



# *NLP Application in Education:*

Whether my kids write a great essay?

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# ***Background: NLP application on Education***

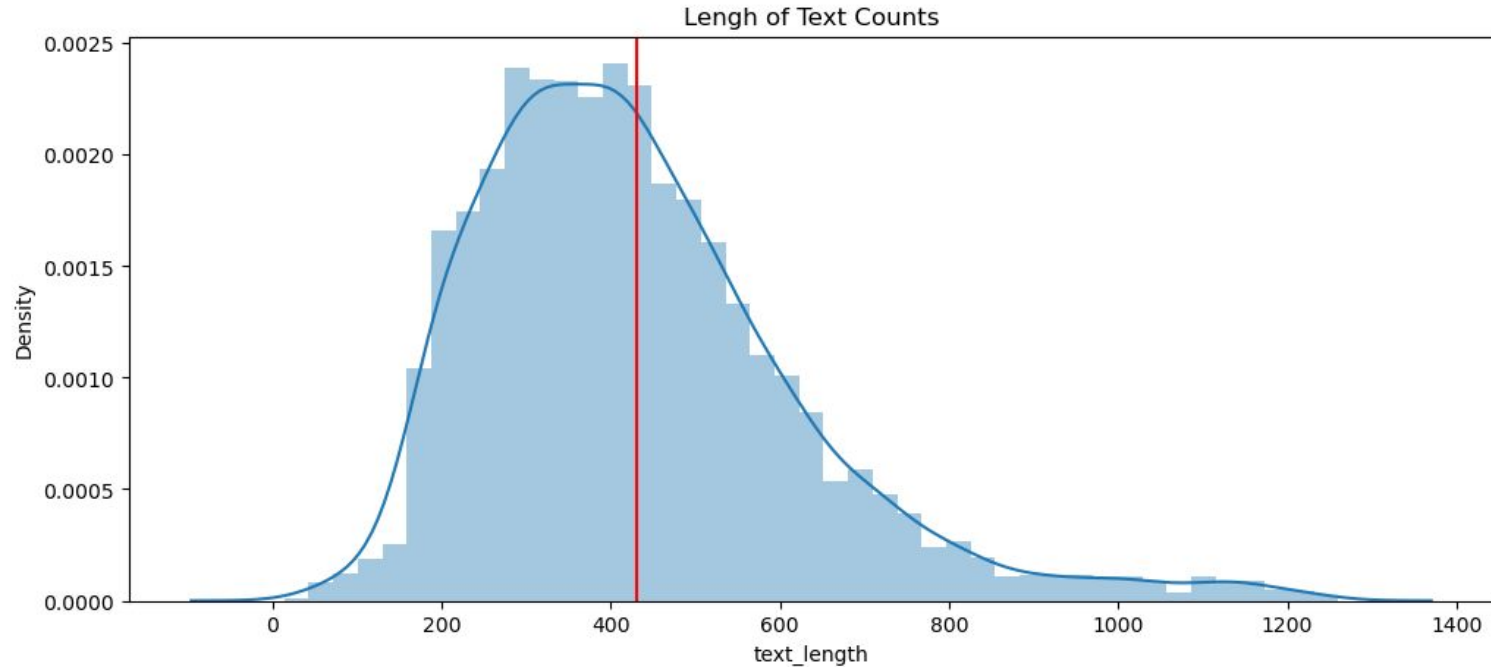
**Problem:** Current auto feedback tools are not designed for English as a second language learners

**Purpose:** assess writing proficiency of writing for 8th - 12th grade English as Second Language Learners

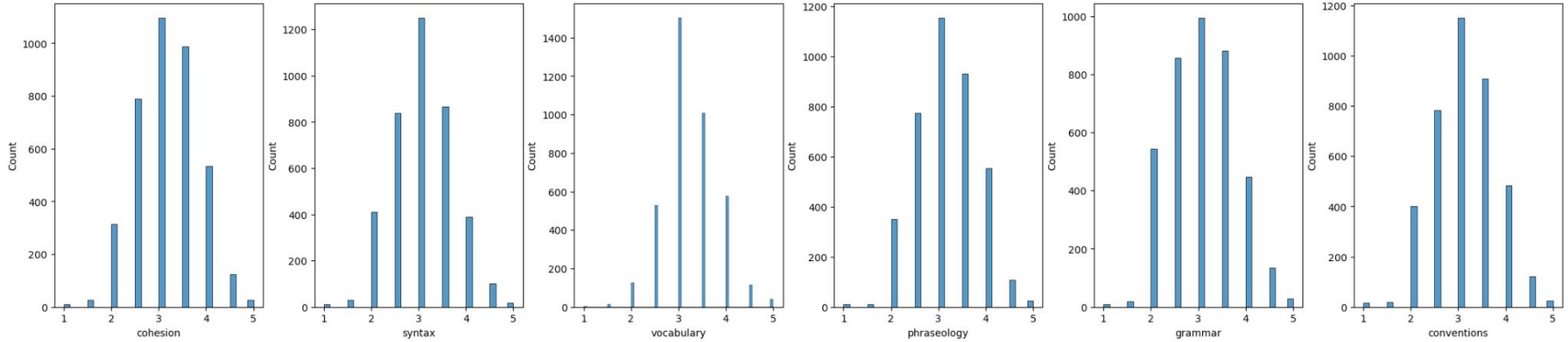
## **Dataset:**

- Train: 3911 student essay and 6 scores (cohesion, syntax, vocabulary, phraseology, grammar, conventions)
- Test: 3 student essay + 2 book paragraphs + 3 essay write by group members

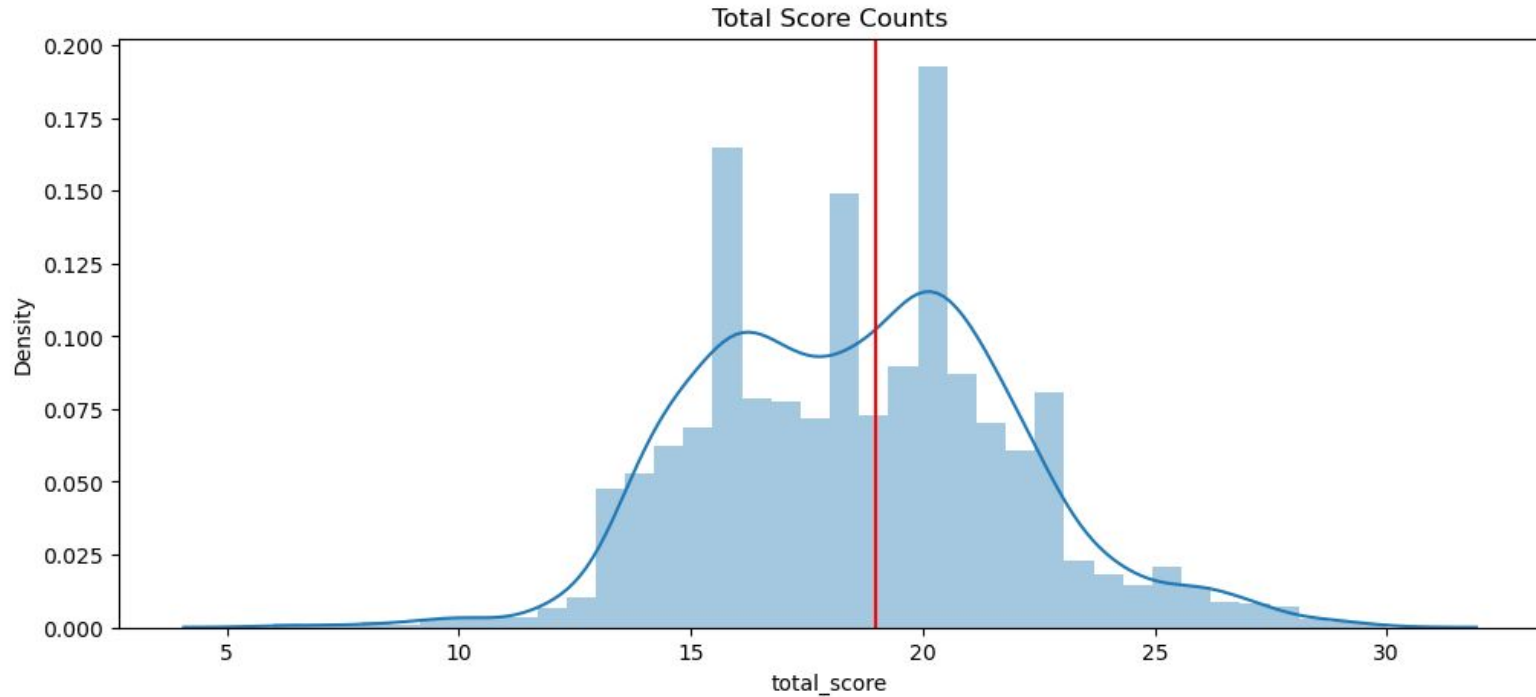
# *EDA: Essay Length Distribution*



# *EDA: Score Distribution*



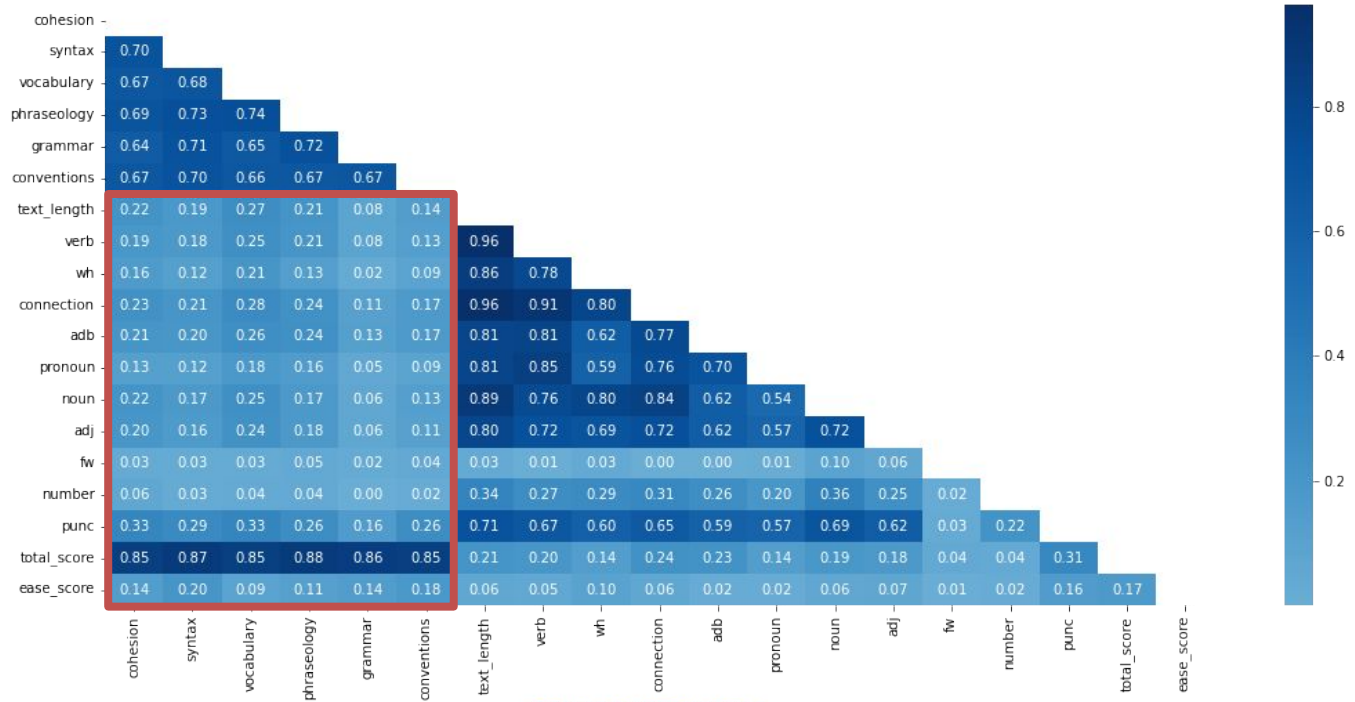
# *EDA: Total Score Distribution*



# EDA: Correlation Matrix

Utilized  
**nltk.pos\_tag()**  
to generate  
following  
categories:

- Noun,
- Verb,
- Adj,
- Adv,
- Others.



# *Before Training: validation data*

In order to better assess the accuracy of our models, we randomly split a test dataset from the train data

	text_id	full_text	cohesion	syntax	vocabulary	phraseology	grammar	conventions
272	13C400DD9794	The year book is for to not forget anything an...	2.0	2.0	2.0	2.0	2.0	2.0
3051	D9BC7F4F22F0	Well what i think about praising for a student...	2.5	2.5	2.5	3.0	2.5	2.0
800	3E170458E9A1	I\ndisagree that first impressions are almos...	2.0	2.0	2.0	2.0	2.0	2.5
3206	E0BFF1488787	I disagree with schools having a program with ...	2.5	2.0	2.5	2.0	2.0	2.5
2664	C50BE3C76571	I dont like becuase the student forget all inf...	3.0	2.5	2.0	2.0	2.0	2.5

# *Before Training: add prediction set*

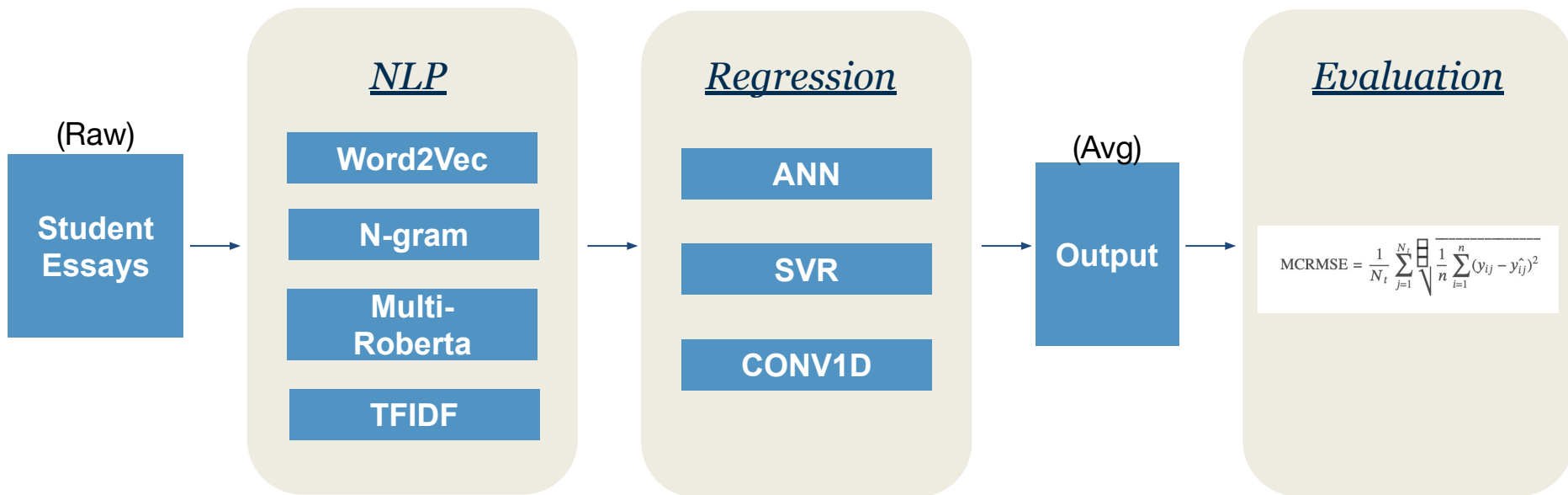
	text_id	full_text
0	0000C359D63E	when a person has no experience on a job their...
1	000BAD50D026	Do you think students would benefit from being...
2	00367BB2546B	Thomas Jefferson once states that "it is wonde...
3	hp	Dumbledore and Professor McGonagall bent forwa...
4	tkm	Being Southerners, it was a source of shame to...
5	high school	With the development of the technology, more a...
6	college1	"We need to move to a place with an elevator."...
7	college2	In the article "Beyond borders: what it means ...



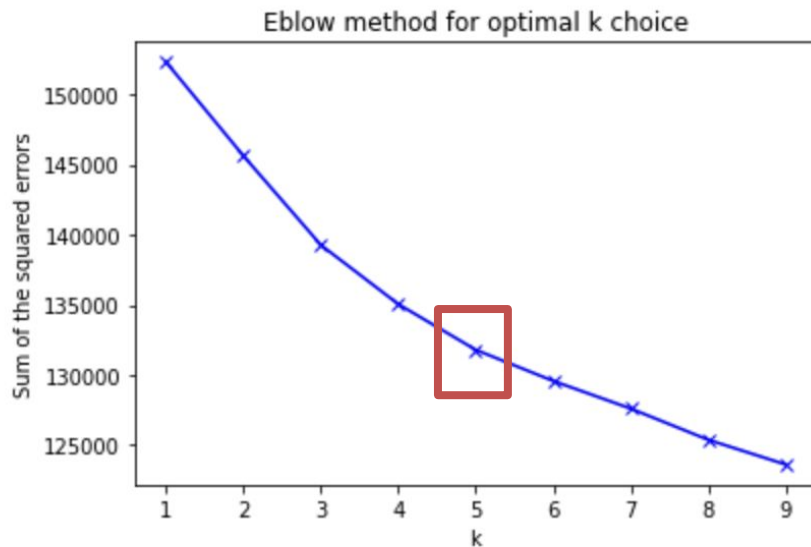
# *Before Training: learn about testset*

	text_id	full_text	text_length	verb	adj	adb	punc
0	0000C359D63E	when a person has no experience on a job their...	835	188	39	45	35
1	000BAD50D026	Do you think students would benefit from being...	386	87	14	16	22
2	00367BB2546B	Thomas Jefferson once states that "it is wonde...	442	107	29	26	33
3	hp	Dumbledore and Professor McGonagall bent forwa...	675	126	58	38	96
4	tkm	Being Southerners, it was a source of shame to...	560	85	36	15	56
5	high school	With the development of the technology, more a...	287	45	23	13	41
6	college1	"We need to move to a place with an elevator."...	654	141	59	19	82
7	college2	In the article "Beyond borders: what it means ...	330	72	47	20	30

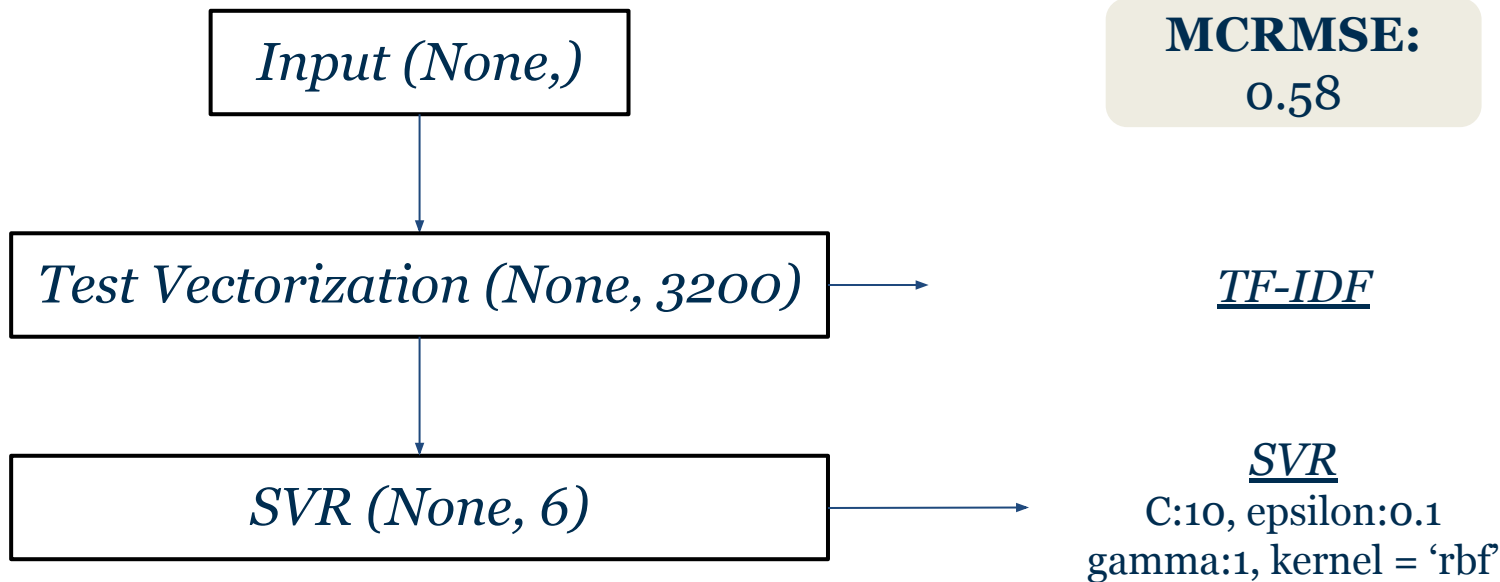
# *Methodology: how the task is analyzed*



# *Before Training: Find the K-fold Value*



# *Model 1: TF-IDF + SVR*



## ***Result:** Weak Correlation between TF-IDF and grammar*

	text_id	full_text	text_length	verb	adj	adb	punc
0	0000C359D63E	when a person has no experience on a job their...	835	188	39	45	35
1	000BAD50D026	Do you think students would benefit from being...	386	87	14	16	22
2	00367BB2546B	Thomas Jefferson once states that "it is wonde...	442	107	29	26	33

	cohesion	syntax	vocabulary	phraseology	grammar	conventions
text_id						
0000C359D63E	2.903885	2.846374	3.243762	3.129120	2.709364	2.811444
000BAD50D026	3.051334	2.783242	2.934718	2.746411	2.696641	2.949309
00367BB2546B	3.452976	3.466839	3.510834	3.404067	3.320165	3.382930

# Model 2: TFIDF + Simple ANN

input_1: InputLayer	input:	[(None,)]
	output:	[(None,)]

**MCRMSE:**  
0.51

text_vectorization: TextVectorization	input:	None
	output:	(None, 3200)

TF-IDF

dense: Dense	input:	(None, 3200)
	output:	(None, 64)

dense_1: Dense	input:	(None, 64)
	output:	(None, 32)

dense_2: Dense	input:	(None, 32)
	output:	(None, 6)

SIMPLE ANN  
Learning rate: 0.01  
Activation:  
dense - softmax  
dense\_1- softmax  
dense\_2 - no activation

## ***Result: TF-IDF works not well for syntax and grammar***

	text_id	full_text	text_length	verb	adj	adb	punc
0	0000C359D63E	when a person has no experience on a job their...	835	188	39	45	35
1	000BAD50D026	Do you think students would benefit from being...	386	87	14	16	22
2	00367BB2546B	Thomas Jefferson once states that "it is wonde...	442	107	29	26	33

	text_id	cohesion	syntax	vocabulary	phraseology	grammar	conventions
0	0000C359D63E	3.170754	3.059791	3.266031	3.159034	3.099517	3.123996
1	000BAD50D026	2.515758	2.466123	2.650434	2.497699	2.415305	2.492382
2	00367BB2546B	3.338218	3.228927	3.430204	3.337766	3.258210	3.290874

# Model 3: N-gram Selection for CONV1D

Hi there everyone  
unigrams

Hi there everyone  
bigrams

Hi there everyone  
trigrams

## What are N-Grams?

N-Grams are words, or combinations of words, broken out by the number of words in that combination.

with no n-gram  
**MCRMSE: 0.52**

input_1: InputLayer	input:	[(None, None)]
	output:	[(None, None)]

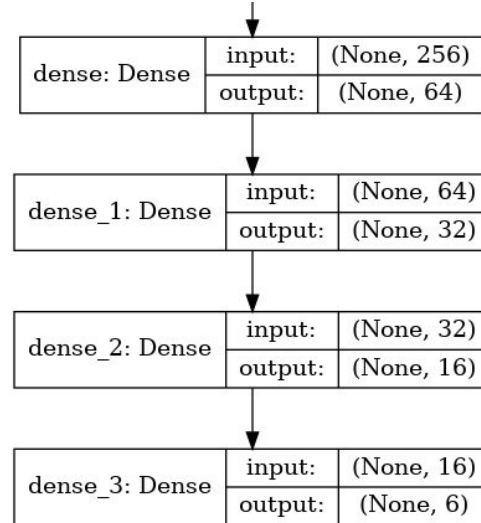
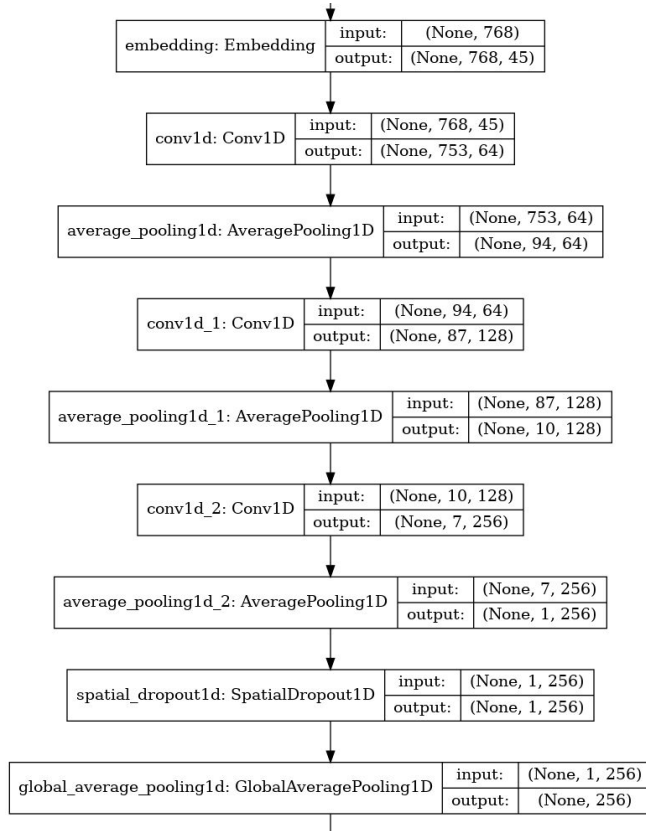
text_vectorization: TextVectorization	input:	(None, None)
	output:	(None, 768)

N-gram

with 2-gram  
**MCRMSE: 0.50**



# Model 3: Conv1D + Dense layers

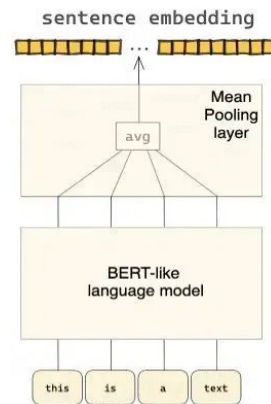
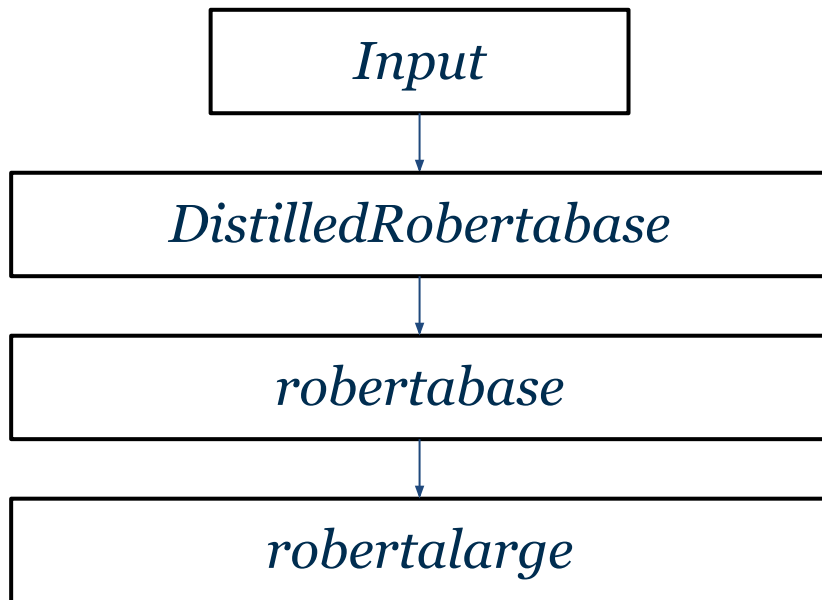


# *Result: Predict better on shorter essay*

	text_id	full_text	text_length	verb	adj	adb	punc
0	0000C359D63E	when a person has no experience on a job their...	835	188	39	45	35
1	000BAD50D026	Do you think students would benefit from being...	386	87	14	16	22
2	00367BB2546B	Thomas Jefferson once states that "it is wonde...	442	107	29	26	33

	cohesion	syntax	vocabulary	phraseology	grammar	conventions
text_id						
0000C359D63E	3.002721	2.930361	3.150743	3.010087	2.931262	2.964754
000BAD50D026	2.962226	2.896393	3.113395	2.970697	2.900718	2.935039
00367BB2546B	3.311953	3.204410	3.407299	3.341134	3.259400	3.240060

# Model 4: Pretrained Roberta + ANN



## Hyperparameter

Optimizer: Adam

Pooling: Mean Pooling

Loss: huber\_loss

SVR: C= 10

# *Result: Multi Embeddings enhance the accuracy*

	text_id	full_text	text_length	verb	adj	adb	punc
0	0000C359D63E	when a person has no experience on a job their...	835	188	39	45	35
1	000BAD50D026	Do you think students would benefit from being...	386	87	14	16	22
2	00367BB2546B	Thomas Jefferson once states that "it is wonde...	442	107	29	26	33

	text_id	cohesion	syntax	vocabulary	phraseology	grammar	conventions
0	0000C359D63E	2.847516	2.767603	2.990523	2.889130	2.576317	2.593019
1	000BAD50D026	2.724639	2.471339	2.718179	2.438099	2.157643	2.610832
2	00367BB2546B	3.447244	3.366904	3.545405	3.535074	3.348391	3.309278

**MCRMSE: 0.47**

# *Result: Multi-Roberta outperform all models*

	text_id	full_text	text_length	verb	adj	adb	punc
0	0000C359D63E	when a person has no experience on a job their...	835	188	39	45	35
1	000BAD50D026	Do you think students would benefit from being...	386	87	14	16	22
2	00367BB2546B	Thomas Jefferson once states that "it is wonde...	442	107	29	26	33

	cohesion	syntax	vocabulary	phraseology	grammar	conventions
text_id						
0000C359D63E	2.981219	2.901032	3.162765	3.046843	2.829115	2.873303
000BAD50D026	2.813489	2.654274	2.854182	2.663226	2.542577	2.746890
00367BB2546B	3.387598	3.316770	3.473436	3.404510	3.296542	3.305785

**MCRMSE: 0.48**

# Prediction: Compare to “textstats” Package

text_id	full_text	ease_score	readability	dale_score	grade level
0000C359D63E	when a person has no experience on a job their...	65.59	Standard	6.48	average 7th or 8th-grade student
000BAD50D026	Do you think students would benefit from being...	72.50	Fairly Easy	5.73	average 5th or 6th-grade student
00367BB2546B	Thomas Jefferson once states that "it is wonde...	70.67	Fairly Easy	6.93	average 7th or 8th-grade student
hp	Dumbledore and Professor McGonagall bent forwa...	81.83	Easy	8.26	average 11th or 12th-grade student
tkm	Being Southerners, it was a source of shame to...	48.27	Difficult	9.31	average 13th to 15th-grade (college) student
high school	With the development of the technology, more a...	50.77	Fairly Difficult	9.75	average 13th to 15th-grade (college) student
college1	"We need to move to a place with an elevator."...	74.39	Fairly Easy	7.62	average 9th or 10th-grade student
college2	In the article "Beyond borders: what it means ...	35.10	Difficult	9.02	average 13th to 15th-grade (college) student

	cohesion	syntax	vocabulary	phraseology	grammar	conventions
text_id						
0000C359D63E	2.981219	2.901032	3.162765	3.046843	2.829115	2.873303
000BAD50D026	2.813489	2.654274	2.854182	2.663226	2.542577	2.746890
00367BB2546B	3.387598	3.316770	3.473436	3.404510	3.296542	3.305785
hp	2.966599	2.908159	3.125404	2.997357	2.977395	2.886424
tkm	3.118585	3.068782	3.259446	3.123207	3.076440	3.001423
high school	3.104421	3.012561	3.299080	3.081790	3.015582	3.079106
college1	3.143586	3.096990	3.307885	3.169932	3.107581	3.072751
college2	3.385375	3.258080	3.474078	3.314947	3.249708	3.286568

[Introduction](#)[Methodology](#)[Model](#)[Evaluation](#)

# *Thank You*

## *Q & A*



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