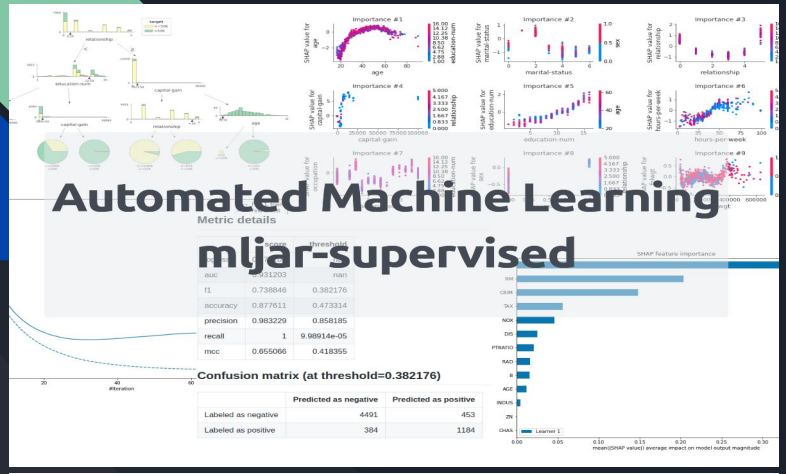
Text Representation in NLP

Sep 13 2020

Who am I ?


Automated Machine Learning
mljar-supervised
Metric details
Confusion matrix (at threshold=0.382176)
SHAP feature importance


Author: Shahul ES
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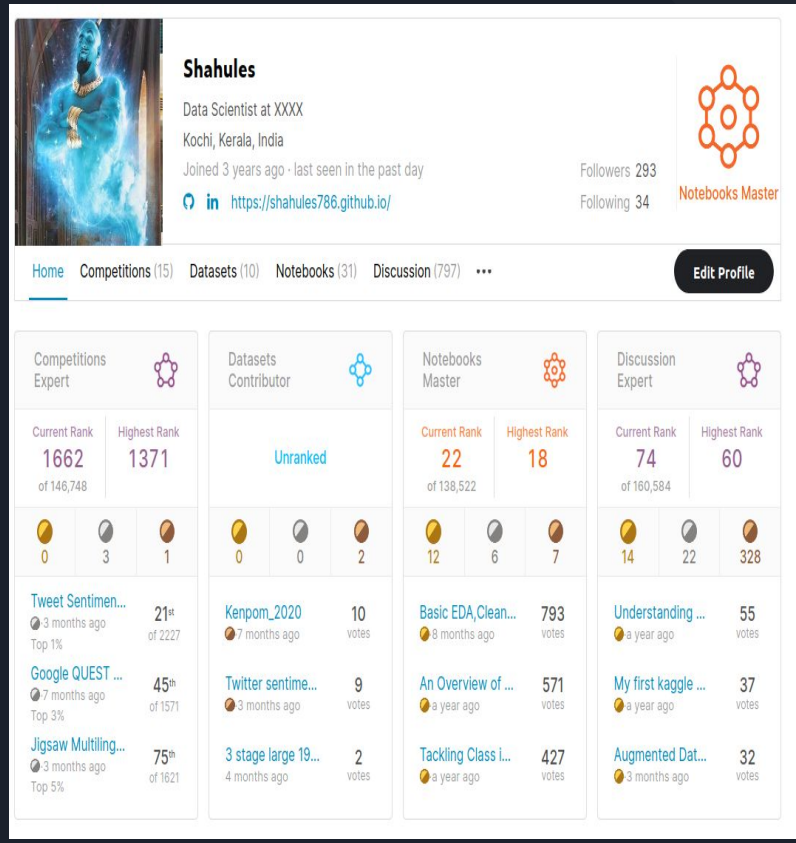
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Kochi, Kerala, India
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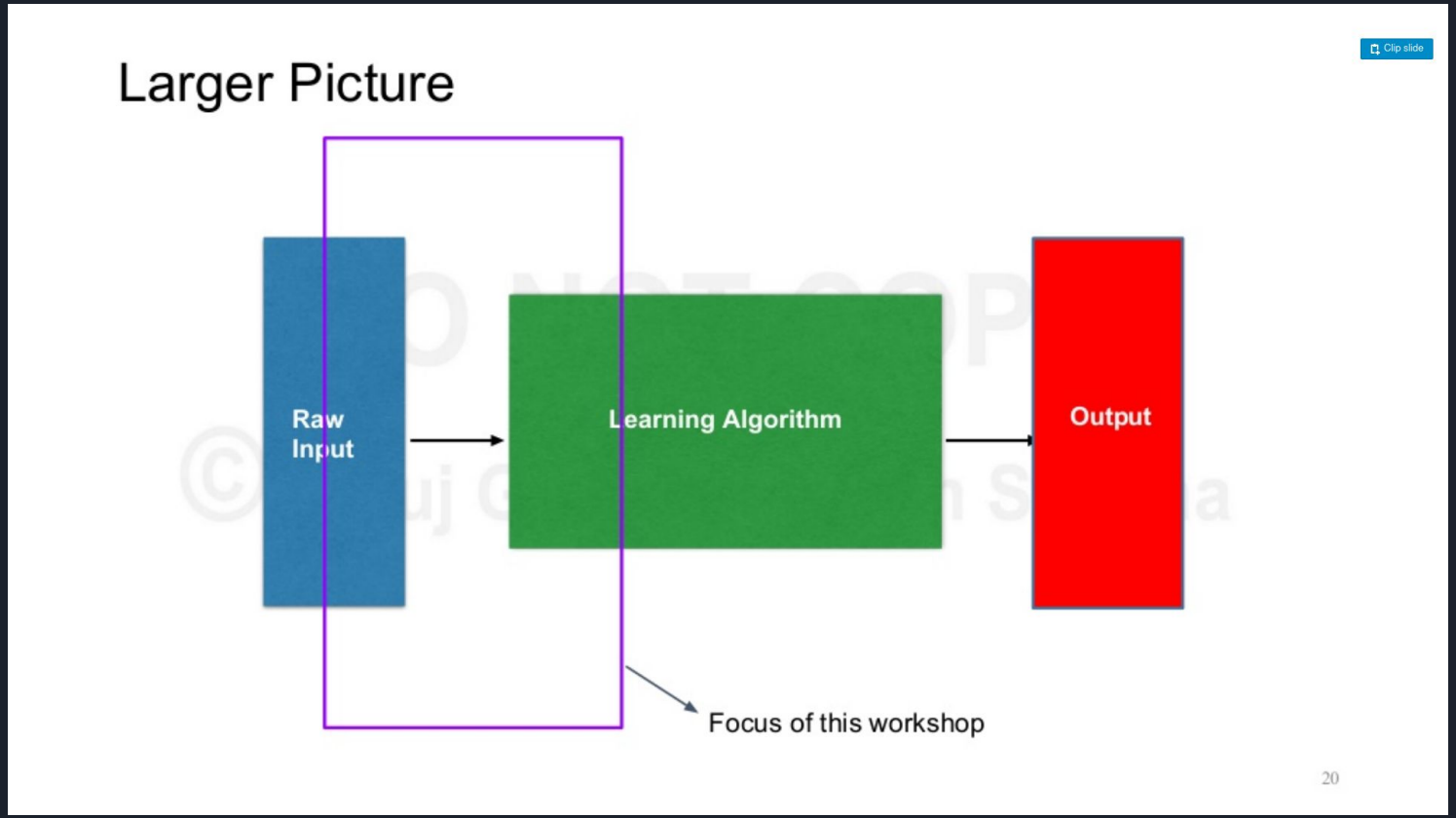
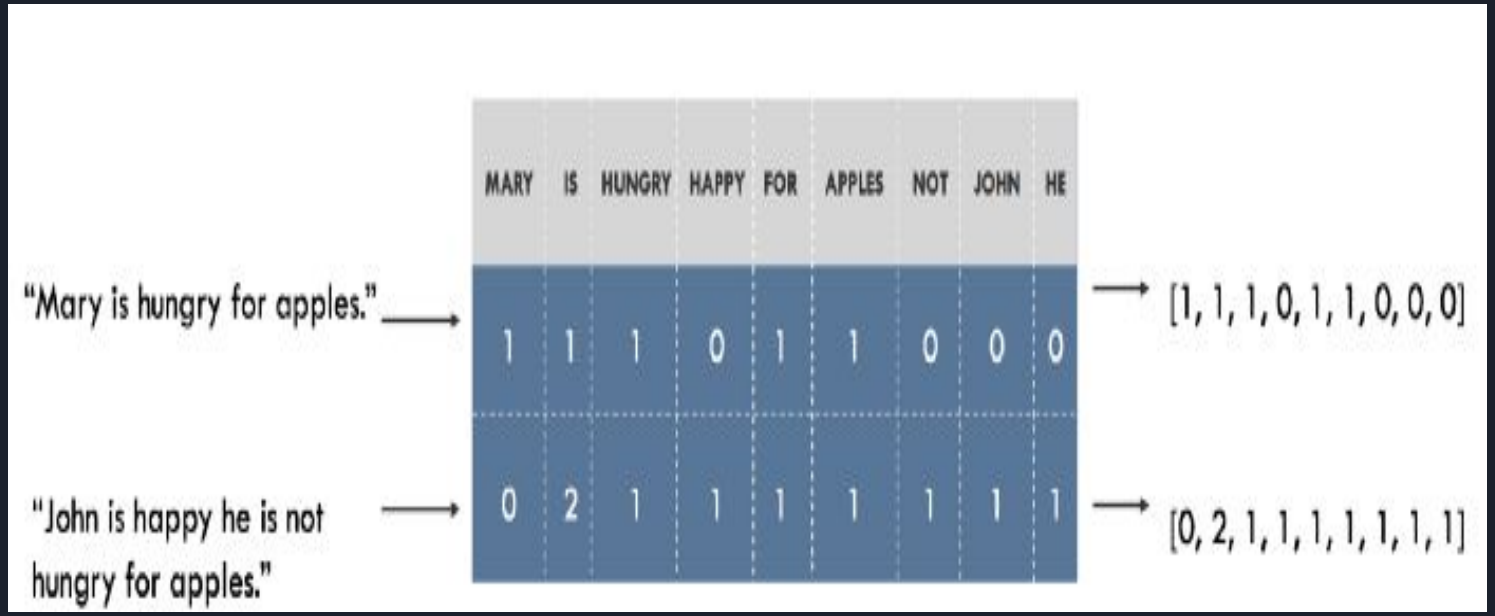
NLP Workflow



Bag of words


MARY IS HUNGRY HAPPY FOR APPLES NOT JOHN HE
"Mary is hungry for apples."
1 1 1 0 1 1 0 0 0
[1, 1, 1, 0, 1, 1, 0, 0, 0]
"John is happy he is not hungry for apples."
0 2 1 1 1 1 1 1 1
[0, 2, 1, 1, 1, 1, 1, 1, 1]

What’s the main issue?

- The words such as ‘is’, ‘the’, etc are called stopwords in Natural language processing.
- These words get more importance in bag of words model .

So, what next?

Inverse Document Frequency (IDF)

$$idf_t = \log \frac{number\ of\ documents}{number\ of\ documents\ with\ term\ 't'}$$

- Review 1: This movie is very scary and long
- Review 2: This movie is not scary and is slow
- Review 3: This movie is spooky and good

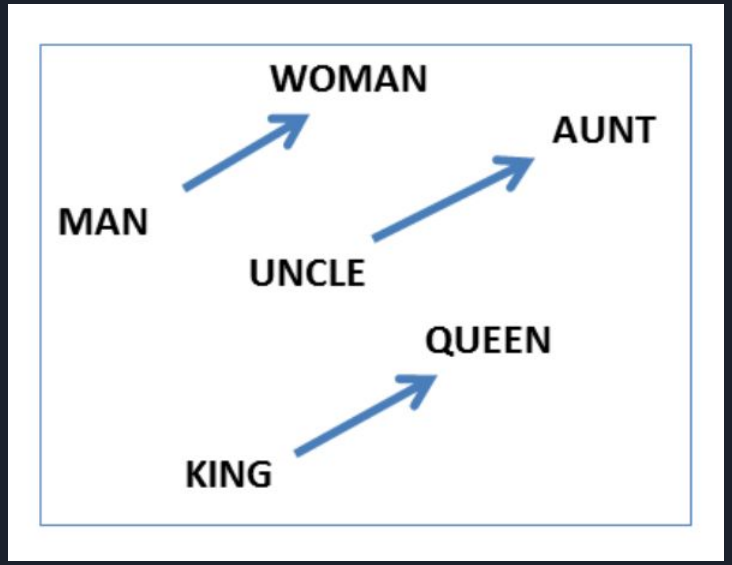
Term	Review 1	Review 2	Review 3	TF (Review 1)	TF (Review 2)	TF (Review 3)
This	1	1	1	1/7	1/8	1/6
movie	1	1	1	1/7	1/8	1/6
is	1	2	1	1/7	1/4	1/6
very	1	0	0	1/7	0	0
scary	1	1	0	1/7	1/8	0
and	1	1	1	1/7	1/8	1/6
long	1	0	0	1/7	0	0
not	0	1	0	0	1/8	0
slow	0	1	0	0	1/8	0
spooky	0	0	1	0	0	1/6
good	0	0	1	0	0	1/6

- IDF('movie',) = log(3/3) = 0
- IDF('is') = log(3/3) = 0
- IDF('not') = log(3/1) = log(3) = 0.48
- IDF('scary') = log(3/2) = 0.18
- IDF('and') = log(3/3) = 0
- IDF('slow') = log(3/1) = 0.48

So, What’s the issue?

- The size of matrix increases as the size of vocabulary increases.
- It does not capture position in text,semantics,co-occurrence in sentences.
- Out of vocabulary words, what happens when a new word occur during test?

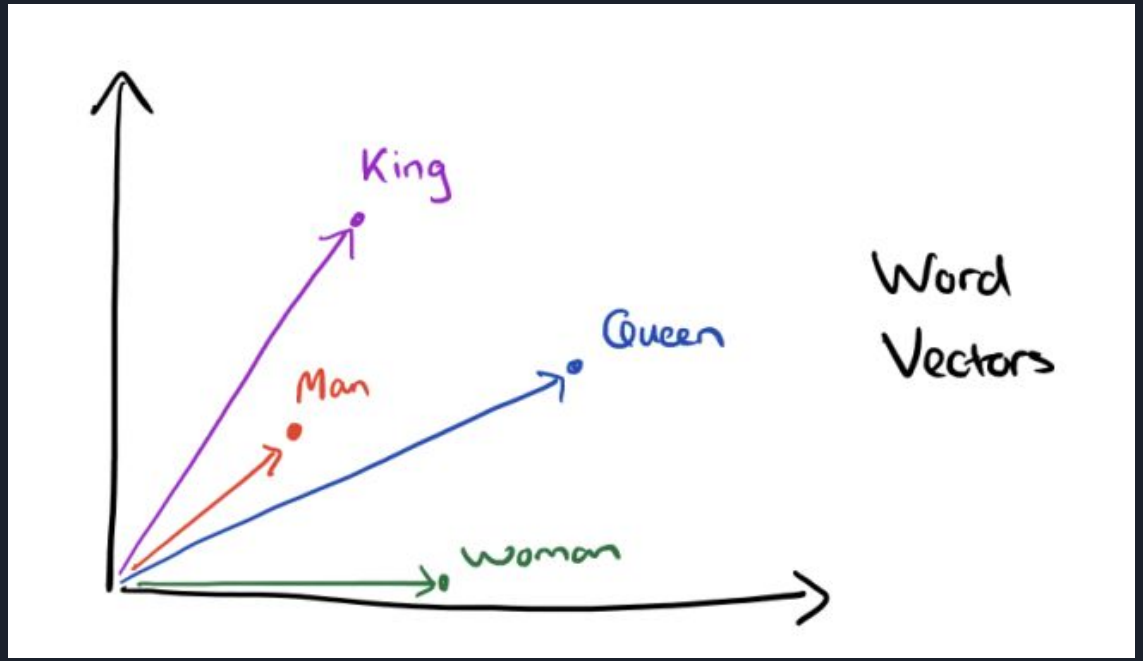
Word embeddings



- A word embedding is a learned representation for text where words that have the same meaning have a similar representation.
- It is this approach to representing words and documents that may be considered one of the key breakthroughs of deep learning on challenging natural language processing problems.
- Here each word is represented using a n dimensional vector.

Pre trained word embeddings

- Word2vec
- Glove
- Fastext



So,What's the issue again?

- Word embeddings are non contextual embeddings, meaning it does not take context in which word is used to create the representation.
- Out of vocabulary embeddings.

For example,

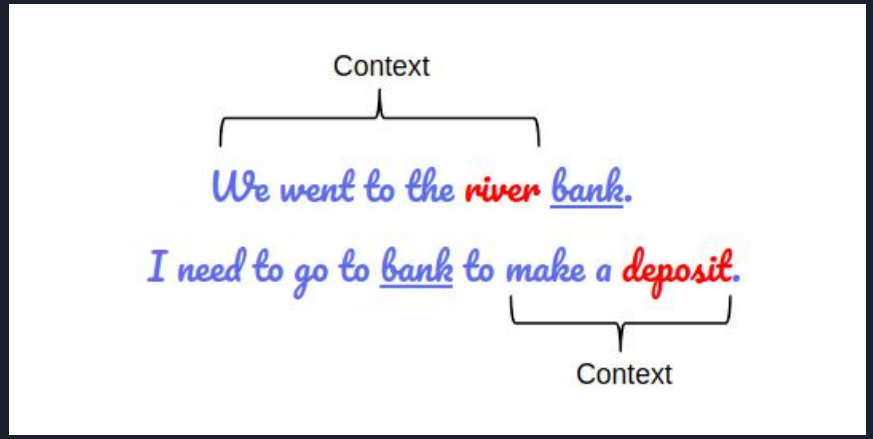
- I went to the bank for an enquiry.
- I was in the river bank.

Here the word "bank" is used in different context, but will have same representation using word embeddings.

BERT

- BERT stands for Bidirectional Encoder Representations from Transformers.
- It is designed to pre-train deep bidirectional representations from unlabeled text by jointly conditioning on both left and right context.
- As a result, the pre-trained BERT model can be fine-tuned with just one additional output layer to create state-of-the-art models for a wide range of NLP tasks.

So,what's the final result?



We have very different representation for these two sentences which is finally what we wanted to have.