.]]
```

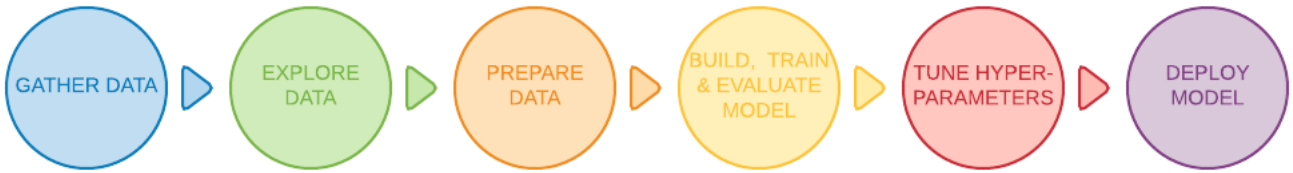
Text Classification



Source: https://developers.google.com/machine-learning/guides/text-classification/

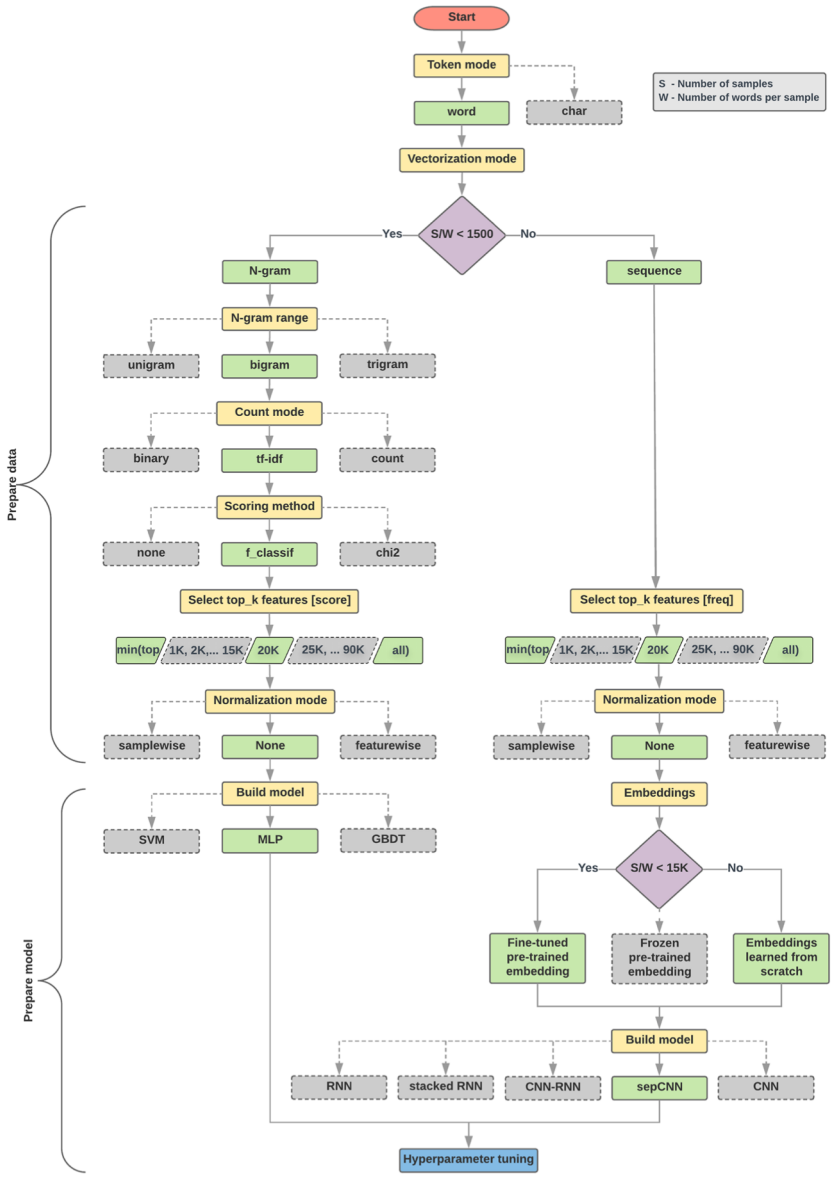
Text Classification Workflow

- Step 1: Gather Data
- Step 2: Explore Your Data
- Step 2.5: Choose a Model*
- Step 3: Prepare Your Data
- Step 4: Build, Train, and Evaluate Your Model
- Step 5: Tune Hyperparameters
- Step 6: Deploy Your Model



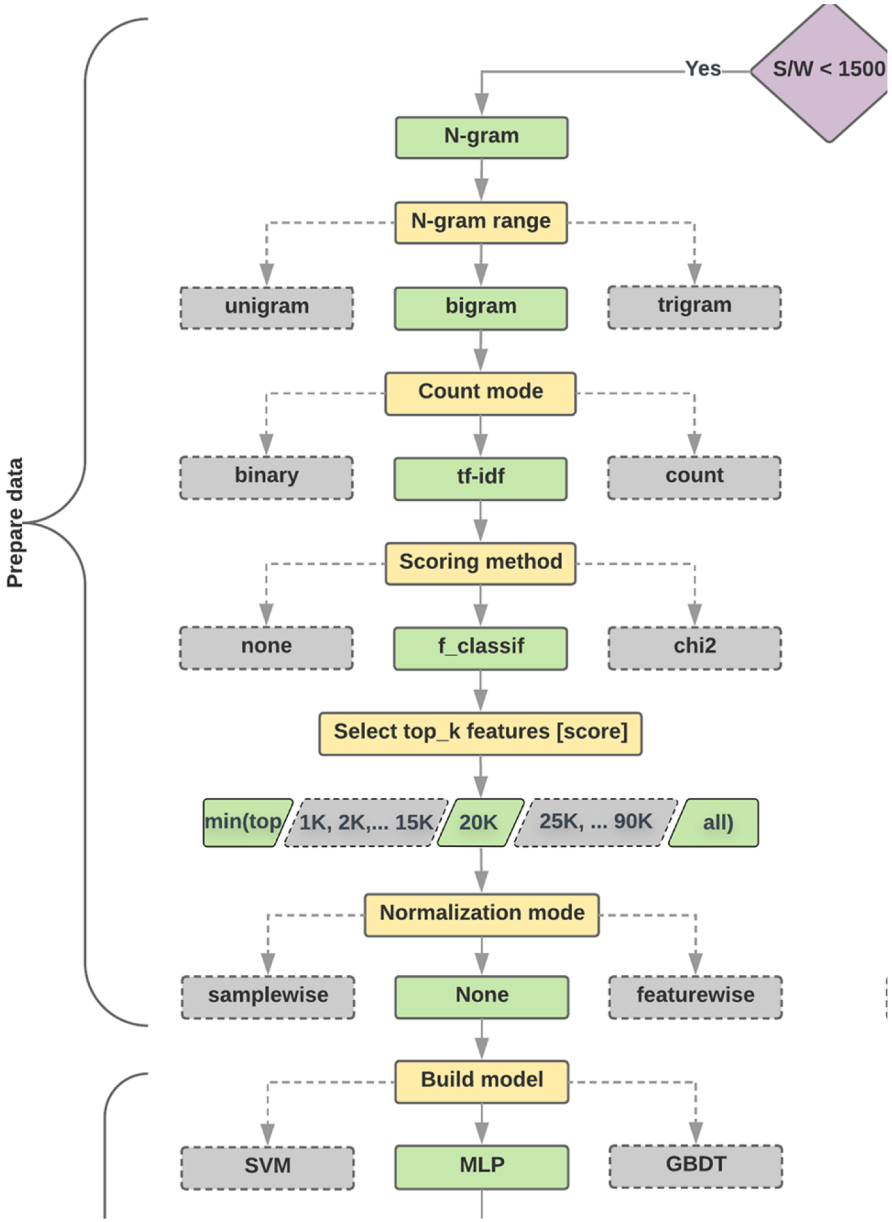
Source: https://developers.google.com/machine-learning/guides/text-classification/

Text Classification Flowchart



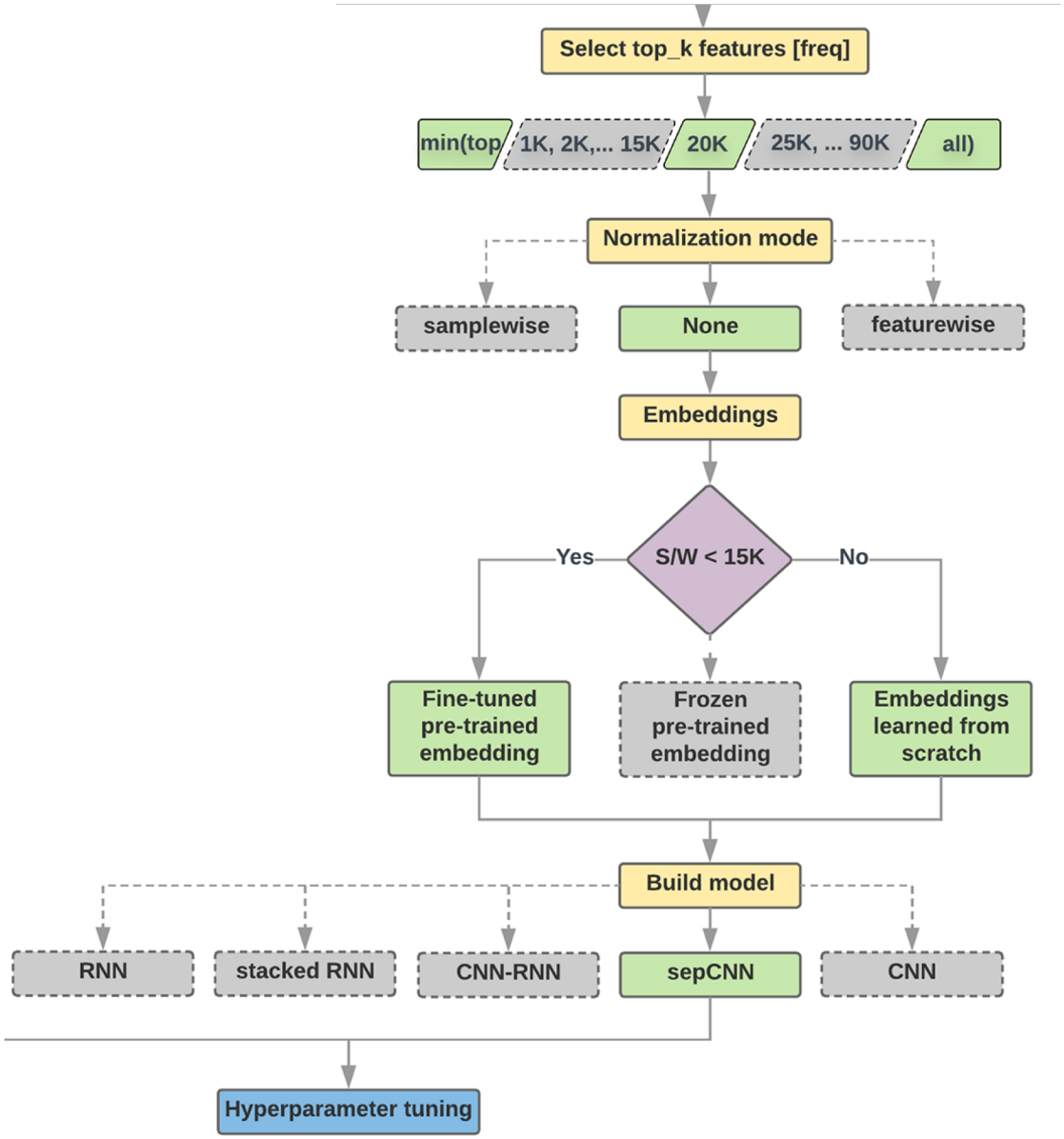
Source: https://developers.google.com/machine-learning/guides/text-classification/step-2-5

Text Classification S/W<1500: N-gram



Source: https://developers.google.com/machine-learning/guides/text-classification/step-2-5

Text Classification S/W>=1500: Sequence

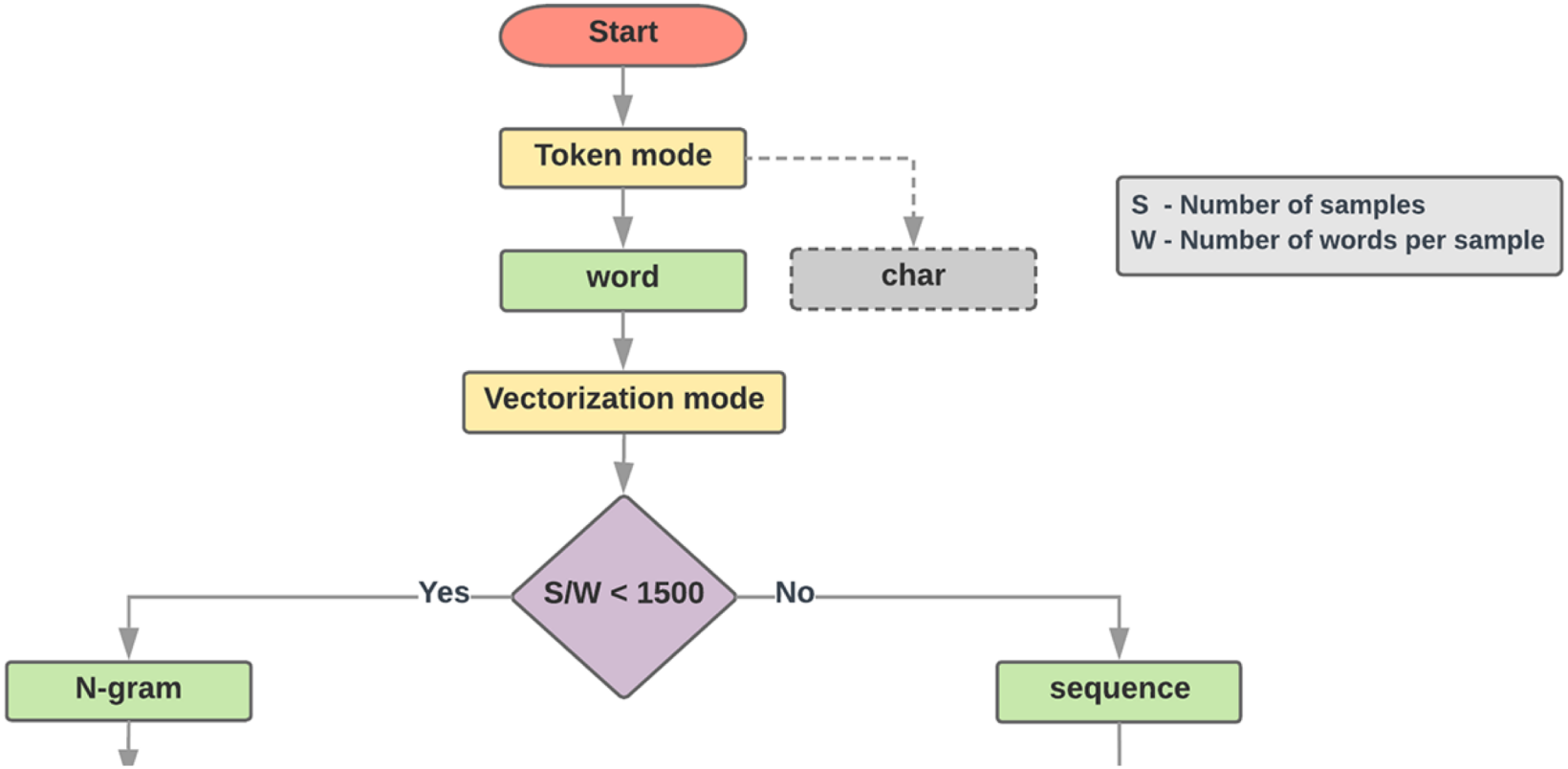


Source: https://developers.google.com/machine-learning/guides/text-classification/step-2-5

Step 2.5: Choose a Model

Samples/Words < 1500

150,000/100 = 1500



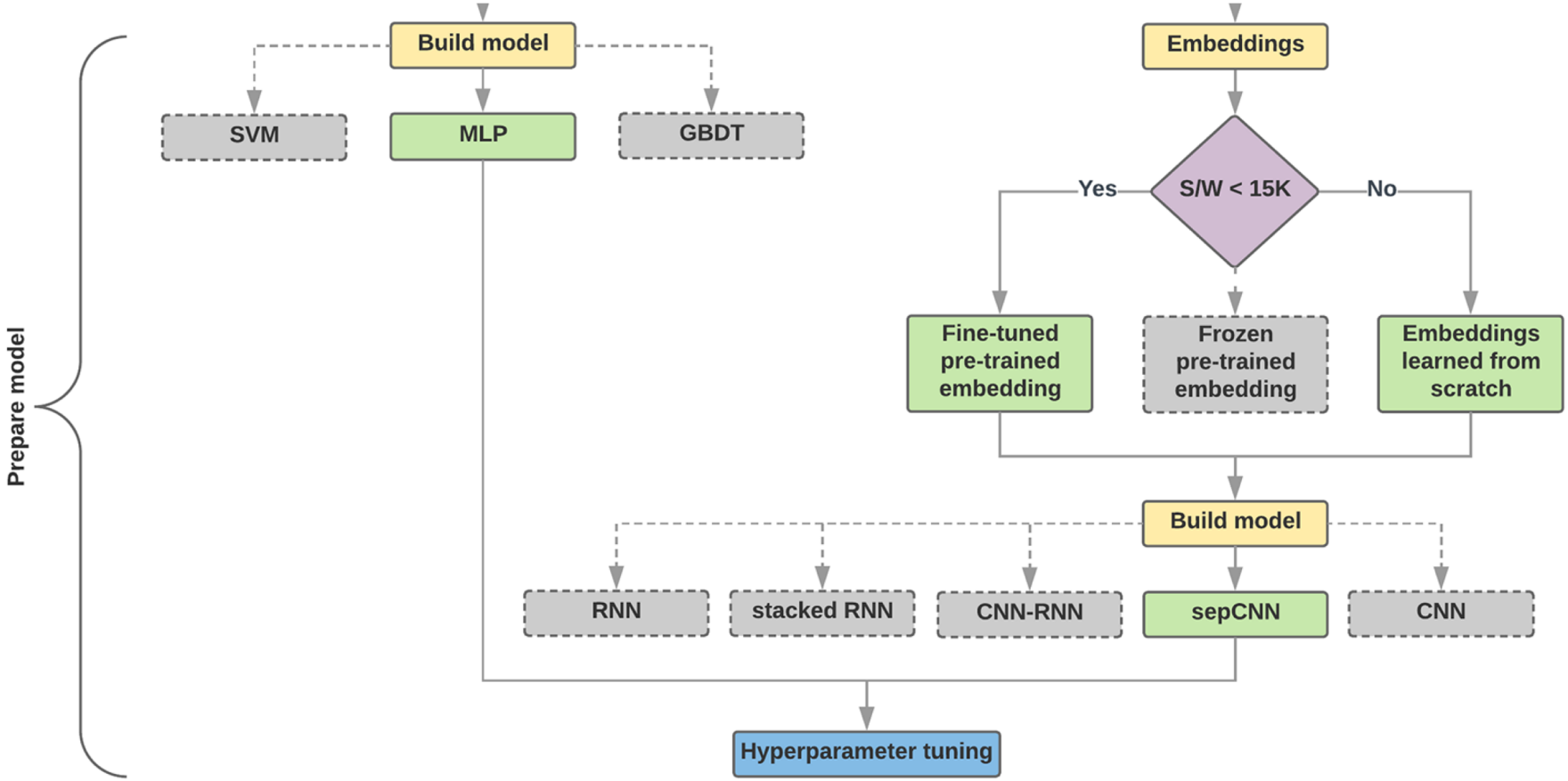
IMDb review dataset,
the samples/words-per-sample ratio is ~ 144

Source: https://developers.google.com/machine-learning/guides/text-classification/step-2-5

Step 2.5: Choose a Model

Samples/Words < 15,000

1,500,000/100 = 15,000



Source: https://developers.google.com/machine-learning/guides/text-classification/step-2-5

Step 3: Prepare Your Data

```
Texts:
T1: 'The mouse ran up the clock'
T2: 'The mouse ran down'

Token Index:
{'the': 1, 'mouse': 2, 'ran': 3, 'up': 4, 'clock': 5, 'down': 6,}.
   NOTE: 'the' occurs most frequently,
         so the index value of 1 is assigned to it.
         Some libraries reserve index 0 for unknown tokens,
         as is the case here.

Sequence of token indexes:
T1: 'The mouse ran up the clock' =
      [1,  2,   3, 4,  1,  5]
T1: 'The mouse ran down' =
      [1,   2,   3,  6]
```

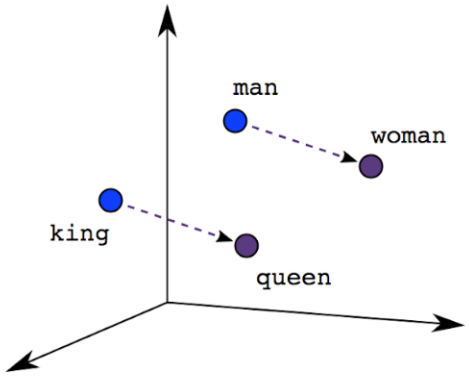
Source: https://developers.google.com/machine-learning/guides/text-classification/step-3

One-hot encoding

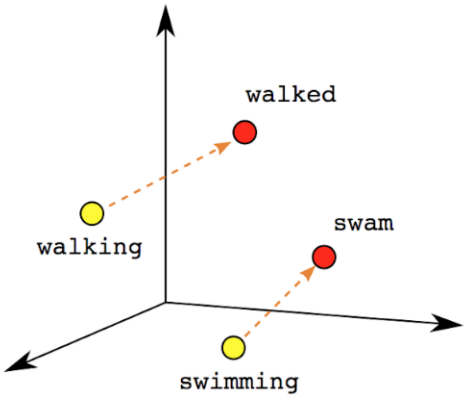
```
                'The mouse ran up the clock' =

The       1   [ [0, 1, 0, 0, 0, 0, 0],
mouse     2     [0, 0, 1, 0, 0, 0, 0],
ran       3     [0, 0, 0, 1, 0, 0, 0],
up        4     [0, 0, 0, 0, 1, 0, 0],
the       1     [0, 1, 0, 0, 0, 0, 0],
clock     5     [0, 0, 0, 0, 0, 1, 0] ]

                [0, 1, 2, 3, 4, 5, 6]
```

Source: https://developers.google.com/machine-learning/guides/text-classification/step-3

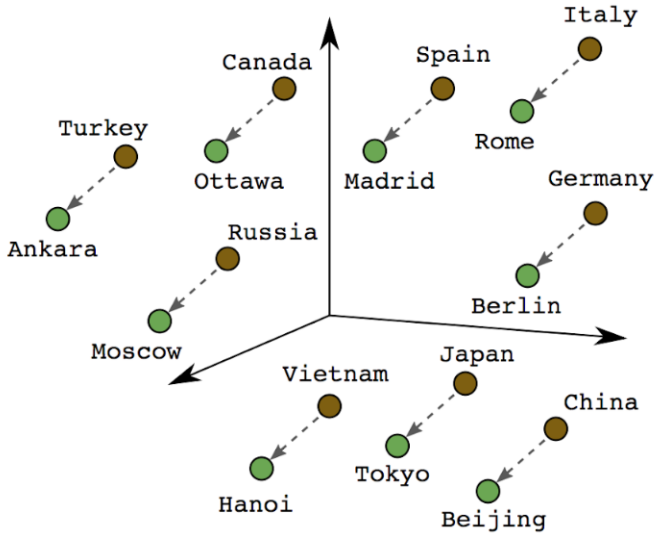
Word embeddings



Male-Female



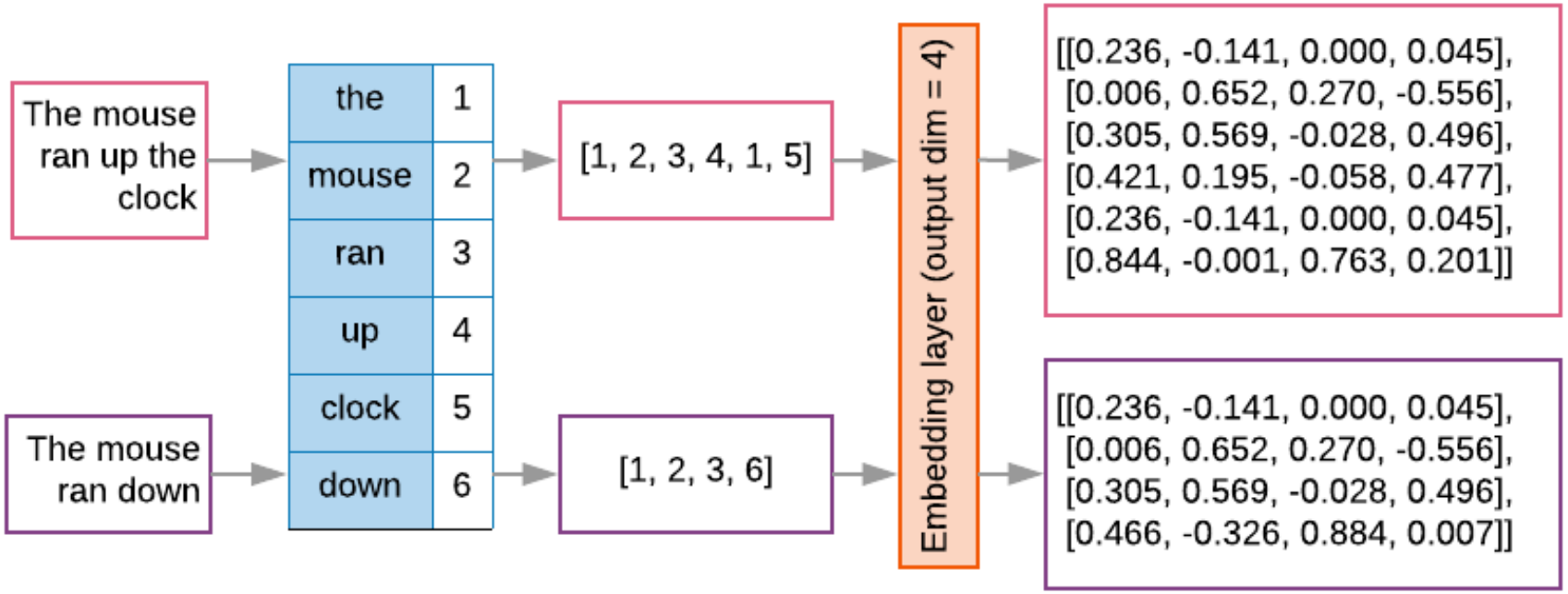
Verb Tense



Country-Capital

Source: https://developers.google.com/machine-learning/guides/text-classification/step-3

Word embeddings



Source: https://developers.google.com/machine-learning/guides/text-classification/step-3

```
t1 = 'The mouse ran up the clock'
t2 = 'The mouse ran down'
s1 = t1.lower().split(' ')
s2 = t2.lower().split(' ')
terms = s1 + s2
sortedset = sorted(set(terms))
print('terms =', terms)
print('sortedset =', sortedset)
```

```
1 t1 = 'The mouse ran up the clock'
2 t2 = 'The mouse ran down'
3 s1 = t1.lower().split(' ')
4 s2 = t2.lower().split(' ')
5 terms = s1 + s2
6 sortedset = sorted(set(terms))
7 print('terms =', terms)
8 print('sortedset =', sortedset)
```

```
terms = ['the', 'mouse', 'ran', 'up', 'the', 'clock', 'the', 'mouse', 'ran', 'down']
sortedset = ['clock', 'down', 'mouse', 'ran', 'the', 'up']
```

https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT

```
t1 = 'The mouse ran up the clock'
t2 = 'The mouse ran down'
s1 = t1.lower().split(' ')
s2 = t2.lower().split(' ')
terms = s1 + s2
print(terms)

tfdict = {}
for term in terms:
    if term not in tfdict:
        tfdict[term] = 1
    else:
        tfdict[term] += 1

a = []
for k,v in tfdict.items():
    a.append('{}, {}'.format(k,v))
print(a)
```

```
['the', 'mouse', 'ran', 'up', 'the', 'clock', 'the', 'mouse', 'ran', 'down']
['the, 3', 'mouse, 2', 'ran, 2', 'up, 1', 'clock, 1', 'down, 1']
```

https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT

```
sorted_by_value_reverse = sorted(tfdict.items(),
key=lambda kv: kv[1], reverse=True)

sorted_by_value_reverse_dict =
dict(sorted_by_value_reverse)

id2word = {id: word for id, word in
enumerate(sorted_by_value_reverse_dict)}

word2id = dict([(v, k) for (k, v) in
id2word.items()])
```

```
sorted_by_value:  [('up', 1), ('clock', 1), ('down', 1), ('mouse', 2), ('ran', 2), ('the', 3)]
sorted_by_value2:  ['the', 'mouse', 'ran', 'up', 'clock', 'down']
sorted_by_value_reverse:  [('the', 3), ('mouse', 2), ('ran', 2), ('up', 1), ('clock', 1), ('down', 1)]
sorted_by_value_reverse_dict {'the': 3, 'mouse': 2, 'ran': 2, 'up': 1, 'clock': 1, 'down': 1}
id2word {0: 'the', 1: 'mouse', 2: 'ran', 3: 'up', 4: 'clock', 5: 'down'}
word2id {'the': 0, 'mouse': 1, 'ran': 2, 'up': 3, 'clock': 4, 'down': 5}
len_words: 6
sorted_by_key:  [('clock', 1), ('down', 1), ('mouse', 2), ('ran', 2), ('the', 3), ('up', 1)]
the, 3
mouse, 2
ran, 2
up, 1
clock, 1
down, 1
```

https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT

```
sorted_by_value = sorted(tfdict.items(), key=lambda kv: kv[1])
print('sorted_by_value: ', sorted_by_value)
sorted_by_value2 = sorted(tfdict, key=tfdict.get, reverse=True)
print('sorted_by_value2: ', sorted_by_value2)
sorted_by_value_reverse = sorted(tfdict.items(), key=lambda kv: kv[1], reverse=True)
print('sorted_by_value_reverse: ', sorted_by_value_reverse)
sorted_by_value_reverse_dict = dict(sorted_by_value_reverse)
print('sorted_by_value_reverse_dict', sorted_by_value_reverse_dict)
id2word = {id: word for id, word in enumerate(sorted_by_value_reverse_dict)}
print('id2word', id2word)
word2id = dict([(v, k) for (k, v) in id2word.items()])
print('word2id', word2id)
print('len_words:', len(word2id))

sorted_by_key = sorted(tfdict.items(), key=lambda kv: kv[0])
print('sorted_by_key: ', sorted_by_key)

tfstring = '\n'.join(a)
print(tfstring)
tf = tfdict.get('mouse')
print(tf)
```

```
sorted_by_value:  [('up', 1), ('clock', 1), ('down', 1), ('mouse', 2), ('ran', 2), ('the', 3)]
sorted_by_value2:  ['the', 'mouse', 'ran', 'up', 'clock', 'down']
sorted_by_value_reverse:  [('the', 3), ('mouse', 2), ('ran', 2), ('up', 1), ('clock', 1), ('down', 1)]
sorted_by_value_reverse_dict {'the': 3, 'mouse': 2, 'ran': 2, 'up': 1, 'clock': 1, 'down': 1}
id2word {0: 'the', 1: 'mouse', 2: 'ran', 3: 'up', 4: 'clock', 5: 'down'}
word2id {'the': 0, 'mouse': 1, 'ran': 2, 'up': 3, 'clock': 4, 'down': 5}
len_words: 6
sorted_by_key:  [('clock', 1), ('down', 1), ('mouse', 2), ('ran', 2), ('the', 3), ('up', 1)]
the, 3
mouse, 2
ran, 2
up, 1
clock, 1
down, 1
```

https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT

from keras.preprocessing.text import Tokenizer

```
from keras.preprocessing.text import Tokenizer
# define 5 documents
docs = ['Well done!', 'Good work', 'Great effort', 'nice work', 'Excellent!']
# create the tokenizer
t = Tokenizer()
# fit the tokenizer on the documents
t.fit_on_texts(docs)
print('docs:', docs)
print('word_counts:', t.word_counts)
print('document_count:', t.document_count)
print('word_index:', t.word_index)
print('word_docs:', t.word_docs)
# integer encode documents
texts_to_matrix = t.texts_to_matrix(docs, mode='count')
print('texts_to_matrix:')
print(texts_to_matrix)
```

```
docs: ['Well done!', 'Good work', 'Great effort', 'nice work', 'Excellent!']
word_counts: OrderedDict([('well', 1), ('done', 1), ('good', 1), ('work', 2), ('great', 1), ('effort', 1), ('ni
document_count: 5
word_index: {'work': 1, 'well': 2, 'done': 3, 'good': 4, 'great': 5, 'effort': 6, 'nice': 7, 'excellent': 8}
word_docs: {'done': 1, 'well': 1, 'work': 2, 'good': 1, 'great': 1, 'effort': 1, 'nice': 1, 'excellent': 1}
texts_to_matrix:
[[0. 0. 1. 1. 0. 0. 0. 0. 0.]
 [0. 1. 0. 0. 1. 0. 0. 0. 0.]
 [0. 0. 0. 0. 0. 1. 1. 0. 0.]
 [0. 1. 0. 0. 0. 0. 0. 1. 0.]
 [0. 0. 0. 0. 0. 0. 0. 0. 1.]]
```

Source: https://machinelearningmastery.com/prepare-text-data-deep-learning-keras/

from keras.preprocessing.text import Tokenizer

```
from keras.preprocessing.text import Tokenizer
# define 5 documents
docs = ['Well done!', 'Good work', 'Great effort', 'nice
work', 'Excellent!']
# create the tokenizer
t = Tokenizer()
# fit the tokenizer on the documents
t.fit_on_texts(docs)
print('docs:', docs)
print('word_counts:', t.word_counts)
print('document_count:', t.document_count)
print('word_index:', t.word_index)
print('word_docs:', t.word_docs)
# integer encode documents
texts_to_matrix = t.texts_to_matrix(docs, mode='count')
print('texts_to_matrix:')
print(texts_to_matrix)
```

Source: https://machinelearningmastery.com/prepare-text-data-deep-learning-keras/

texts_to_matrix = t.texts_to_matrix(docs, mode='count')

```
docs: ['Well done!', 'Good work', 'Great effort',
'nice work', 'Excellent!']
word_counts: OrderedDict([('well', 1), ('done', 1),
('good', 1), ('work', 2), ('great', 1), ('effort', 1),
('nice', 1), ('excellent', 1)])
document_count: 5
word_index: {'work': 1, 'well': 2, 'done': 3, 'good':
4, 'great': 5, 'effort': 6, 'nice': 7, 'excellent': 8}
word_docs: {'done': 1, 'well': 1, 'work': 2, 'good': 1,
'great': 1, 'effort': 1, 'nice': 1, 'excellent': 1}
texts_to_matrix:
[[0. 0. 1. 1. 0. 0. 0. 0. 0.]
 [0. 1. 0. 0. 1. 0. 0. 0. 0.]
 [0. 0. 0. 0. 0. 1. 1. 0. 0.]
 [0. 1. 0. 0. 0. 0. 0. 1. 0.]
 [0. 0. 0. 0. 0. 0. 0. 0. 1.]]
```

Source: https://machinelearningmastery.com/prepare-text-data-deep-learning-keras/

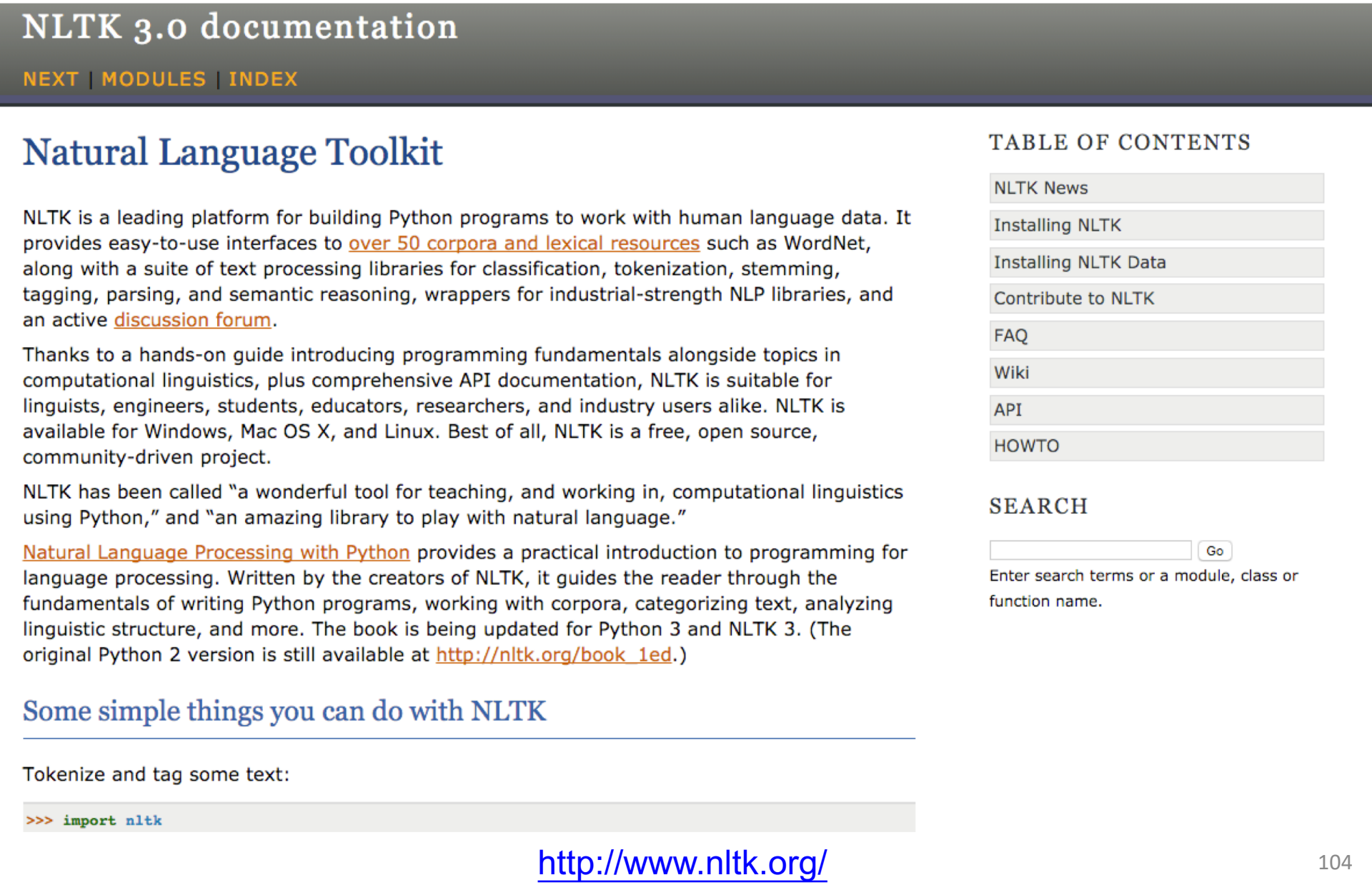
t.texts_to_matrix(docs, mode='tfidf')

```
from keras.preprocessing.text import Tokenizer
# define 5 documents
docs = ['Well done!', 'Good work', 'Great effort', 'nice work',
'Excellent!']
# create the tokenizer
t = Tokenizer()
# fit the tokenizer on the documents
t.fit_on_texts(docs)
print('docs:', docs)
print('word_counts:', t.word_counts)
print('document_count:', t.document_count)
print('word_index:', t.word_index)
print('word_docs:', t.word_docs)
# integer encode documents
texts_to_matrix = t.texts_to_matrix(docs, mode='tfidf')
print('texts_to_matrix:')
print(texts_to_matrix)
```

```
texts_to_matrix:
[[0.  0.  1.25276297 1.25276297 0.  0.  0.  0.  0. ]
[0.  0.98082925 0.  0.  1.25276297 0.  0.  0.  0. ]
[0.  0.  0.  0.  0.  1.25276297 1.25276297 0.  0. ]
[0.  0.98082925 0.  0.  0.  0.  0.  1.25276297 0. ]
[0.  0.  0.  0.  0.  0.  0.  0.  1.25276297]]
```

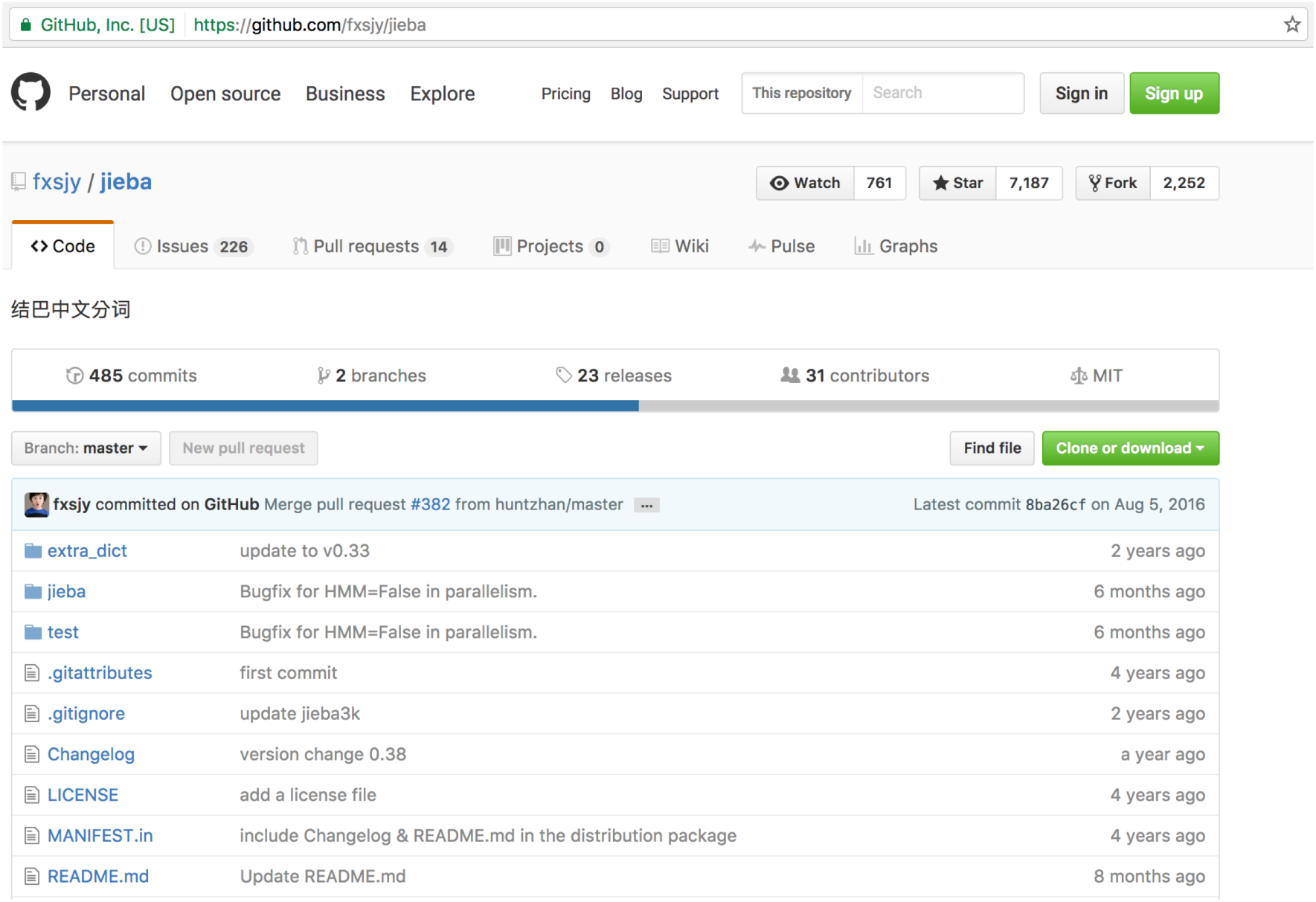
Source: https://machinelearningmastery.com/prepare-text-data-deep-learning-keras/

NLTK (Natural Language Toolkit)



http://www.nltk.org/

Python Jieba “结巴”中文分词



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)
```

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CODE TEXT CELL CELL

```
1  import jieba
2  import jieba.posseg as pseg
3  sentence = "銀行產業正在改變，金融機構欲挖角科技人才"
4  words = jieba.cut(sentence)
5  print(sentence)
6  print(" ".join(words))
7  wordspos = pseg.cut(sentence)
8  result = ''
9  for word, pos in wordspos:
10     print(word + ' (' + pos + ')')
11     result = result + ' ' + word + '(' + pos + ')'
12 print(result.strip())
```

```
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)
```

https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT

Python Jieba “结巴”中文分词

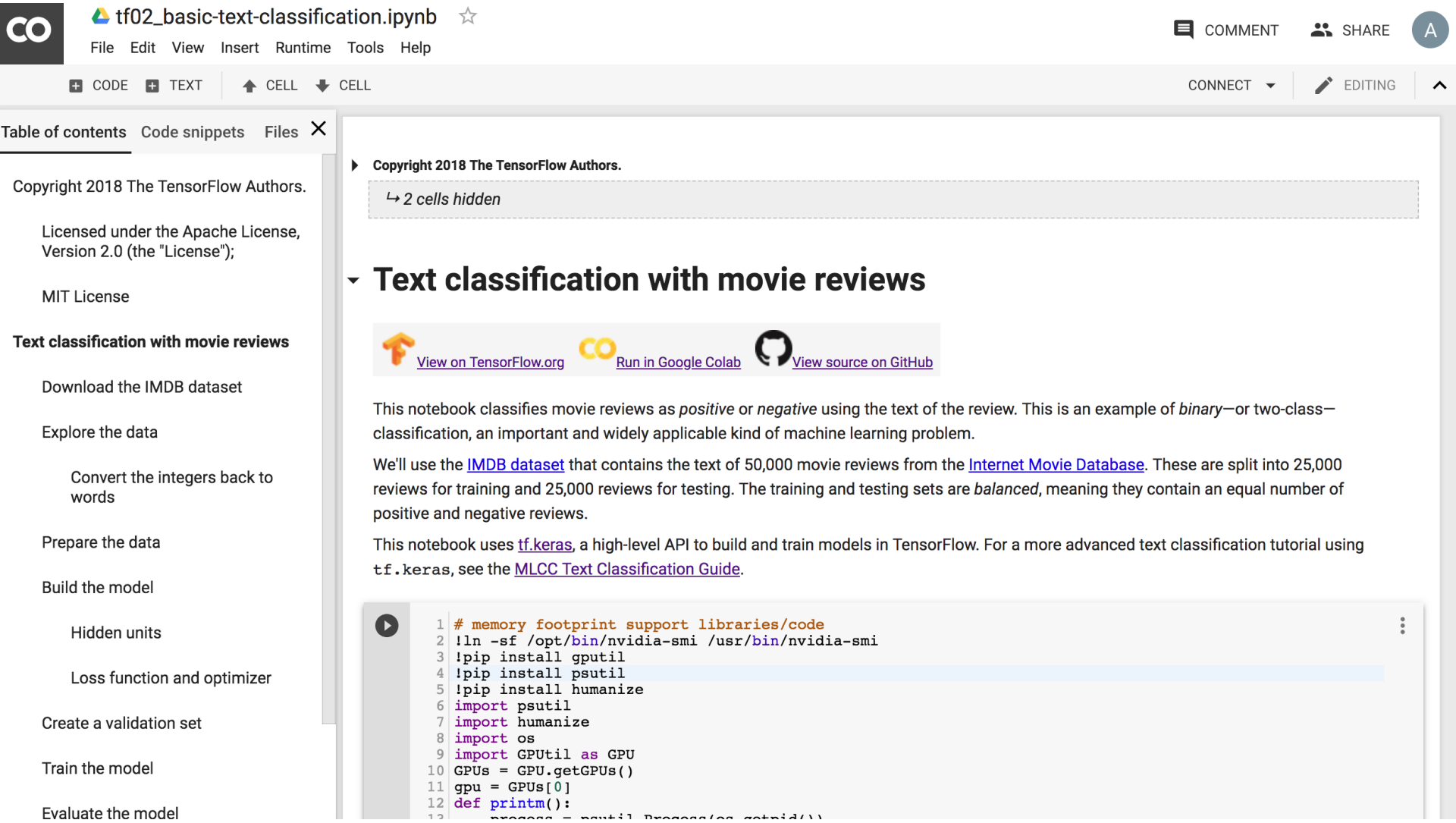
- https://github.com/fxsjy/jieba
- jieba.set_dictionary('data/dict.txt.big')
  - #/anaconda/lib/python3.5/site-packages/jieba
  - dict.txt (5.4MB)(349,046)
  - dict.txt.big.txt (8.6MB)(584,429)
  - dict.txt.small.txt (1.6MB)(109,750)
  - dict.tw.txt (4.2MB)(308,431)
- https://github.com/ldkrsi/jieba-zh_TW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

TensorFlow NLP Examples

- Basic Text Classification (Text Classification) (46 Seconds)
  - https://colab.research.google.com/github/tensorflow/docs/blob/master/site/en/tutorials/keras/basic_text_classification.ipynb
- NMT with Attention (20-30 minutes)
  - https://colab.research.google.com/github/tensorflow/tensorflow/blob/master/tensorflow/contrib/eager/python/examples/nmt_with_attention/nmt_with_attention.ipynb

Text Classification
IMDB Movie Reviews

https://colab.research.google.com/drive/1x16h1GhHsLIrLYtPCvCHaoO1W-i_gror



Source: https://colab.research.google.com/github/tensorflow/docs/blob/master/site/en/tutorials/keras/basic_text_classification.ipynb

Summary

- Natural Language Processing (NLP)
- NLP Libraries and Tools
- NLP and Text Analytics with Python

References

- Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson.
- Rajesh Arumugam (2018), Hands-On Natural Language Processing with Python: A practical guide to applying deep learning architectures to your NLP applications, Packt.
- Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018). "BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding." arXiv preprint arXiv:1810.04805.
- Christopher D. Manning and Hinrich Schütze (1999), Foundations of Statistical Natural Language Processing, The MIT Press.
- Dipanjan Sarkar (2016), Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from your Data, Apress.
- Jake VanderPlas (2016), Python Data Science Handbook: Essential Tools for Working with Data, O'Reilly Media.
- Steven Bird, Ewan Klein and Edward Loper (2009), Natural Language Processing with Python, O'Reilly Media, http://www.nltk.org/book/ , http://www.nltk.org/book_1ed/
- Nitin Hardeniya (2015), NLTK Essentials, Packt.
- Bing Liu (2009), Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data, Springer.