

# Introduction

Depression and anxiety are among the leading causes of illness among adolescents.



(source: everydayhealth)

But many patients may not be getting the treatment they need



Diagnosis relies on experienced psychologists not accessible to the greater population



Meaning many patients with mental disorders may not be seeking treatment due to lack of diagnosis



Natural language processing (NLP) may help in addressing this lack of diagnosis



# Introduction (contin.)

Hypothesis:

- 1 Natural language processing models can find subtle language patterns using raw text of online posts to detect the presence of mental health disorder(s)
- 2 State of the art pre-trained language models can improve the accuracy of such predictive power

 Data collection

Increased social media usage provides unique research opportunities

- Combination of existing public datasets (TalkLife & Dreaddit) and constructed datasets is used
- The collected datasets include text from Twitter and Reddit that indicate anxiety, depression, and post-traumatic psychological distress.

Table 1. Collected dataset label distribution

Label	Number of samples
Mental health issue presence	7,952
No mental health issue presence	8,000

# Data processing

Table 2. Data processing steps

Processing Step	Text
Convert all cases to lower case	I like New York. → i like new york.
Remove symbols such as emojis and URLs	i have been feeling unwell. 😊 → i have been feeling unwell.
Expand contractions	i don't want to leave. → i do not want to leave.
Remove punctuation and stop words	lately, i can not sleep. → lately i can not sleep

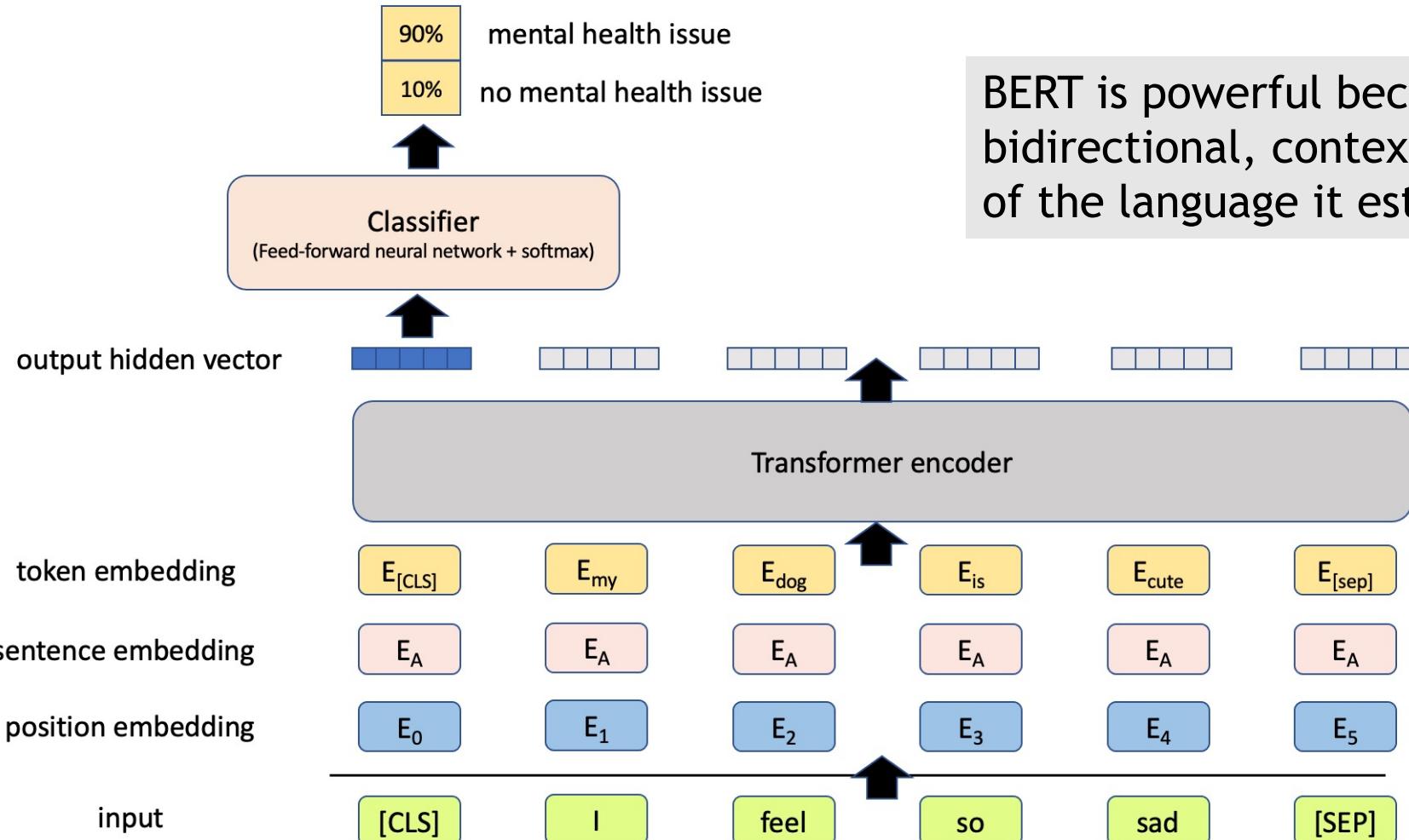


## Experimental Models: Non-BERT

- Random Predictor Model
  - Natural baseline model and label distributions are memorized and used to predict a random class
- Sentence2vec
  - Compute the sentence embedding as the average of pre-trained word embeddings using GLoVe
- Long short-term memory (LSTM) Model
  - LSTM model with embedding layer to take tokenized sequence and trained end-to-end



# Experimental Deep Learning Models: BERT



BERT is powerful because of deep bidirectional, contextual understanding of the language it establishes.



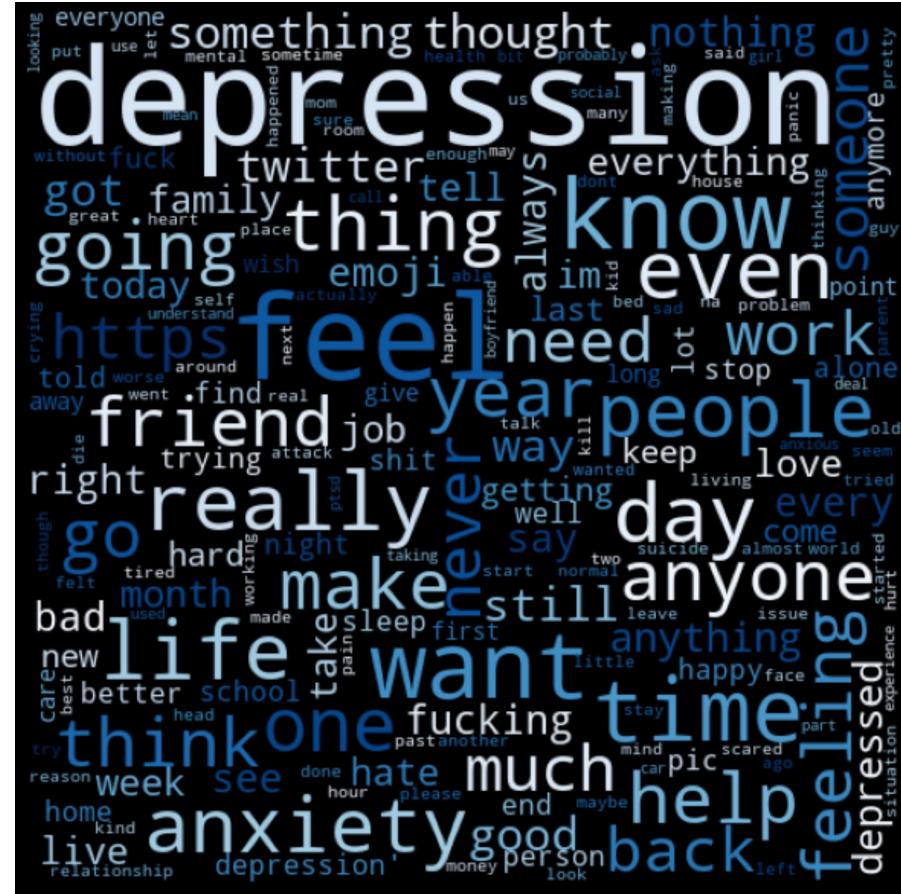
# Experimental Deep Learning Models: BERT

- Pre-trained BERT
  - Pre-trained model extracts high quality language features
  - Trained logistic regression model over the extracted language features for classification
  
- Fine-tuned BERT
  - Extra fully connected layer after general BERT model
  - Overall model fine-tuned over processed dataset

## Word Cloud Analysis

## Word cloud visualization of word frequency of tweets/posts with mental health issue signs

The larger the font size,  
the more frequently the  
word appears in the dataset



# 🎯 Quantitative Results

Model	Accuracy
Random	0.511
Sentence2vec + LR	0.857
LSTM	0.934
Pre-trained BERT + LR	0.947
Fine-tuned BERT	<b>0.963</b>

# 🎯 Qualitative Results

If anyone will listen. I'm in a bad place right now. I could really use a friend

Label



Prediction



Just checked my user timeline on my blackberry, it looks like the twanking is still happening Are ppl still having probs w/ BGs and UIDs



"Just heard gun shots in my neighborhood!!!"



**“Feel** horrible today but I look like a pirate with my eye patch! Eye is still sore!”





## Discussion

- Natural language processing models help detect the presence of mental disorders based solely on raw text of online posts.
- Fine-tuned BERT model demonstrates the highest accuracy at determining the presence of mental health disorder in the social media post given.
- The proposed models offer an accessible means of diagnosis.



# Conclusions & Future Work

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## Future Work

- Improving the portability of the model for greater accessibility
- Increasing the amount and quality of data for better performance