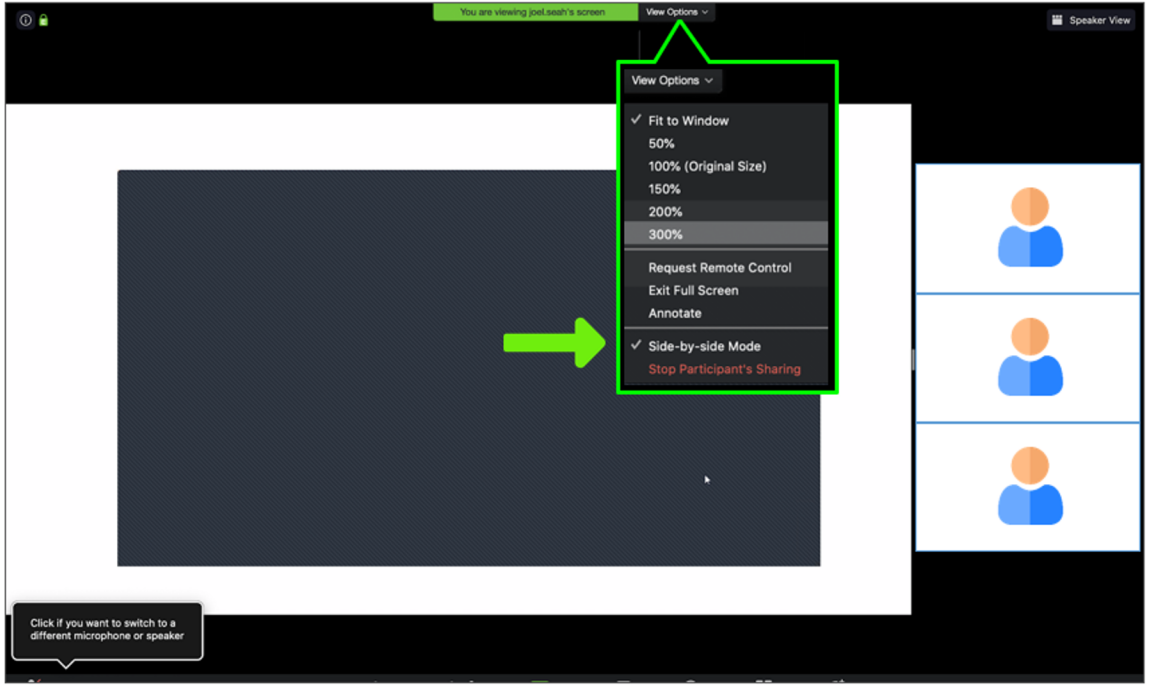
We'll be starting shortly!

To help us run the workshop smoothly, please kindly:

- Submit all questions using the Q&A function
- If you have an urgent request, please use the "Raise Hand" function

Thank you!

Using Zoom: People & Slides



Side-By-Side Mode

- When sharing screen (slide share)
- With small thumbnails of people on the sidebar

STEPS:

1. View Options
2. Side-By-Side Mode

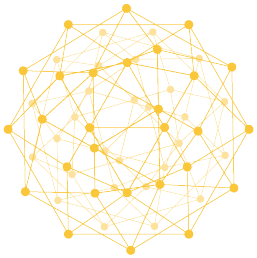
Training Partner Introduction:

Smartcademy

Smartcademy is one of Singapore's leading training provider for in-demand tech skills training & career transformation

Shopee CODE LEAGUE 2020

Our training programs:



Smartcademy

Digital Marketing

Web Development

Cyber Security

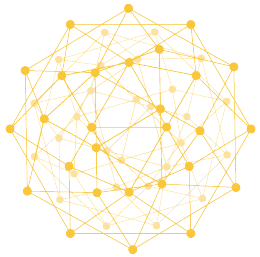
Mobile App Development

Data Analytics

Data Science

UX Design

Smartcademy:



Smartcademy

We are your first choice when it comes to learning skills set that can supercharge your career!

www.smartcademy.sg

Shopee CODE LEAGUE 2020

Natural Language Processing

ENGLISH

CHINESE

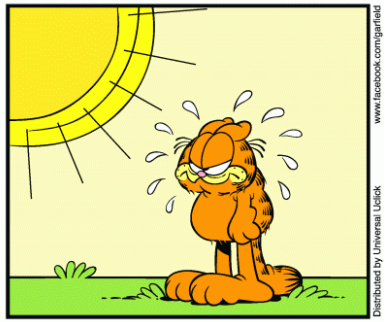
Natural Language Processing

Natural Language Processing

Natural Language Processing

Garfield was trying to stay cool

- GARFIELD WAS TRYING TO STAY COOL



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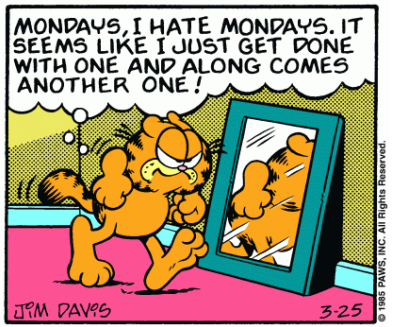
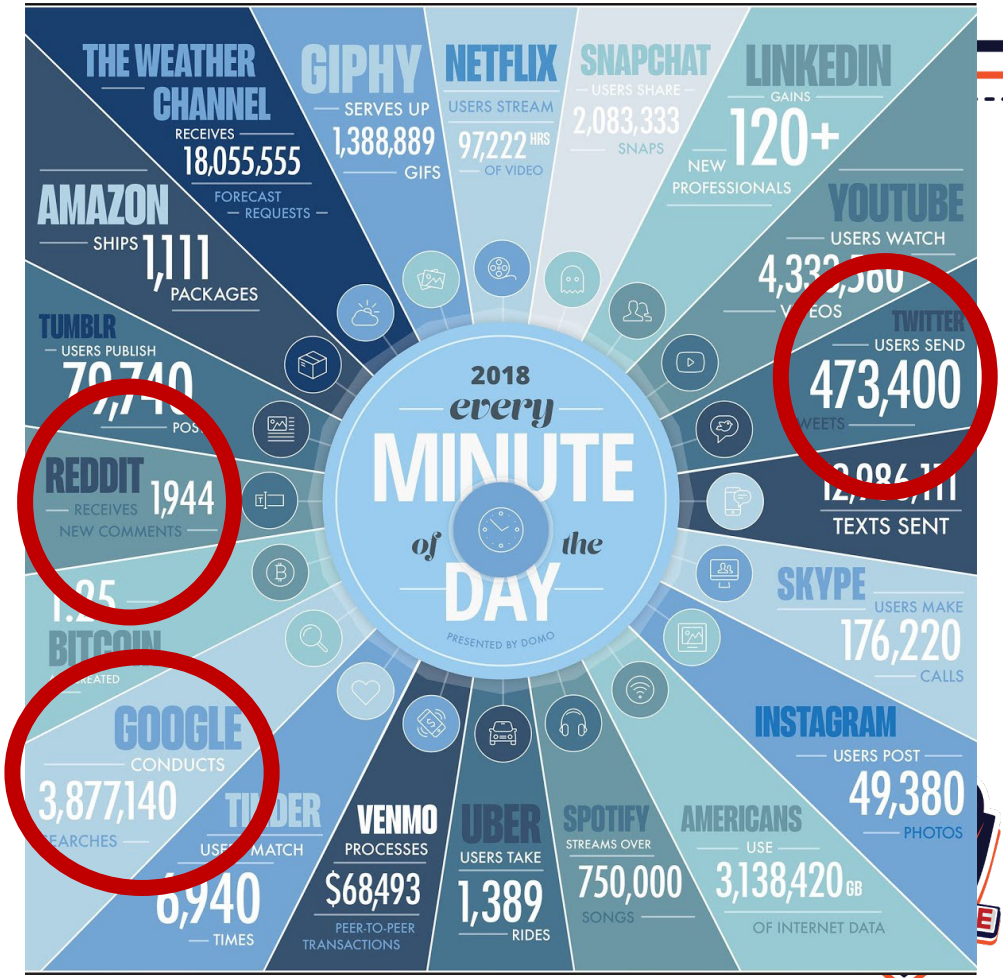


- GARFIELD WAS TRYING TO STAY COOL

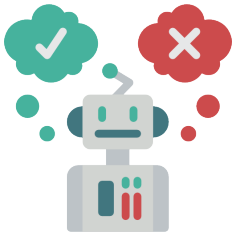
WHY

- Natural Language
- Convey information between 2 people
- Structured Vs Unstructured Data
- NLP is the interdisciplinary field combining computer science and linguistics



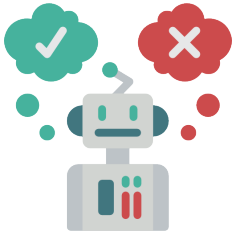
Source: https://www.domo.com/solution/data-never-sleeps-6

Natural Language Processing - NLP



- **MACHINE CAN INTERPRET HUMAN LANGUAGE**
  - Facilitates the Human Machine Interaction
  - Enables the Machine to Machine Interaction

Natural Language processing - NLP



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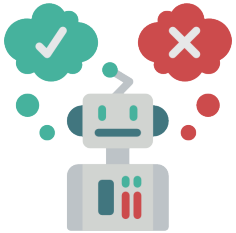
- **DATA DRIVEN AND KNOWLEDGE DRIVEN**
  - Machine Learning for data classification and generation
  - Semantic reasoning for data discovery and disambiguation

Natural Language Processing - NLP



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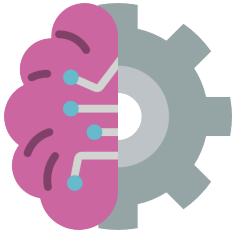
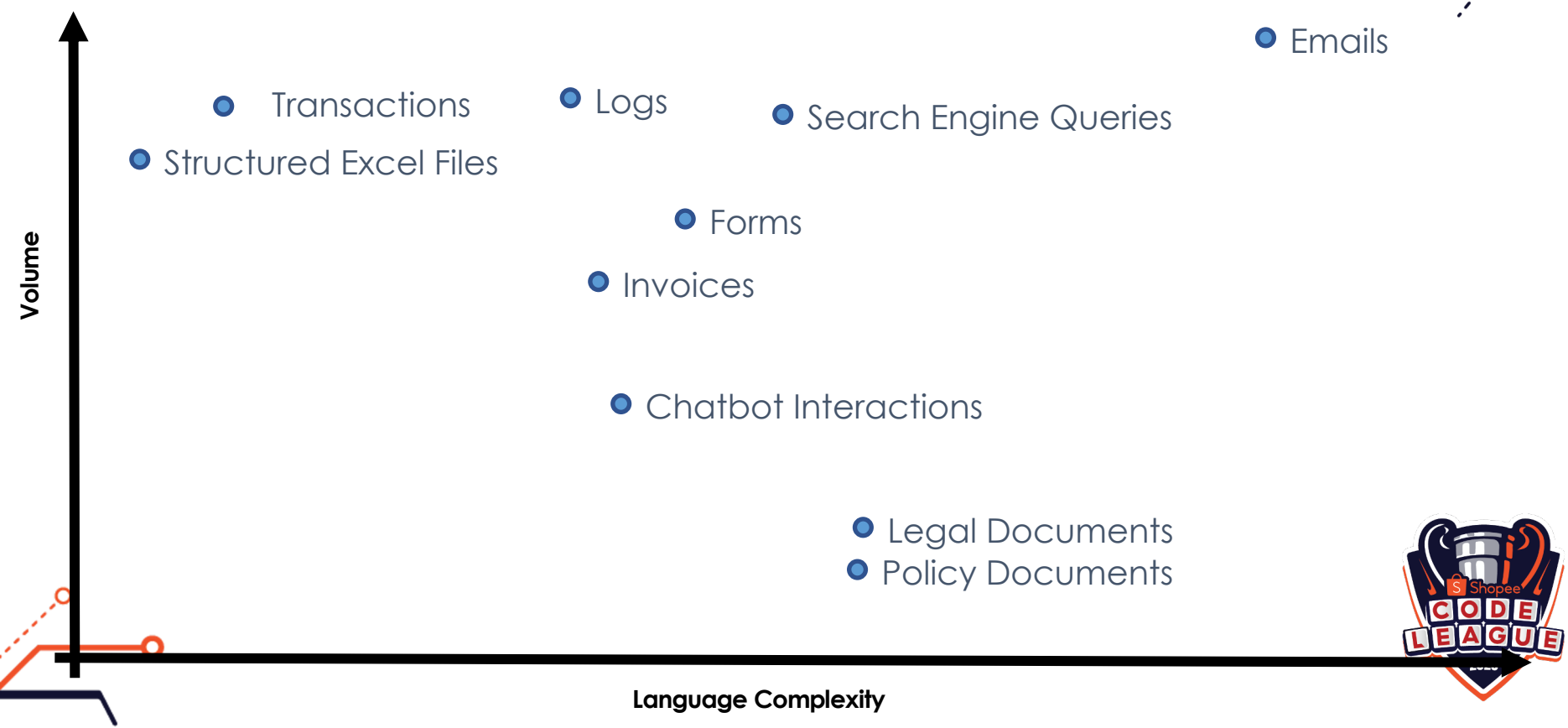


- **SIMULATING HUMAN BRAIN**
  - Current models performs well at individual task, still needs improvements for multiple tasks

WHY


Social Media
Emails
Transactions
Logs
Search Engine Queries
Structured Excel Files
Forms
Invoices
Chatbot Interactions
Legal Documents
Policy Documents
Volume
Language Complexity

Applications of NLP

1. Sentiment analysis
2. Chatbot
3. Speech recognition
4. Language Translation
5. Information retrieval/extraction
6. Advertisement matching

Applications of NLP

1. Sentiment analysis
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Nordstrom digs into 5-star customer reviews and finds a shipping problem.

Applications of NLP

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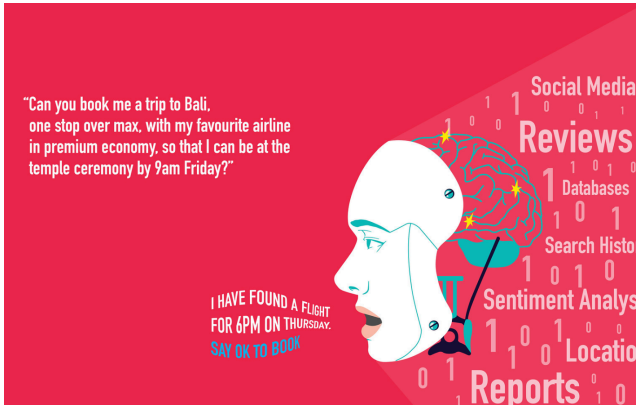

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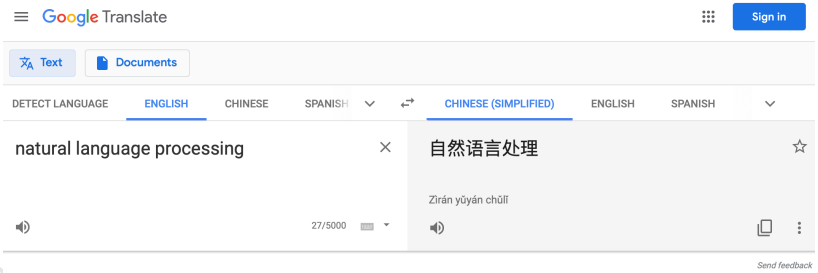

Applications of NLP

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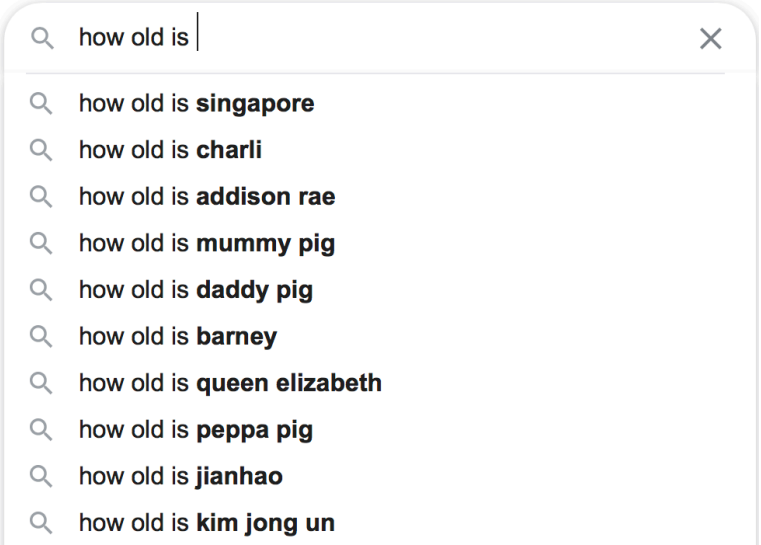
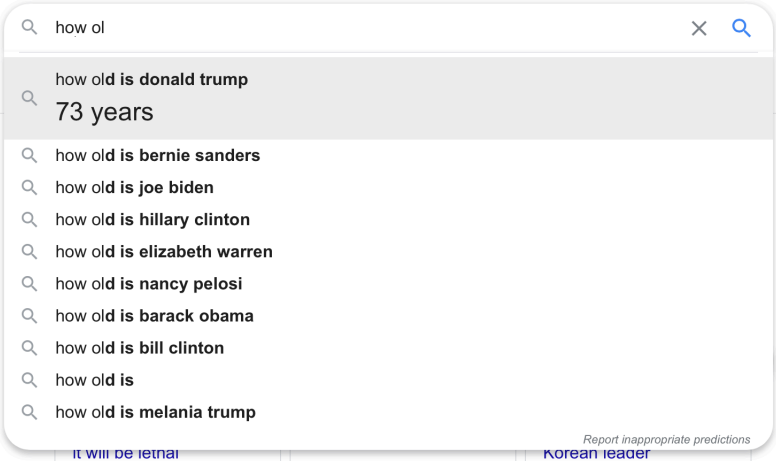
E.g. Semantic search engine





Walmart's semantic search engine increased conversion rates by 10-15%

Applications of NLP

1. Sentiment analysis
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6. Advertisement matching

Natural Language Processing

1. Natural Language Understanding
2. Natural Language Generation

Natural Language Understanding

TEXT NORMALISATION

She bought 10 apples and 10 oranges from the nearby grocer .

- **CONVERTING ALL LETTERS TO LOWER OR UPPER CASE**

  she bought 10 apples and 10 oranges from the nearby grocer .

- **CONVERTING NUMBERS INTO WORDS OR REMOVING NUMBERS**

  she bought apples and oranges from the nearby grocer .

- **REMOVING PUNCTUATIONS, ACCENT MARKS AND OTHER DIACRITICS**

  she bought apples and oranges from the nearby grocer

- **REMOVING WHITE SPACES**

  she bought apples and oranges from the nearby grocer

- **REMOVING STOP WORDS, AND PARTICULAR WORDS**

  bought apples oranges nearby grocer

You can add your own Stop word. Go to your NLTK download **directory path** -> **corpora** -> **stopwords** -> update the stop word **file** depends on your language which one you are using. Here we are using english (stopwords.words('english')).

PRE-PROCESSING

She bought 10 red apples and 10 cans of coca cola from the nearby grocer.

TOKENISATION	“bought” “red” “apples” “cans” “coca” “cola” “nearby” “grocer”
N-GRAMS	“red apples” “coca cola” “nearby grocer”
STEMMING	“bought” “appl” “can” “coca” “cola” “nearbi” “grocer”
PART OF SPEECH (POS) TAGGING	[('She', 'PRP'), ('bought', 'VBD'), ('10', 'CD'), ('apples', 'NNS'), ('and', 'CC'), ('10', 'CD'), ('cans', 'NNS'), ('of', 'IN'), ('coca', 'NN'), ('cola', 'NN'), ('from', 'IN'), ('the', 'DT'), ('nearby', 'JJ'), ('grocer', 'NN')]
NAMED ENTITY RECOGNITION	(S She/PRP bought/VBD 10/CD apples/NNS and/CC 10/CD cans/NNS of/IN (NP coca/NN) (NP cola/NN) from/IN (NP the/DT nearby/JJ grocer/NN))

Tokenisation

Taking a text or set of text and breaking it up into its individual tokens (sentences, words, characters)

She bought 10 red apples and 10 cans of coca cola from the nearby grocer.

TOKENISATION **“bought” “red” “apples” “cans” “coca” “cola” “nearby” “grocer”**

- New York, Los Angeles, Singapore Management University
- **Language specific:**

Chinese: 地铁站
French: L’ensemble

- **Context is often missing: “can”**

N-GRAMS

Sequence of N words, good for putting keywords into local context

bought red apples cans coca cola nearby grocer

NGRAMS **“bought red” “red apples” “apples can” “coca cola” “nearby grocer”**

BIGRAMS **“Coca cola”**

TRIGRAMS **The Three Musketeers**

4-GRAMS **National University of Singapore**

5-GRAMS **etc**

•Compression algorithms (the PPM variety especially) where the length of the grams depends on how much data is available for providing specific contexts.

•Approximate string matching (e.g. BLAST for genetic sequence matching)

•Predictive models (e.g. name generators)

•Speech recognition (phonemes grams are used to help evaluate the likelihood of possibilities for the current phoneme undergoing recognition)

STEMMING & LEMMATISATION

Reduce inflectional forms and sometimes derivationally related forms of a word to a **common base form, to bring variant forms of a word together**

SUFFIX
-ing
-ed
-es
-s
…

```
application
 Stemming: applic Lemmatizing: application
applying
 Stemming: appli Lemmatizing: apply
applies
 Stemming: appli Lemmatizing: apply
applied
 Stemming: appli Lemmatizing: apply
apply
 Stemming: appli Lemmatizing: apply
apples
 Stemming: appl Lemmatizing: apples
apple
 Stemming: appl Lemmatizing: apple
```

She bought 10 red apples and 10 oranges from the nearby grocer.

STEM **“bought” “appl” “orang” “nearbi” “grocer”**

LEMMATIZE **“buy” “apple” “orange” “nearby” “grocer”**

Porter: Most commonly used stemmer, and provides Java support.

Snowball: Improvement over the Porter algorithm, even Porter admits it is better than his original algorithm. Slightly faster computation time than porter, with a fairly large community around it.

To view the entire algorithm: http://people.scs.carleton.ca/~armyunis/projects/KAPI/porter.pdf

PART OF SPEECH TAGGING

Marking up a word in a corpus to a corresponding part of a speech tag, based on its context and definition

I **left** my keys in my **left** pocket.

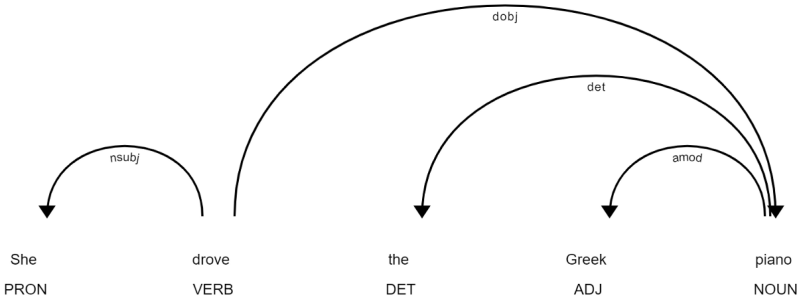
PART OF SPEECH (POS) TAGGING

[('I', 'PRP'), **('left', 'VBD'),** ('my', 'PRP$'), ('keys', 'NNS'), ('in', 'IN'), ('my', 'PRP$'), **('left', 'JJ'),** ('pocket', 'NN')]

Left - VBD verb, past tense took

Left - JJ adjective

Building parse trees, which are used in building Named Entity Recognisers and extracting relations between words, helps in Syntactic and semantic analysis



Types:

1. Lexical Based Methods
2. Rule-Based Methods
3. Probabilistic Methods
4. Deep Learning Methods

NAMED ENTITY Recognition

Identify all textual mentions of the named entities and classify them into pre-defined categories

She bought 10 red apples and 10 cans of coca cola from the nearby grocer.

NAMED ENTITY RECOGNITION

(S She/PRP bought/VBD 10/CD apples/NNS and/CC 10/CD cans/NNS of/IN (NP coca/NN) (NP cola/NN) from/IN (NP the/DT nearby/JJ grocer/NN))

Stanford's Named Entity Recognizer is based on an implementation of linear chain Conditional Random Field (CRF) sequence models. Model is only trained on instances of ***PERSON***, ***ORGANIZATION*** and ***LOCATION*** types.
Based on training data, the model will support different types of entities: https://spacy.io/api/annotation#section-named-entities

Samples of Pre-defined categories	Examples
Names of people	Joan, Jeremy, Adam
Organisations	Accenture, Apple, GoJek
Locations	City Hall, Mount Fuji,
Expressions of times	June, 1980, 2008-03-10
Percent	100%, Twenty pct,
Monetary value	18 Euros, $19, 600 Yen

Each POS tag is attached to a single word, while NER tags can be attached to multiple words.

https://towardsdatascience.com/a-comparison-between-spacy-ner-stanford-ner-using-all-us-city-names-c4b6a547290

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DOCUMENT TERM MATRIX

1

ORIGINAL STATEMENT

D1: Natural language processing is fun!
D2: Natural language processing is not fun!
D3: Drinking beer is fun!

2

PROCESSED STATEMENT

D1: natur languag process fun
D2: natur languag process fun
D3: drink beer fun

3

VECTOR OUTPUT

	natur	languag	process	fun	drink	beer
D1	1	1	1	1		
D2	1	1	1	1		
D3				1	1	1

Final vectors:
D1: (1,1,1,1,0,0)
D2: (1,1,1,1,0,0)
D3: (0,0,0,1,1,1)

TERM FREQUENCY VS. TERM FREQUENCY – INVERSE DOCUMENT FREQUENCY

- **TERM FREQUENCY (TF)**
  - Frequency of the term in the document
  - i.e. if the word appears twice, the frequency in the vector will be 2

- **TERM FREQUENCY - INVERSE DOCUMENT FREQUENCY (TF-IDF)**
  - Words that appear across multiple documents are less important (less discriminative)
  - Give higher weightage to words that appear less
  - $IDF(W) = log\frac{N}{df(W)}$
  - N = Number of documents
  - df(W) = Number of documents the word appears in
  - $TF - IDF\ (W) = TF(W) \times IDF(W)$

$IDF(W) = log\frac{100}{20}$

$TF - IDF\ (W) = 25 \times log\frac{100}{20}$

100 movie reviews
20 on movie reviews
'Avengers' → 25 times

5 min break

Natural Language Generation

Evolution of NLP algorithms

Evolution of NLP algorithms

- **Markov Chains**

* Hidden Markov Models

* Stochastic model that describes a sequence of possible events

- **Recurrent Neural Networks**

* Sequence – Sequence model

* Order matters! Live to eat vs Eat to live

* Vanishing gradients issue, where information was not propagating properly

- **Long Short Term Memory Models**

* Improvement of RNN, gating mechanisms to decide if input is important, but training time is still slow

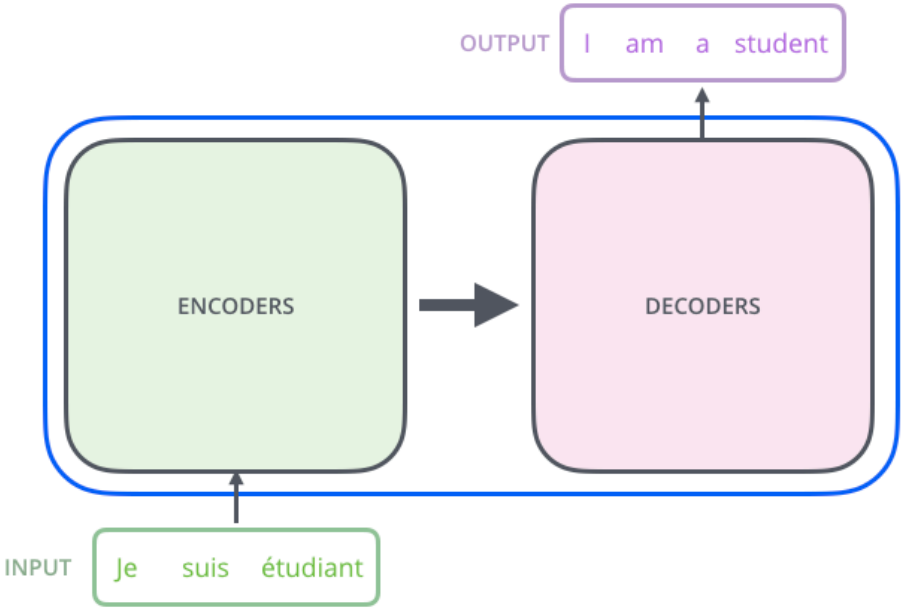
- ***Transformers**

Transformers –Attention is all you need

Attention based encoder decoder type architecture

Source: http://jalammar.github.io/illustrated-transformer/

Transformers



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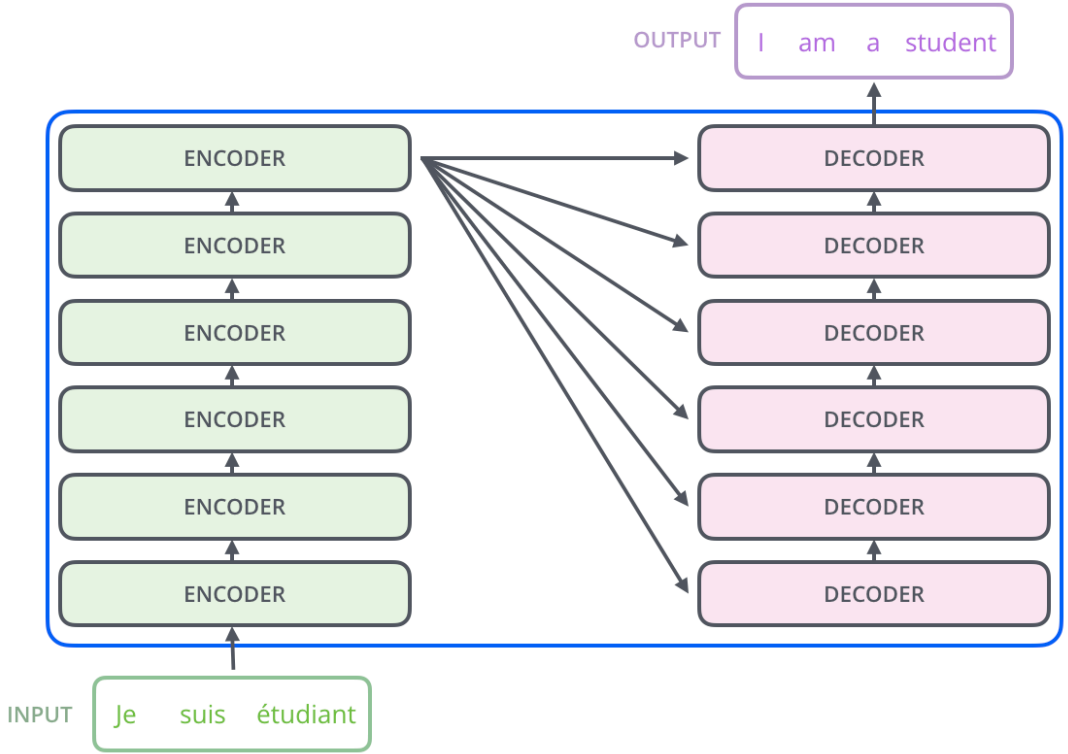
Transformers



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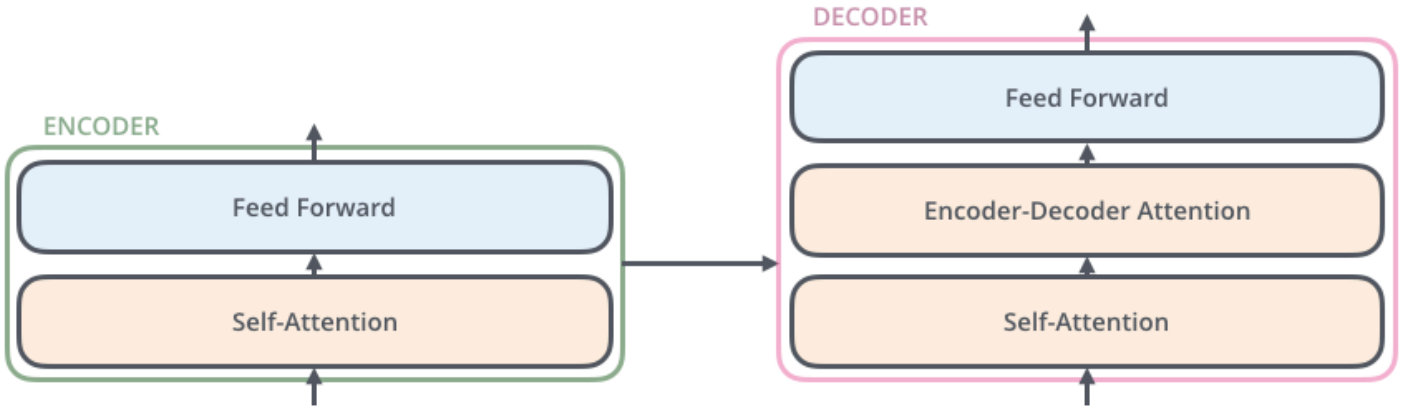

Source: http://jalammar.github.io/illustrated-transformer/

Transformers

- **Encoder Component**

* Encode the input layer to a continuous representation with attention information to help the decoder focus on appropriate words

* Encoding stack to further encode the data, boosting the predictive power of the transformer network

- **Decoder Component**

- Generates text from the encoder output, but with an additional attention layer
- Auto regressive;

- **Attention**

- As the model processes each word, it looks at the other positions in the input sequence to get a better encoding for the word
- The animal didn't cross the street because **it** was too tired.

Source: http://jalammar.github.io/illustrated-transformer/

BERT (Transformer)

- **B**idirectional **E**ncoder **R**epresentation **T**ransformer
- Developed and made open source by Google Research Team
- Pre trained model, trained on the entire Wikipedia and Book Corpus (in total 3,300 million words)
- Deeply Bidirectional
- Trained on a “fill in the next word/sentence” task on a large corpus

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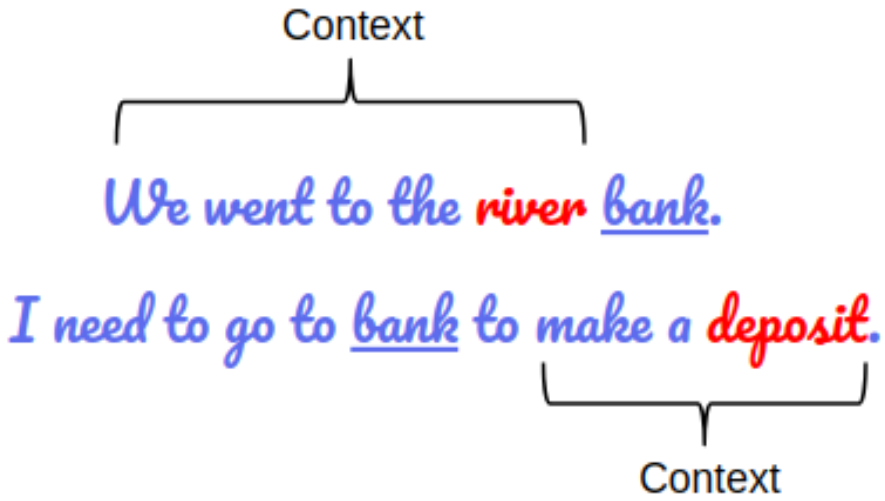
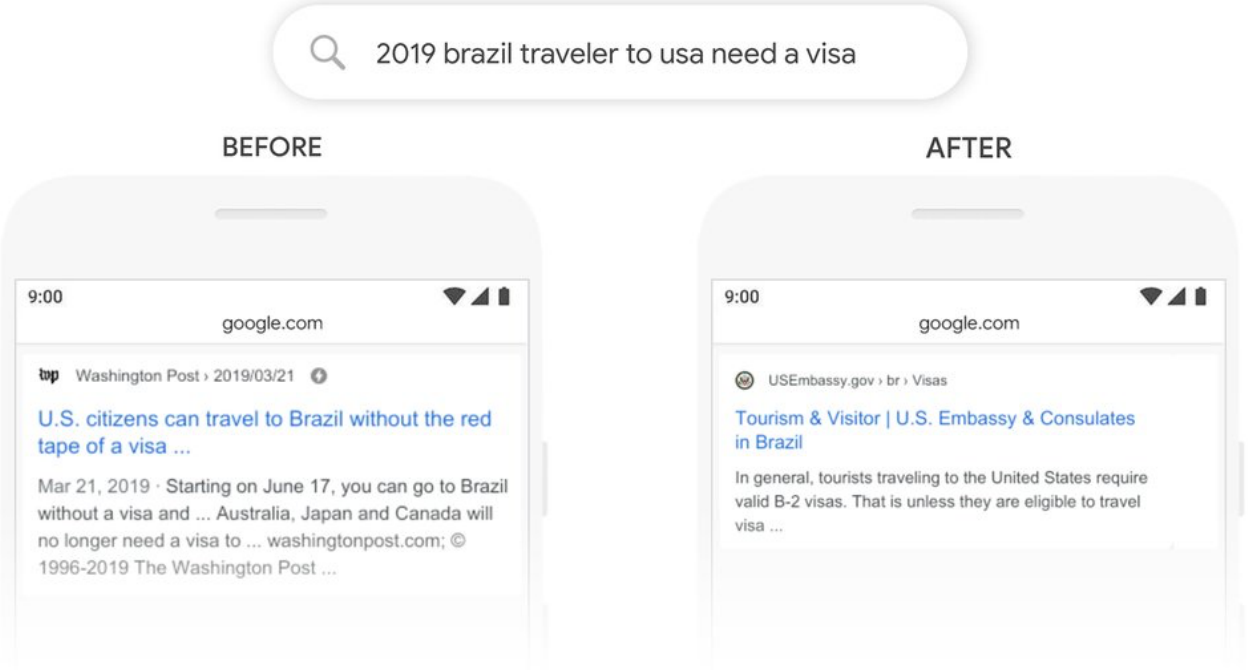
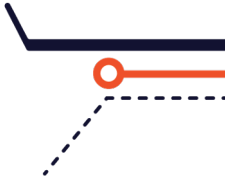

Context
We went to the river bank.
I need to go to bank to make a deposit.
Context



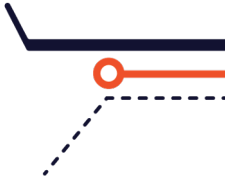
Source: https://www.blog.google/products/search/search-language-understanding-bert/

Why Fine Tuning

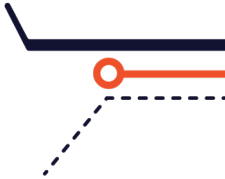
1. Quicker development
2. Less data is required
3. Better results



HANDS ON



NLP Usecases



Customer Services

Recommender Systems

Voice of customer

Underwriting

Claims Processing

Fraud Investigation

Medical Reports

Drug Safety Reports

Drug Discovery

Mergers & Acquisitions

Terms & Conditions

Policy writing

LIBOR Compliance

Fraud Investigation

KYC

Resume Screening

Enrollment Forms

Invoices & Receipts

"NLG offers significant opportunities to improve operations and user experiences. **By 2022, 25% of enterprises will use some form of natural language generation technology.**"

Source: http://blog.arria.com/in-the-news/gartners-first-ever-market-guide-for-nlg-declares-arria-a-world-leader-in-nlg

Your Feedback Matters!

https://techatshopee.formstack.com/forms/shopeecodeleague_workshopfeedbackform