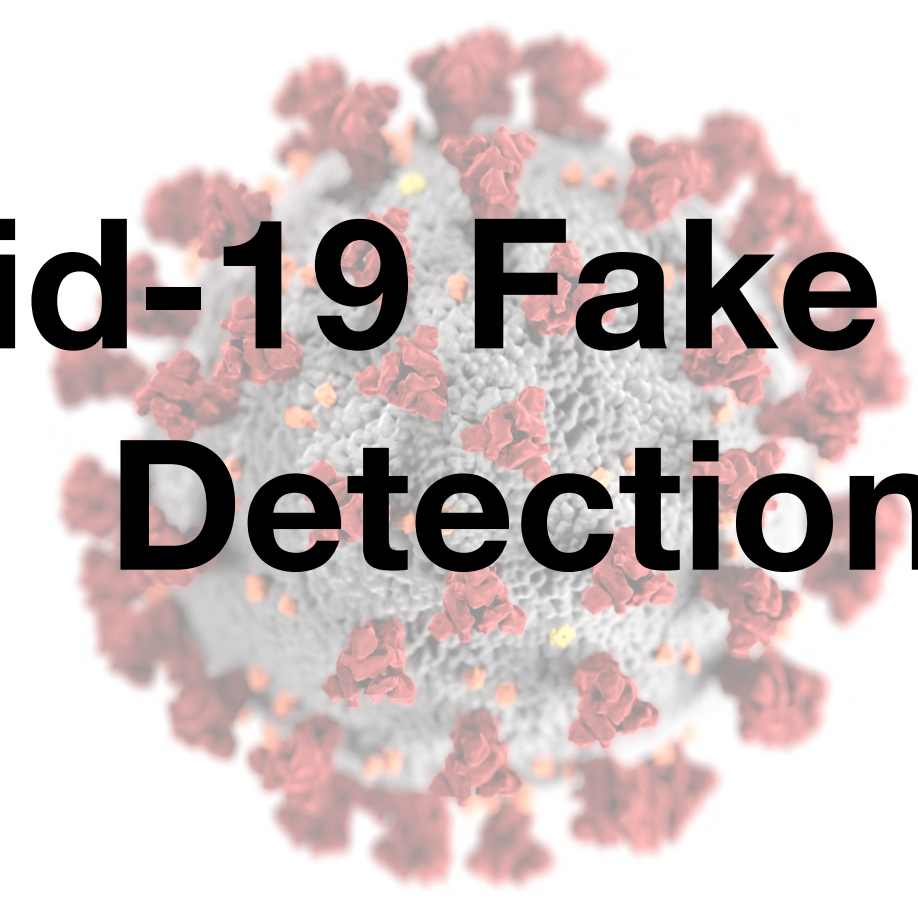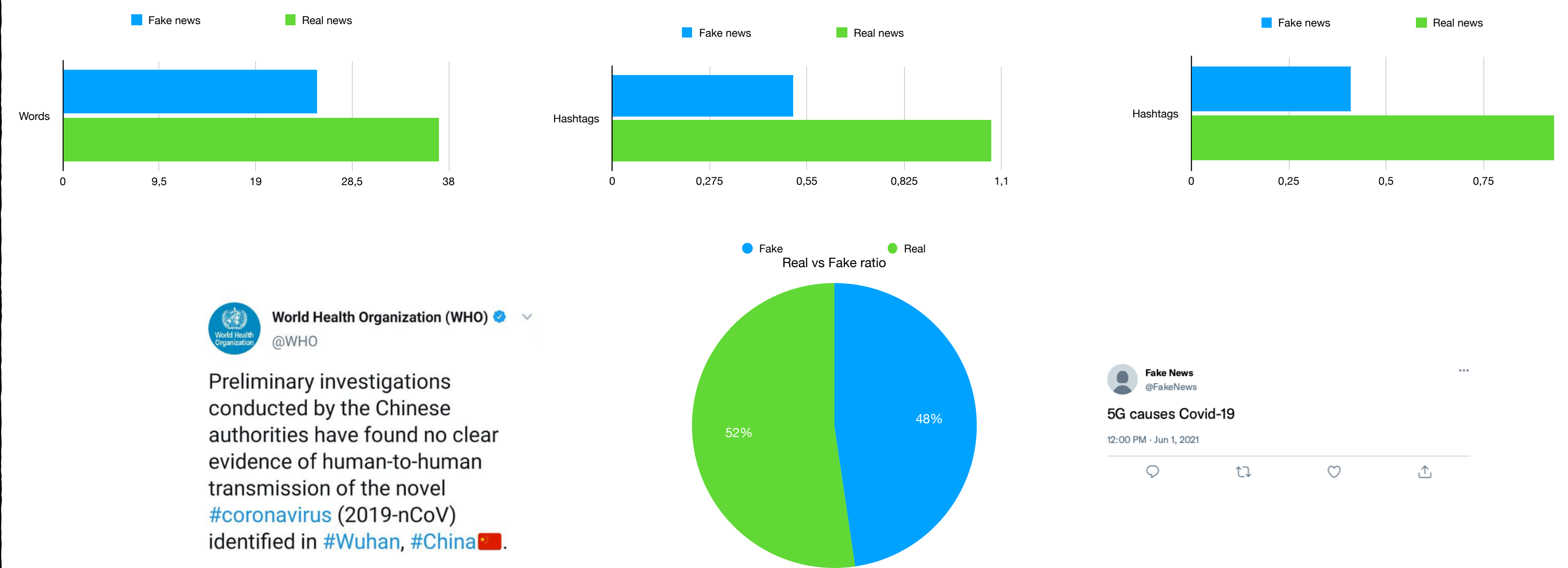# Covid-19 Fake News Detection

1. Introduction

Even tough the pandemic seems to be nearing it's end or at least we can consider that it reached a point where we have it more under control, one thing most of us still have to fight is the information war that sometimes floods social media. In this project our main goal is to build an efficient neural network classifier real vs fake on a dataset with tweets about Covid-19 and train the model to achieve the best accuracy we possibly can. Working on this task we have worked with pytorch, glove twitter pre-trained vectors, MLPs and BERT

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2. Dataset

For our dataset we used a collection of 10000+ news curated from either sites like Twitter, Instagram, Facebook or other social media sites as well as some fake news checking websites.

Our first step was extracting some **statistics** from the dataset to get a better ideea of what we are working with.

World Health Organization (WHO) @WHO
Preliminary investigations conducted by the Chinese authorities have found no clear evidence of human-to-human transmission of the novel #coronavirus (2019-nCoV) identified in #Wuhan, #China.

Fake News @FakeNews
5G causes Covid-19
12:00 PM · Jun 1, 2021

Real vs Fake ratio — Fake 48% / Real 52%

3. Model

For our main model we decided to use a Multilayer Perceptron Architecture with two hidden linear layers of 100 and 20 neurons respectively. As input we are taking in a 50 values vector that's computed for each news post independently.

We also attempted training a model with single or triple hidden layers but the overall performance on the double layer was better with a 3-4% accuracy increase on the validation data.

For comparison with our simple model we utilised a pre-trained transformer-based model BERT. BERT has multiple publicly shared models to choose from.

Average(Tweet Tokens)
[0.3, 0.4 ... , 0.23]
50 inputs — 100 neurons — 20 neurons — 2 outputs
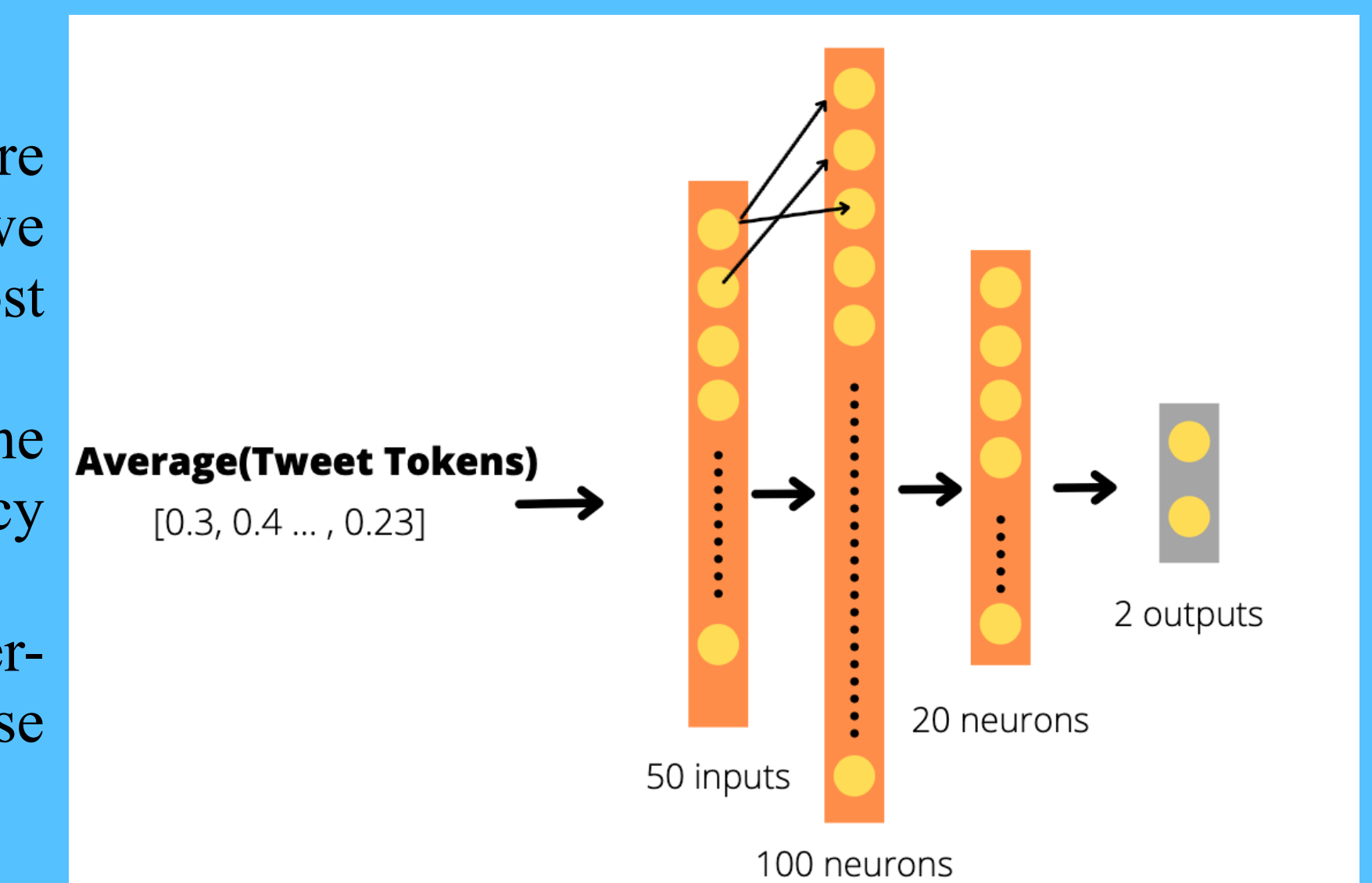
4. Hyperparameters

- Optimizer - Adam
- Loss - Cross Entropy Loss
- Batch size = 32-64-128
- Learning rate = 0.001 - 0.1

4.1 GloVe

GloVe is an unsupervised algorithm that is used for obtaining vector representations for words. We used a pre-trained word vector on Twitter as most of our fake and real news are social media posts.

Compared to Word2Vec - GloVe doesn't just train based on neighbouring words and local context but on the whole global corpus.

GloVe "divides" words making similar words cluster together and opposed words push each other out with the help of cosine similarity.

city - zip code   comparative - superlative [3]
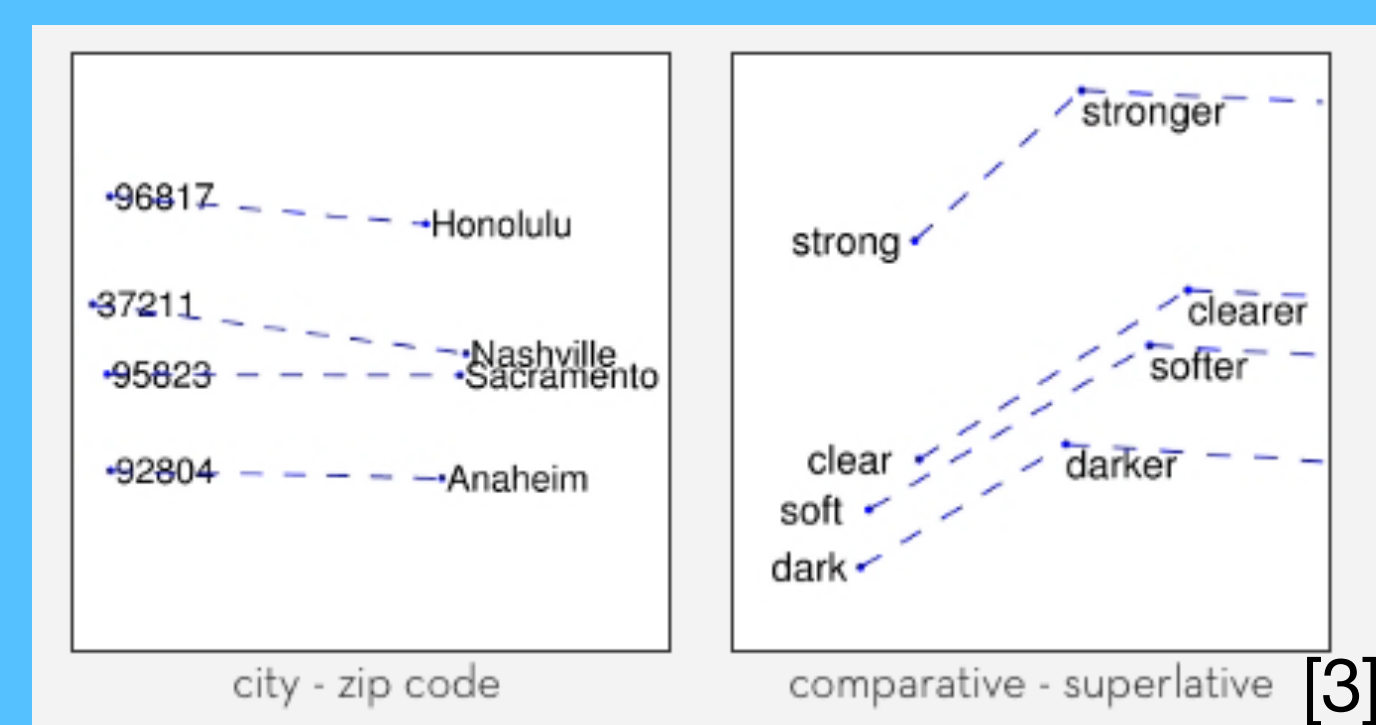
5. Experiments and Results

We took a **supervised learning** approach and our first step was creating a general vocabulary for all the posts and then representing it as a vector with the help of **GloVe** (*Global Vectors for Word Representation*) pre-trained **twitter word vectors**. In the case of words present in our dataset but **missing** from **GloVe** we initialised the vector for the specific word with the **average value from GloVe**. The next step was computing a sentence vector by adding up all the word vectors and dividing it by the number of vectors. This was further used as **input** for the Multilayer NN.

MLP Accuracy/Validation   MLP Loss
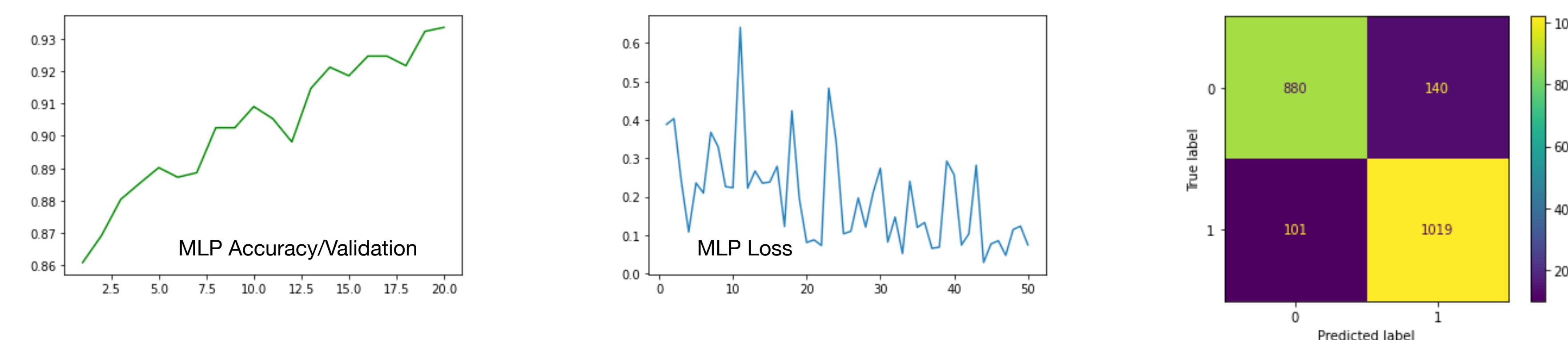
Variation and comparison:
- Learning rate
- Batch size
- BERT

With **BERT** we achieved better accuracy than on our basic model no matter what pre-trained BERT model we used. We made attempts with both **Covid-Twitter-Bert** and **Bert-based-cased** which had similar accuracy compared to each other. However, the **time** needed for the transformer-based model to train is significantly higher.

Accuracy over 5 Epochs — BERT-based-cased / Covid-Twitter-Bert / MLP
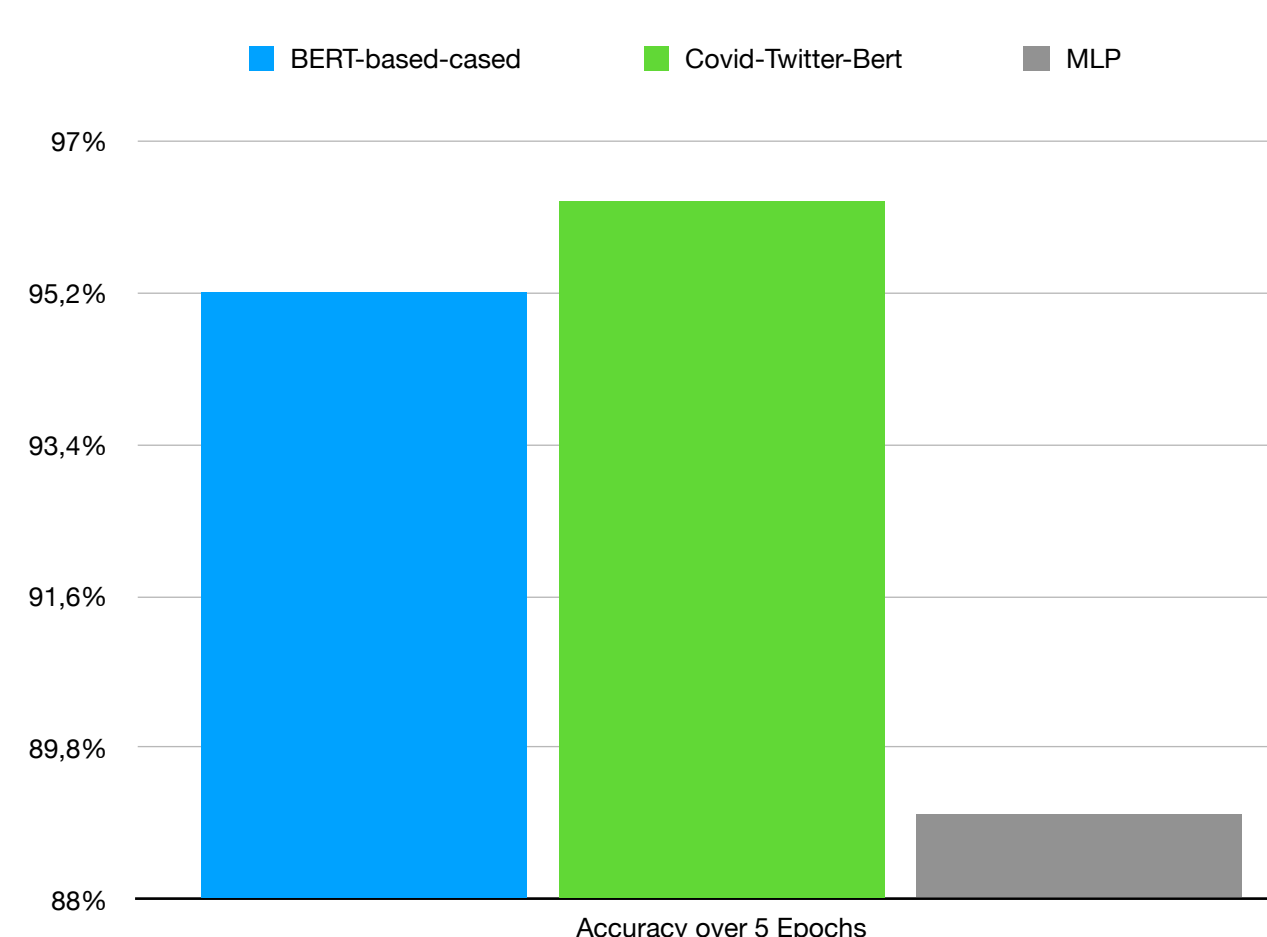
	Model	Precision	Recall	F1-score
Real	BERT	0.9	0.98	0.94
	MLP	0.9	0.86	0.89
Fake	BERT	0.98	0.9	0.94
	MLP	0.88	0.91	0.89

6. Conclusions and future work

Working under the task of classifying various Covid-19 news as either real or fake we analysed the **efficiency** of our Multilayer Perceptron under different architectures or training algorithms. With the help of a Neural Network with two hidden linear layers we have achieved the best **accuracy of 95%** for the training dataset and 89% for the validation dataset. The BERT pre-trained model on a general corpus is however a lot **more efficient** with a 5-6% **increase** in a **quarter** of the training cycles needed for the basic-model.

Future work
- Bigger dataset
- Improve efficiency
- Expand to other types of text such as articles

7. References

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[2] Parth Patwa, Shivam Sharma, Srinivas PYKL, Vineeth Guptha, Gitanjali Kumari, Md Shad Akhtar, Asif Ekbal, Amitava Das, Tanmoy Chakraborty "Fighting an Infodemic: COVID-19 Fake News Dataset" in IIIT Sri City, India. †IIIT Delhi, India ‡IIT Patna, India. *Wipro Reseach, India, 2020

[3] Jeffrey Pennington, Richard Socher, Christopher D. Manning, "GloVe: Global Vectors for Word Representation" in Computer Science Department, Stanford University, Stanford, CA 94305, 2014