



# Textual Entailment Recognition between Sentence Pairs using Transformer Model

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# Outline



- Introduction
- Project Overview
- Datasets
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  - Fine tuning the BERT Model
  - Results
- Conclusion

# Introduction



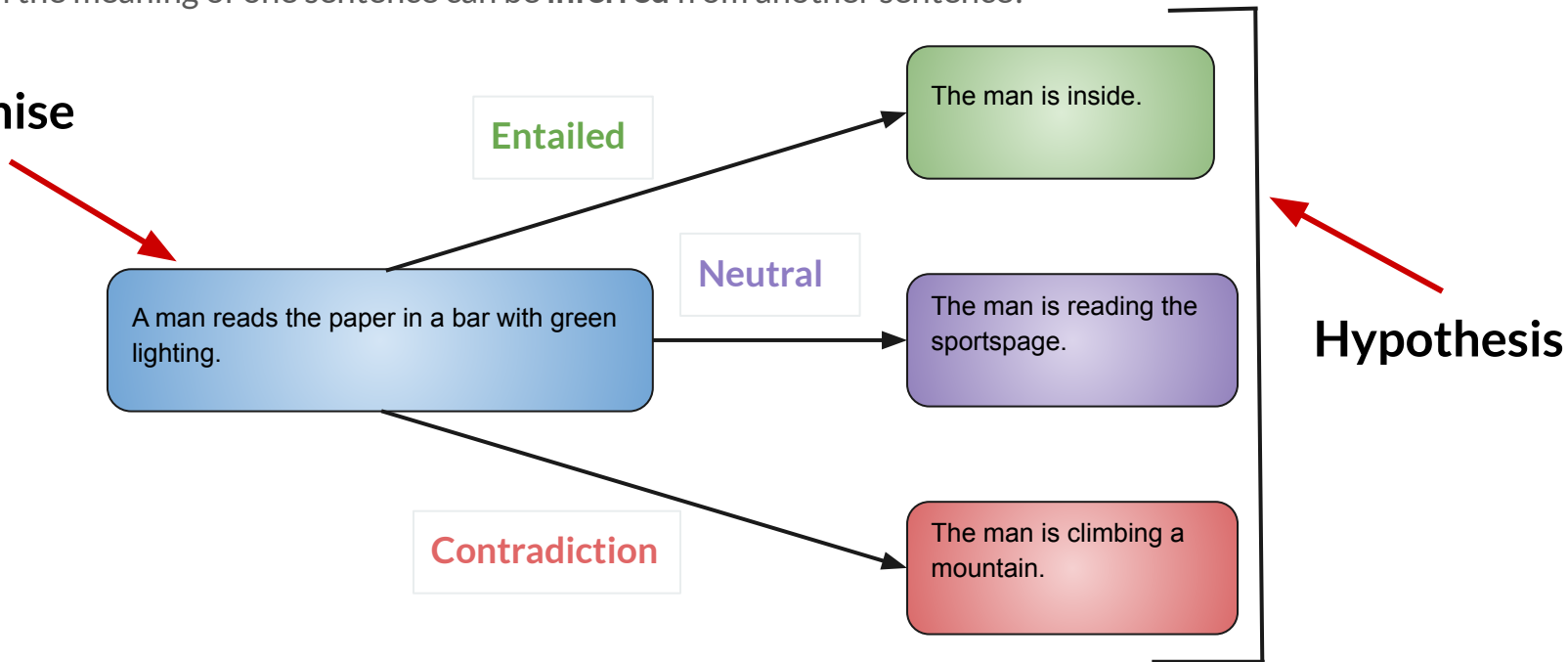
## What is Textual Entailment?

- direct relationship between two text fragments
- the truth of one text requires the truth of the other text

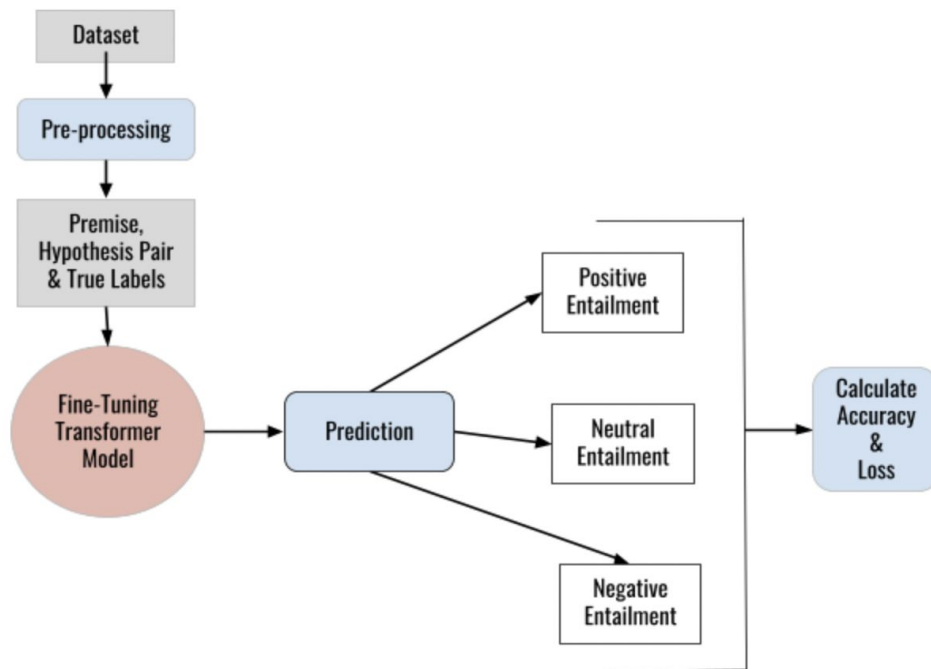
# Introduction

- Can the meaning of one sentence can be **inferred** from another sentence?

Premise



# Project Overview



Model is  
run on AWS  
Cluster

# Dataset



- The MultiNLI dataset has over 433,000 examples
- As part of the training process, 3 columns were considered in the dataset — ‘gold\_label,’ ‘sentence1’ (premise), and ‘sentence2’ (hypothesis)
- The ‘gold\_label’ is the column indicating the label given to the pair of sentences
- There were three labels — ‘entailment,’ ‘neutral,’ and ‘contradiction.’
- 100000 examples were used for training and 9815 examples were used for validation

# Dataset

	gold_label	sentence1	sentence2
0	neutral	Conceptually cream skimming has two basic dime...	Product and geography are what make cream skim...
1	entailment	you know during the season and i guess at at y...	You lose the things to the following level if ...
2	entailment	One of our number will carry out your instruct...	A member of my team will execute your orders w...
3	entailment	How do you know? All this is their information...	This information belongs to them.
4	neutral	yeah i tell you what though if you go price so...	The tennis shoes have a range of prices.
...	...	...	...
99995	neutral	She'd probably ask you the way to the Moat Hou...	Tuppence went missing whilst looking for the m...
99996	entailment	When reporters asked whether Clinton should re...	Personal destruction politics should not decid...
99997	neutral	For the hikers, a bus goes to a point quite cl...	At the summit, the view is said to be the best...
99998	entailment	The capital of the Gododdin was Din Eidyn (the...	Edinburgh derived its name from Din Eidyn, the...
99999	contradiction	In any event, Gore dropped out of the race sho...	In each one of the events, Bush quit the race ...
100000 rows x 3 columns			

Fig : Snippet of the training set

# Fine Tuning the pre-trained BERT model



- **Model** : Bert-base **BertForSequenceClassification** pre-trained model with classification head of three output units for 3 labels
- **Optimizer** : Adam
- **Epochs** : model was fine-tuned for 5 epochs
- **Batch-size** : 16 which means model is trained on 16 sequences at each training step
- **DataLoader** : This object is used to feed data to the model
  - Each pair of sentence is formatted as a sequence: *[CLS] sentence1 [SEP] sentence2 [SEP]*
  - Each sequence is given
    - a segment id
    - an attention mask



# Fine Tuning the pre-trained BERT model

Training Step:

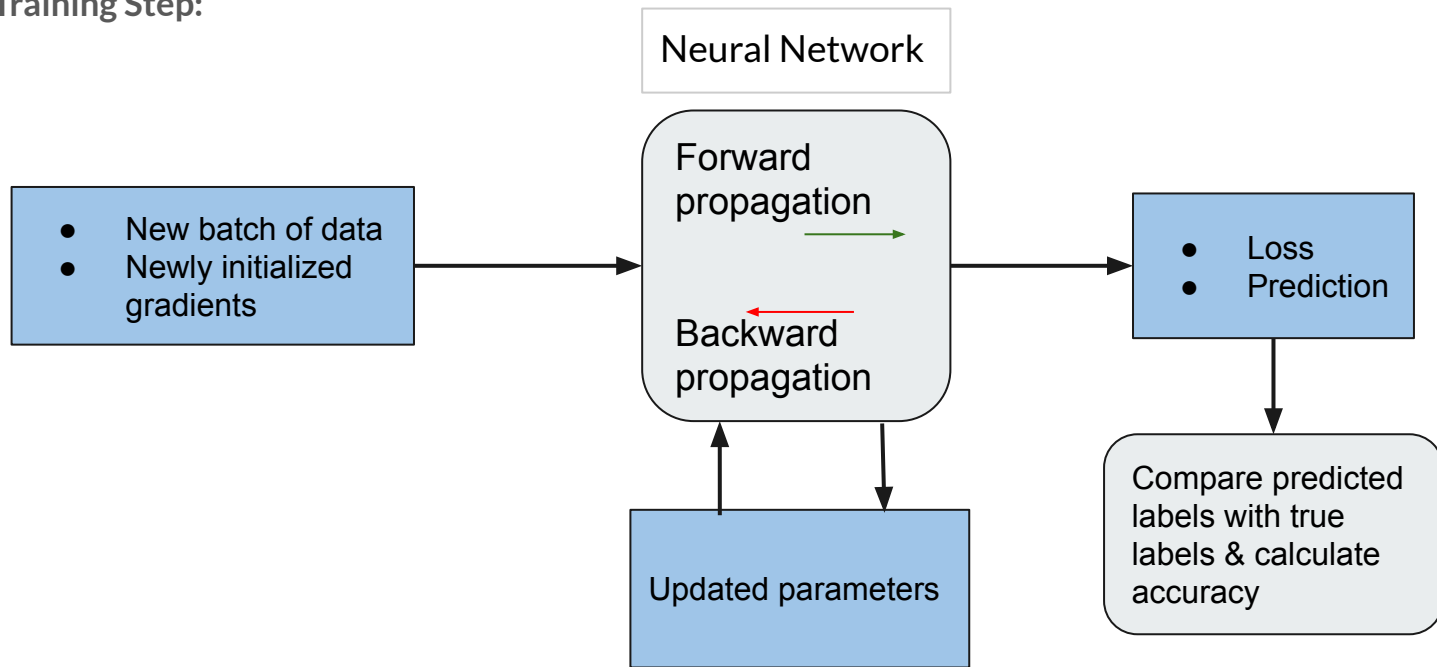


Fig: Processing for one batch of training data. This is done for each batch of training data

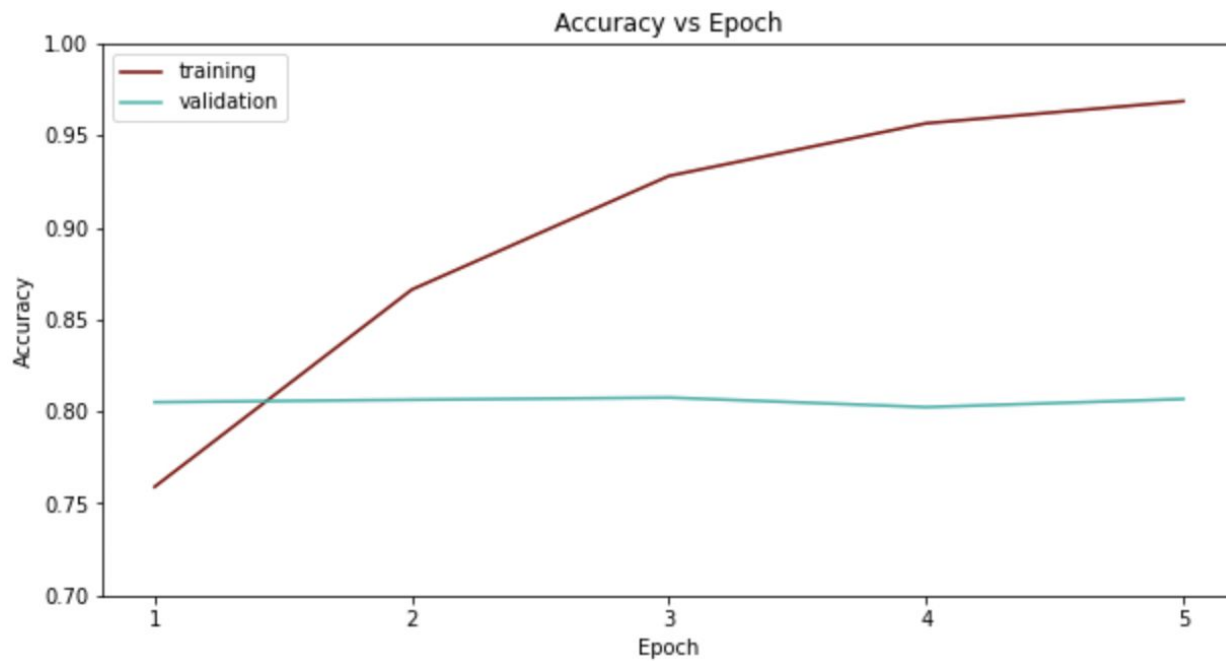
# Fine Tuning the pre-trained BERT model



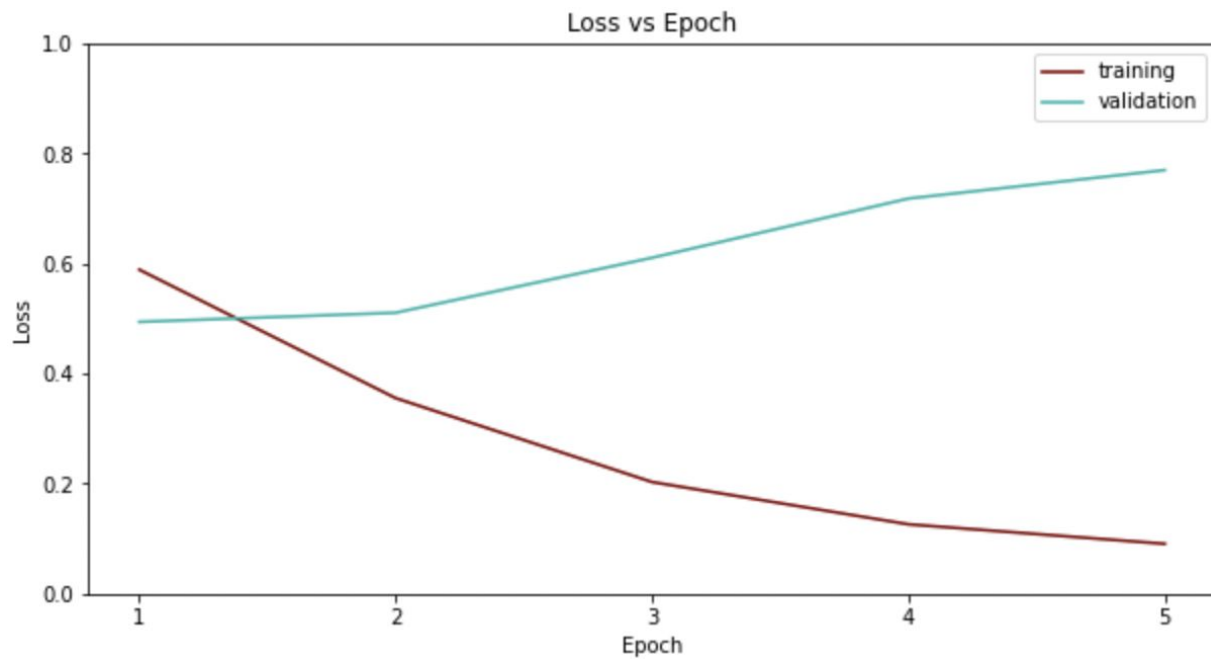
## Validation Step:

- Loss and Accuracy is calculated for each batch of validation/development set data
- No parameter update
- Keeping tabs for the performance of the model after every epoch
- Stop training when performance reaches saturation or overfitting is detected

# Results



# Results



# Results



Epoch	1	2	3	4	5
Runtime	00:32:35.26	00:32:36.77	00:32:36.82	00:32:37.81	00:32:35.92

# Conclusion



In our project, we have :

- Fine-tuned pre-trained transformer model
- Identified directional relation i.e. textual entailment between given sentence pairs.
- Classified entailment in three categories:
  - Positive Entailment
  - Negative Entailment (contradiction)
  - Neutral or No Entailment

# References



- a. <https://cims.nyu.edu/~sbowman/multinli/>
- b. [https://www.tensorflow.org/text/tutorials/fine tune bert](https://www.tensorflow.org/text/tutorials/fine_tune_bert)
- c. [https://en.wikipedia.org/wiki/Textual entailment](https://en.wikipedia.org/wiki/Textual_entailment)
- d. <https://towardsdatascience.com/bert-explained-state-of-the-art-language-model-for-nlp-f8b21a9b6270>
- e. <https://github.com/huggingface/transformers>



# The End