Reflectiveness Classification NLP

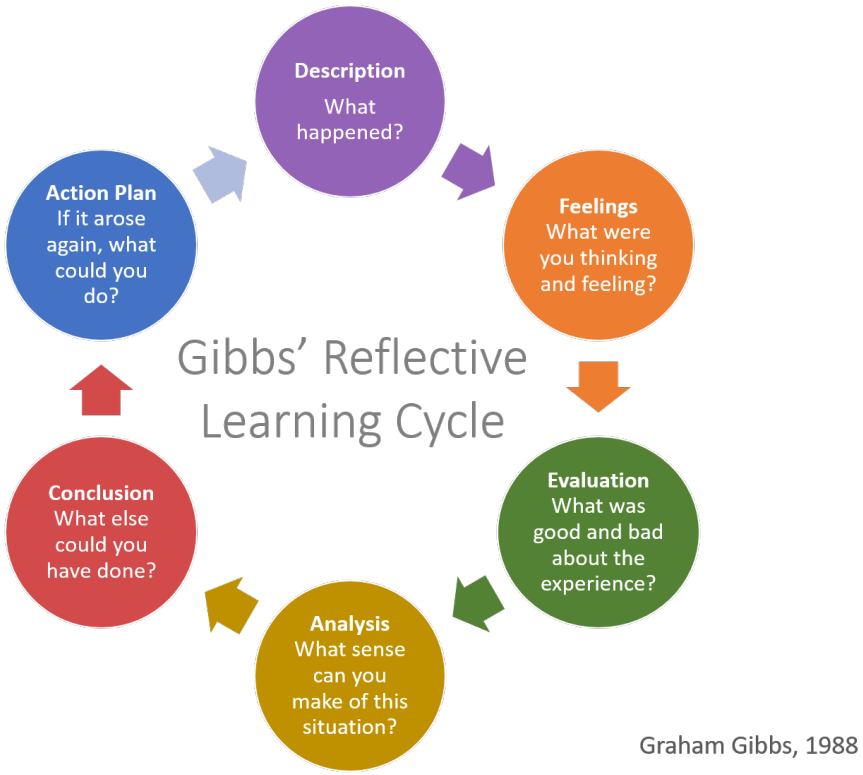
- Hyosang, Raniya
- SoftwareProject - Supervised and unsupervised machine learning in the science of behaviour

Contents

Introduction of Project

- Student’s learning experience

- -> Public corpus of reflective student essays in German
- -> Dundee uni, FU Berlin, TU Berlin



Graham Gibbs, 1988

Annotation

- Label
- 0: Description
- 1: Feelings
- 2: Evaluation
- 3: Analysis
- 4: Conclusion
- 5: Action Plan

- + if one sentence applies for multiple labels, then highest

Data set

- Total entries: 7620
- “options” column – multi-label target
- “final” column – single label target
- manual translation for English sentences

	corpus_id	sentence_id	sentence	options	final
0	0	0.0	Zunächst habe ich meinen Arbeitsplatz vorberei...	0,2	0
1	0	1.0	Anschließend las ich das Fallbeispiel mehrmals...	0	0
2	0	2.0	Ich bin neutral und offen an die Aufgabe heran...	0,1	1
3	0	3.0	Nachdem ich zunächst die Aufgabe ohne Lerninha...	0,2	2
4	0	4.0	Die Tipps haben mir sehr geholfen, um meine Lö...	2	2

EDA- preprocessing

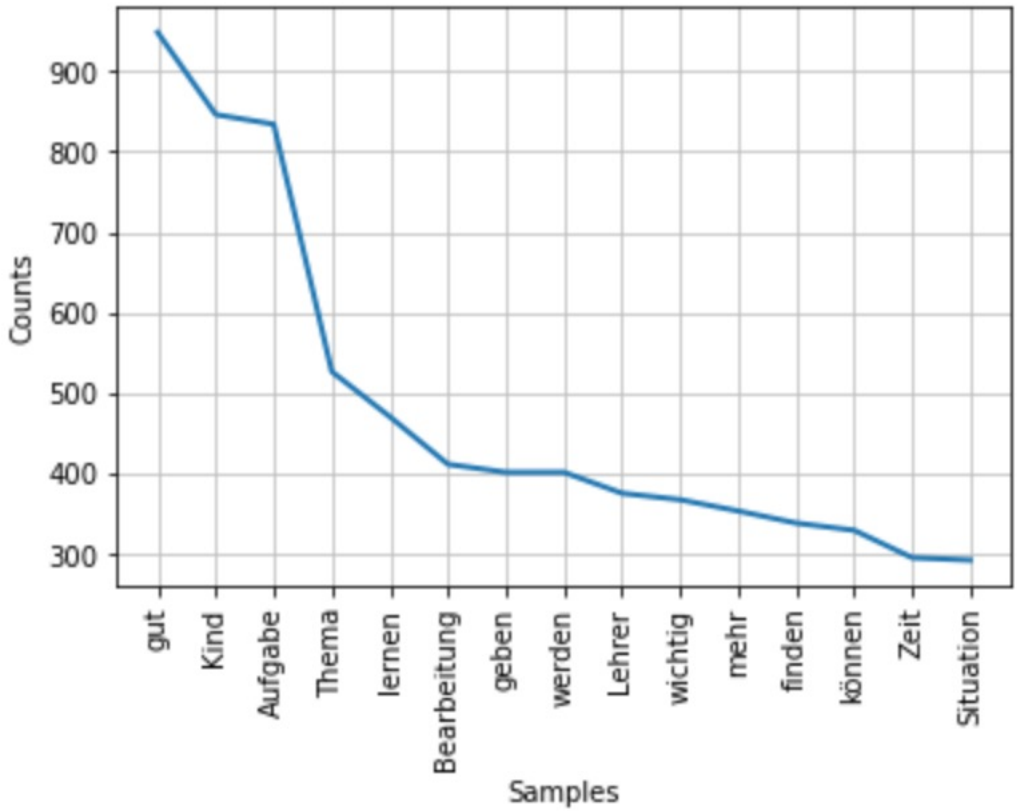
Non—german alphabets, Lower case

Stopwords

Stemming /Lemmatization

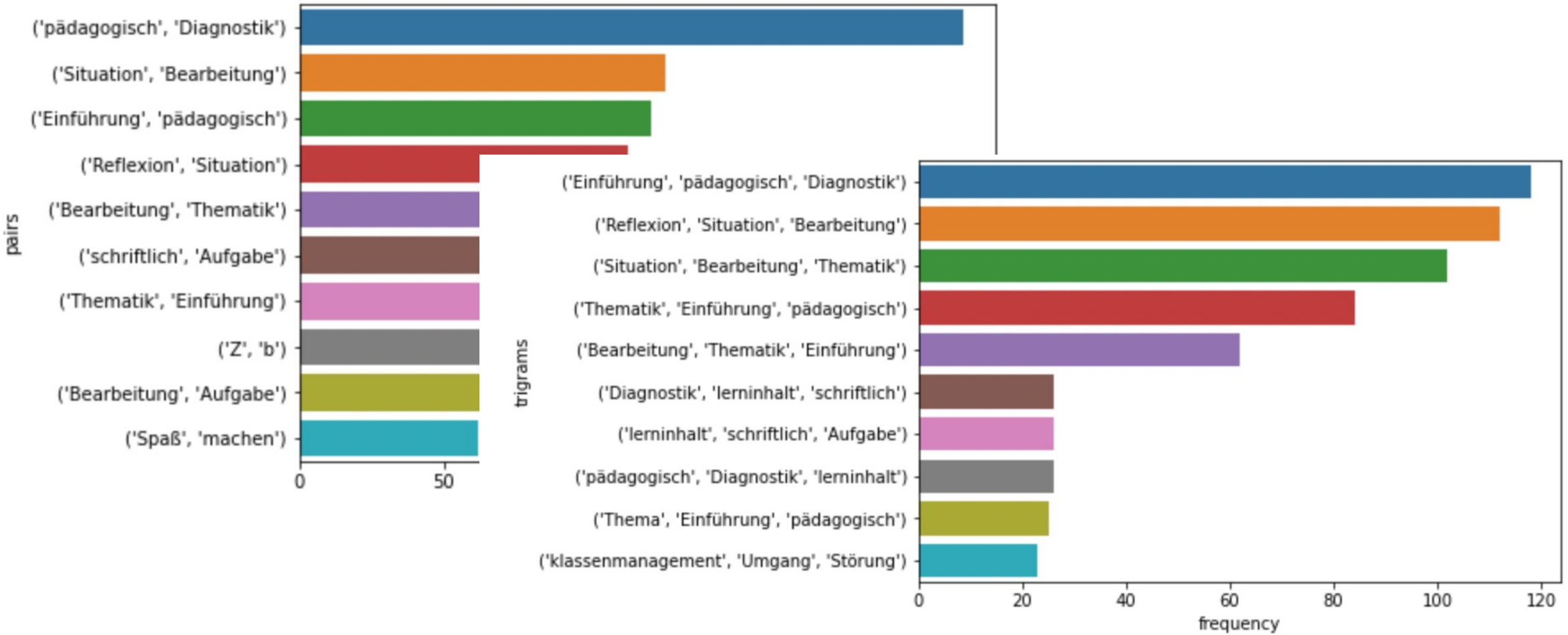
- Redundant
- Decision
- HanTa

EDA – unigram frequency




```
('gut', 948),
('Kind', 846),
('Aufgabe', 834),
('Thema', 527),
('lernen', 471),
('Bearbeitung', 412),
('geben', 402),
('werden', 402),
('Lehrer', 376),
('wichtig', 368)]
```

EDA – bigram, trigram frequency



Model selection – single target

Traditional model

- SVM
- Naiive Bayes
- Random Forest

BERT

Bidirectional

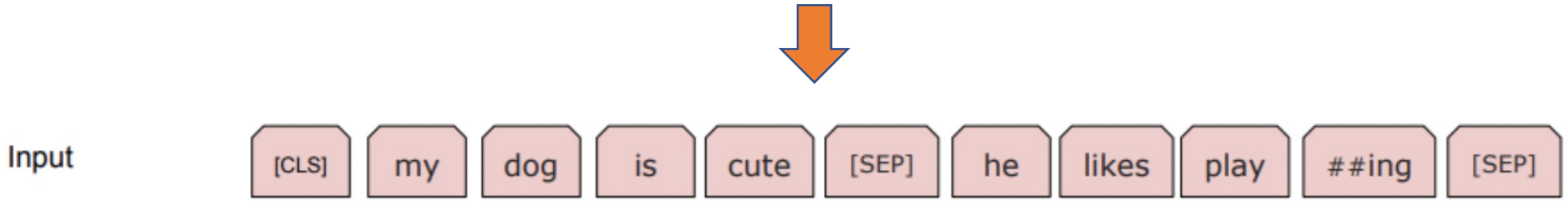
Encoder

Representations from

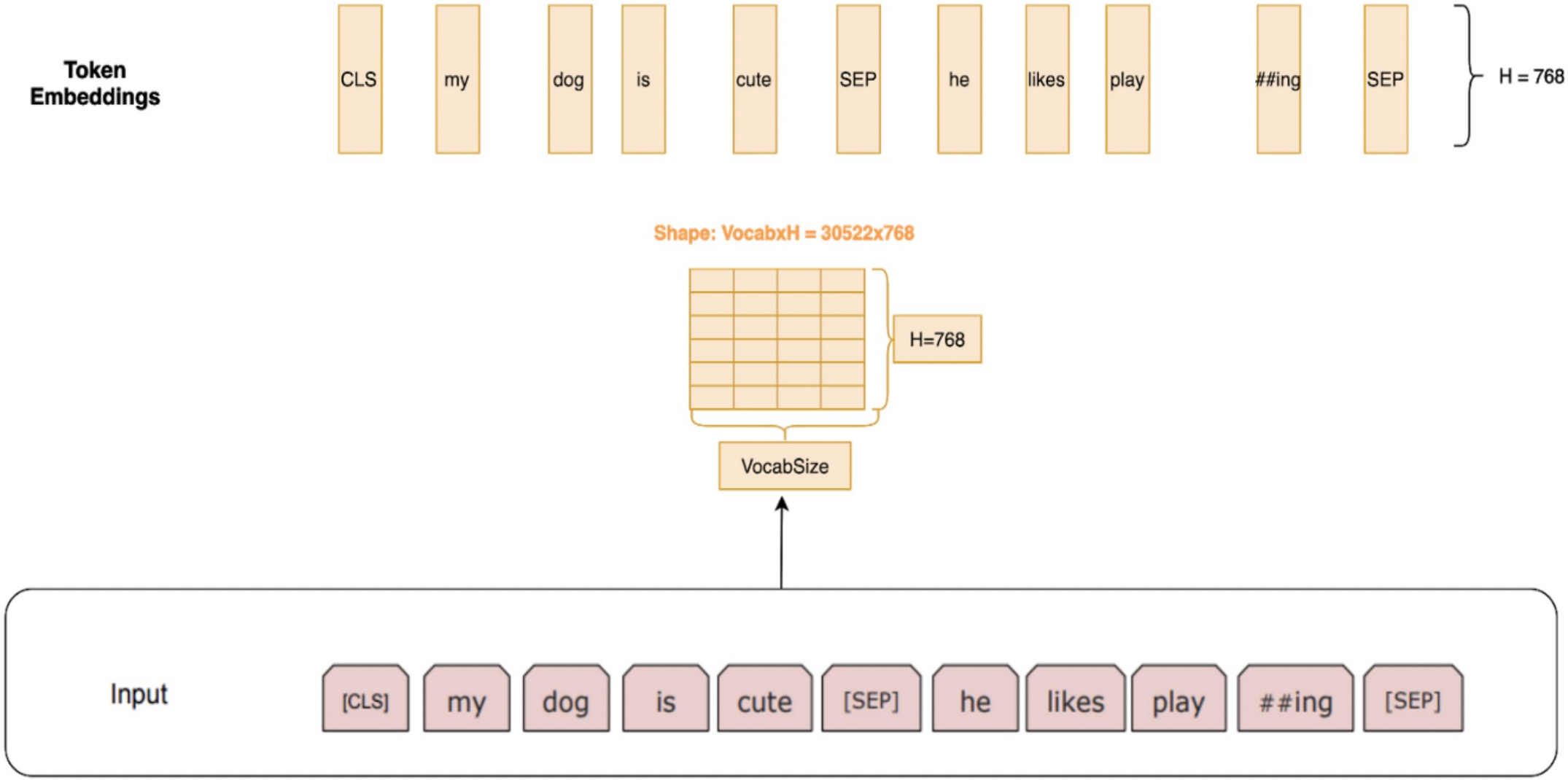
Transformers

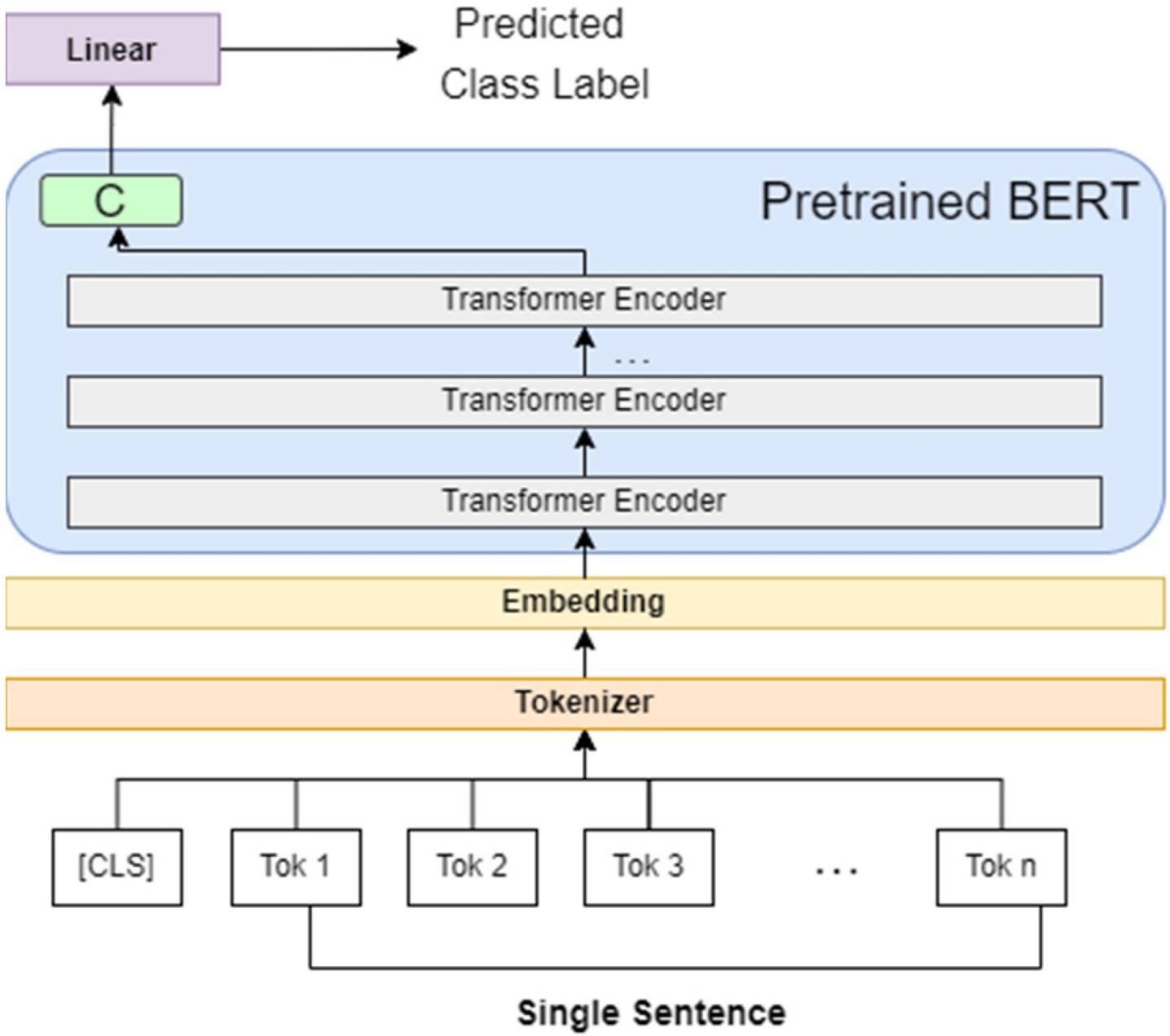
BERT classification

“My dog is cute. He likes playing”



Token embeddings


Token Embeddings
CLS
my
dog
is
cute
SEP
he
likes
play
##ing
SEP
H = 768
Shape: VocabxH = 30522x768
H=768
VocabSize
Input
[CLS]
my
dog
is
cute
[SEP]
he
likes
play
##ing
[SEP]


Linear
Predicted
Class Label
C
Pretrained BERT
Transformer Encoder
...
Transformer Encoder
Transformer Encoder
Embedding
Tokenizer
[CLS]
Tok 1
Tok 2
Tok 3
...
Tok n
Single Sentence

Preprocessing – single target

Bag of Words

	about	bird	heard	is	the	word	you
About the bird, the bird, bird bird bird	1	5	0	0	2	0	0
You heard about the bird	1	1	1	0	1	0	1
The bird is the word	0	1	0	1	2	1	0

* Each sentence in row
* If a word exists in the sentence, +1 otherwise 0.

Training & Evaluation - single target

- Difference in metrics by preprocessing method was negligible
- Corpus: Stemming, Lemmatization, Lemmatized and stemmed

<stemmed>	Svm	Naiive Bayes	Random Forest
F1 score	0.48	0.46	0.42
Cohen’s Kappa	0.2973	0.3094	0.2472

Training & Evaluation - single target

- Metrics for comparison will be added in project document

	BERT
Accuracy	0.5958

Preprocessing – multi label target

BERT process contains itself preprocessing

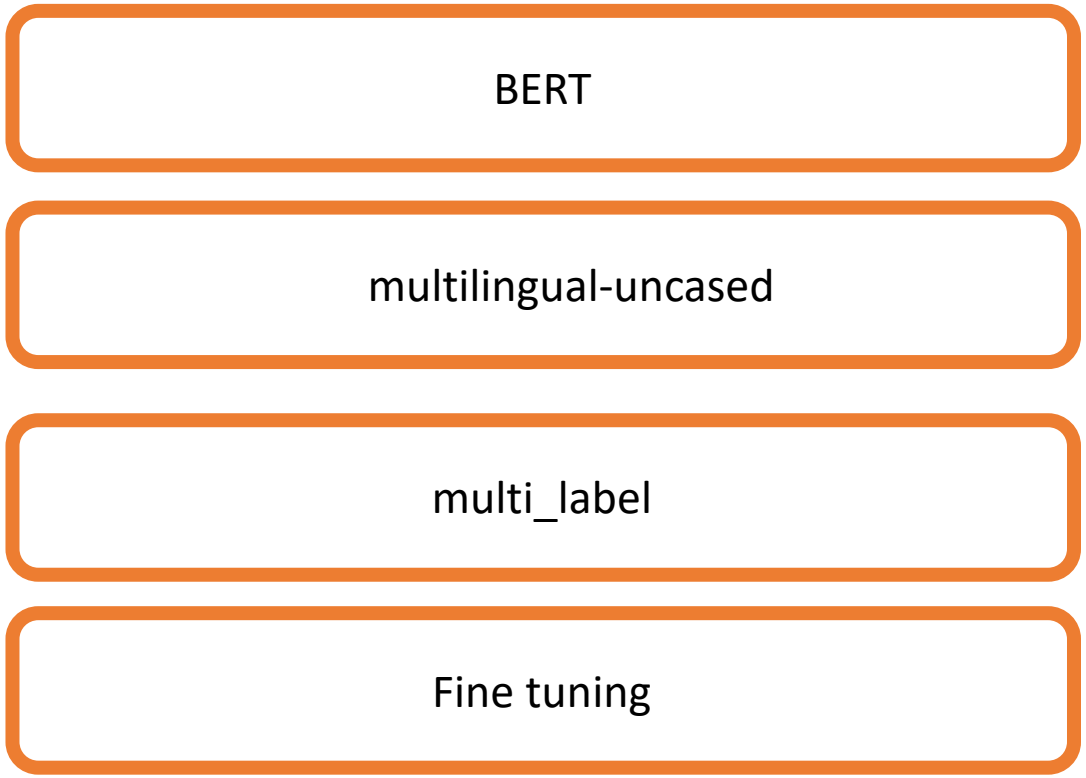
1) Token embeddings (attention_mask)
2) Segment embeddings (Token_type_ids)
3) Positional embeddings

*Input to BERT: raw data

1) Stopwords needed: contextual model
2) Each encoder (uncased, lower case) will preprocess

Model selection – multi label target

***Parameters**



Training & Evaluation– multi label target

***Hamming loss: 0.4055118110236205**

	precision	recall	f1-score	support
0	0.79	0.68	0.73	797
1	0.52	0.40	0.46	134
2	0.44	0.55	0.49	333
3	0.38	0.52	0.44	186
4	0.25	0.03	0.06	31
5	0.44	0.65	0.52	43
accuracy			0.59	1524
macro avg	0.47	0.47	0.45	1524
weighted avg	0.62	0.59	0.60	1524

Evaluation summary

- <Single target>
- 0.42 <= F1 score <= 0.48
- 0.24 <= Cohen's Kappa <=0.31

- <Multi labeled target>
- Hamming loss: 0.4055
- Avg weighted precision: 0. 62
- Avg weighted recall: 0.59
- Avg weighted f1 score: 0.60

-

Cohen's Kappa: [0,1]

- The agreement between classifier and real values (rater 1, rater 2)

Hamming loss: [0,1]

- fraction of the wrong labels to the total number of labels

Python example

https://colab.research.google.com/drive/1kn8Qd3kAEwI6UYto5EGE0S3JZICtfQbT#scrollTo=7Gpe9D1QHoCd

Entire code

https://colab.research.google.com/drive/1Ps2fTAt5ClPYHVTWSz2wS2q_lyd_KWSw#scrollTo=BbGnaDVVDWRq

BERT