Mental Health Risk Assessment

Deepshika Sharma, Martin Berberi, Preethi Panyam

Background

- Pandemic has triggered 25% increase in depression worldwide
- Impacts of COVID-19 have been associated with increased risk for suicidal ideation
- Emergency dept visits for mental health conditions & suicide attempts have risen during the pandemic
- Mental Health providers have struggled to meet increase in demand

Problem Statement:

Is it possible to determine a person's extent of depression or risk for self injurious behavior based on running their online text posts through an NLP-based neural network algorithm ?

Model Workflow
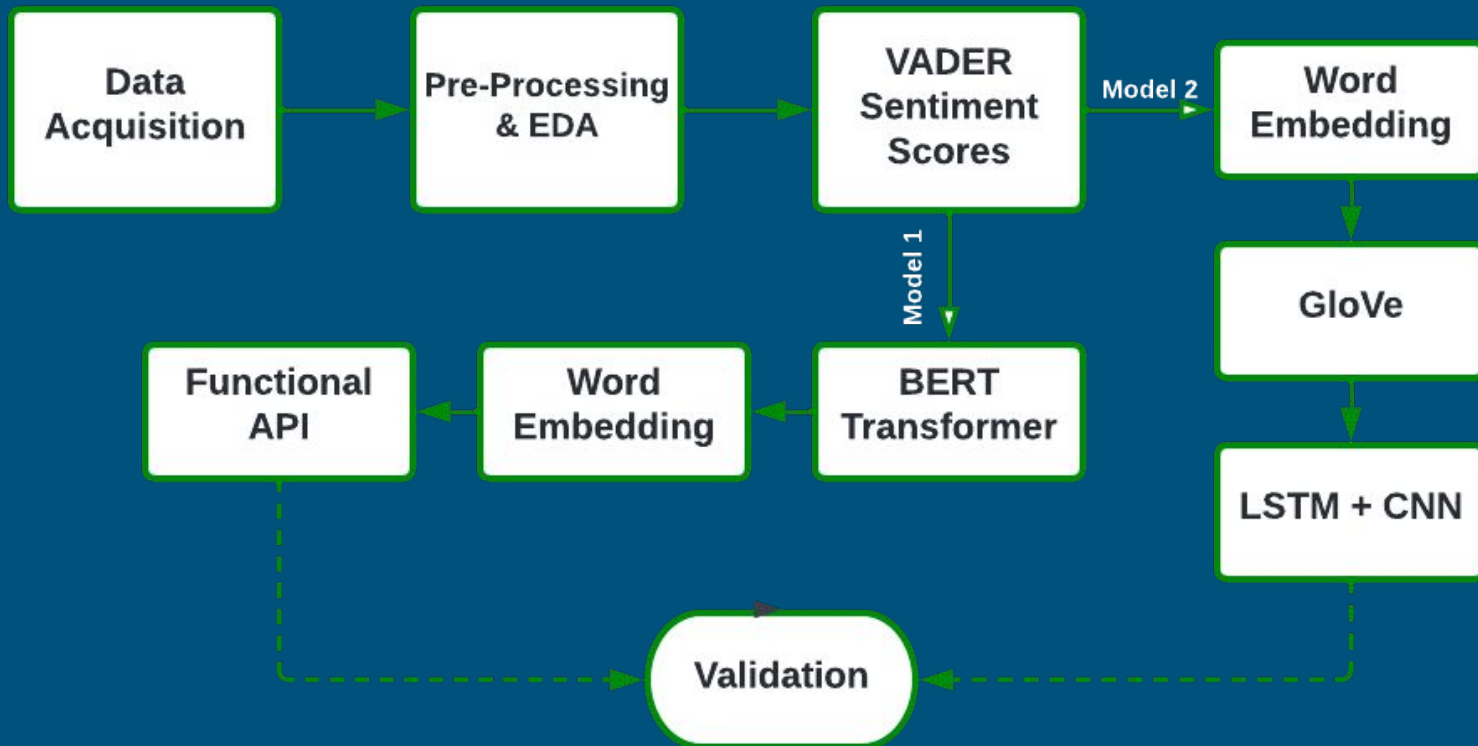
Data Acquisition

Presence of Depression and/or Suicidal Ideation

- Twitter:
    - #depressed ~4,150 posts
- Reddit:
    - r/Depression ~9,535 posts
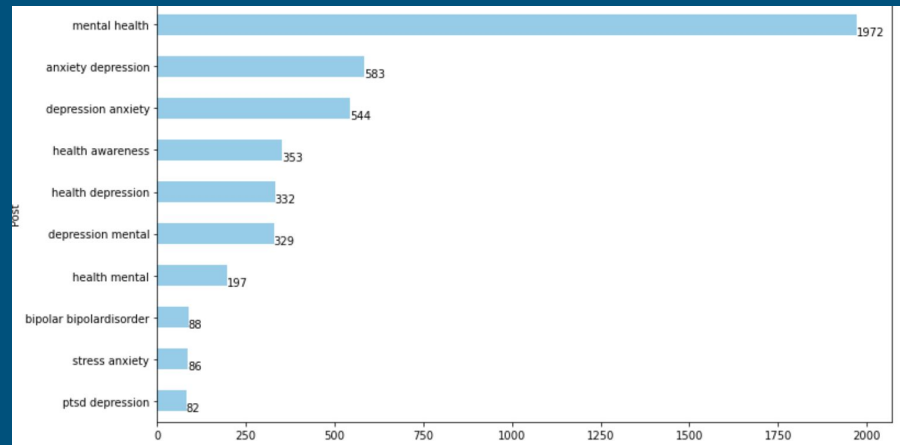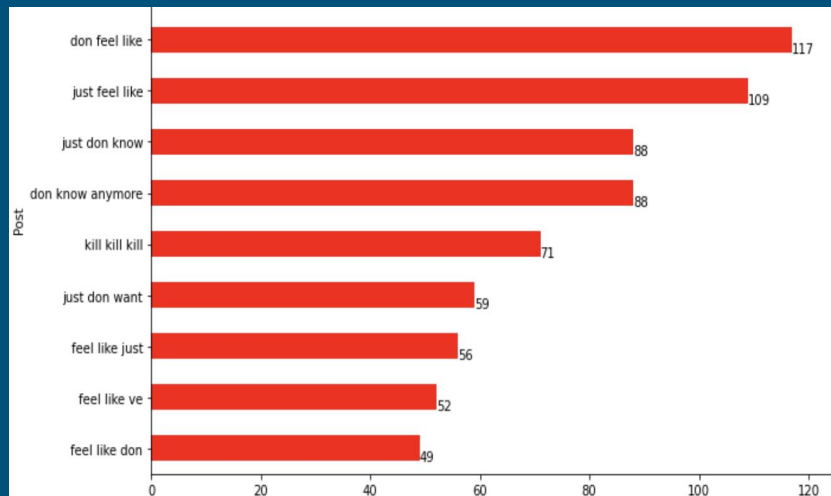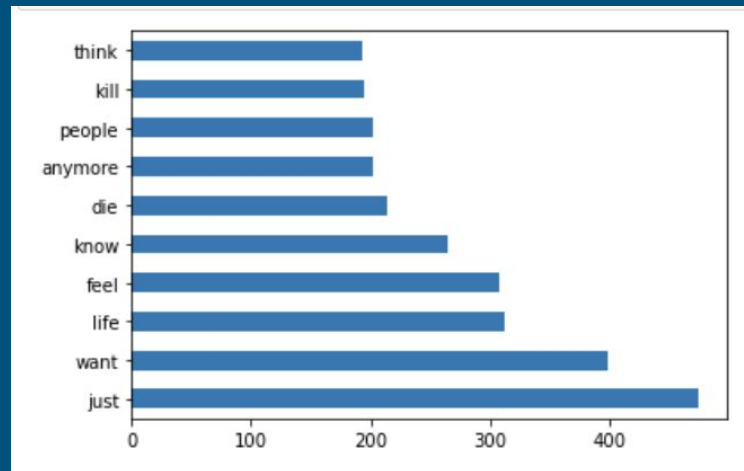   - r/SuicideWatch ~13,195 posts

Neutral

- Reddit:
    - r/happy ~14,600 posts
    - r/exercise ~9,600 posts

Total: ~51,900 posts
(after cleaning)

Pre-processing & EDA

- Data Cleaning
- Most common words:
  - CountVectorizer & TFIDF
  - N-grams (unigrams, bigrams, trigrams)
  - Custom stop words

Sentiment Scores ~ VADER

- Each dataset was converted into sentiment scores using the *SentimentIntensityAnalyzer*
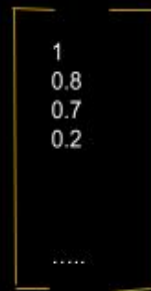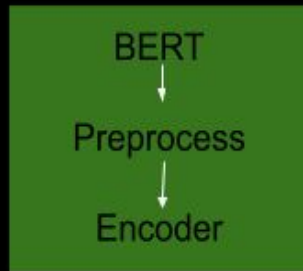- As expected, r/SuicideWatch had majority of posts w/ scores of -.4 or below:

-1.003, -0.8	**39 %**
-0.8, -0.6	**11 %**
-0.6, -0.4	**8 %**

- Datasets were then merged prior to modeling

Model 1: BERT Transformer

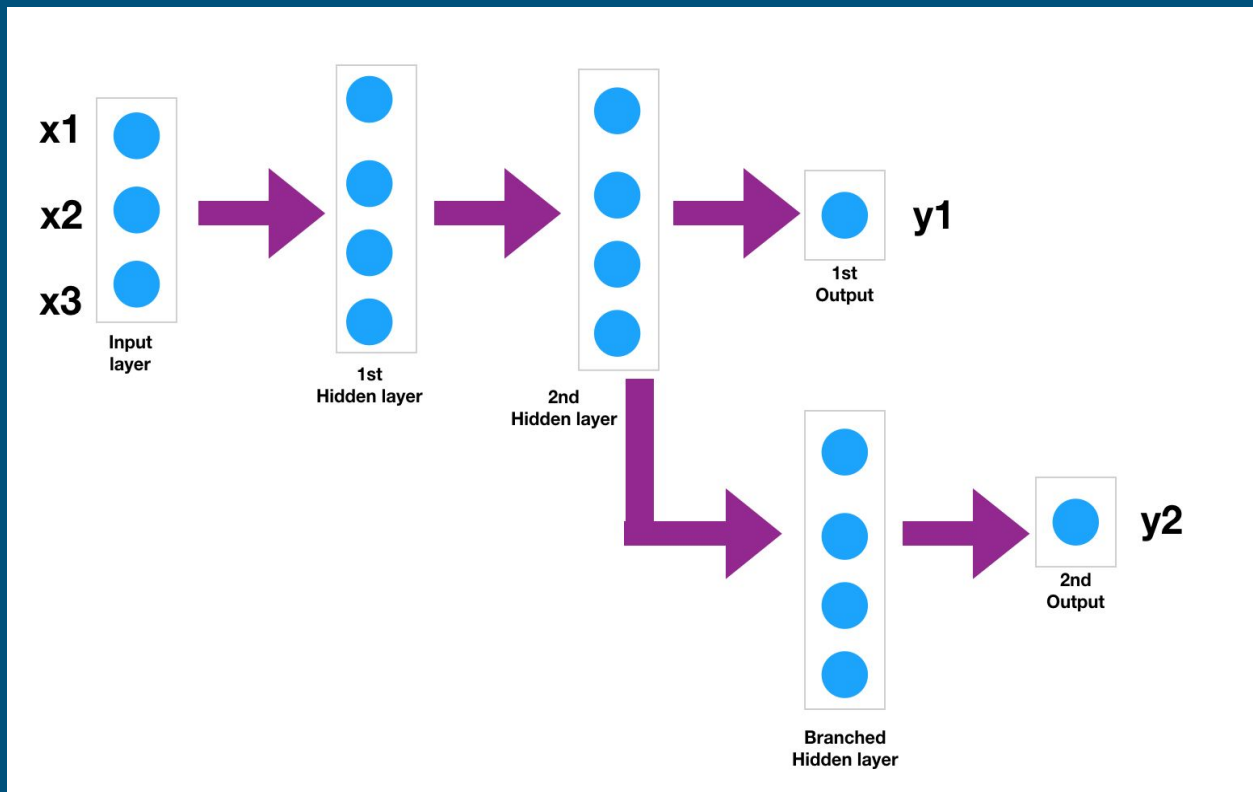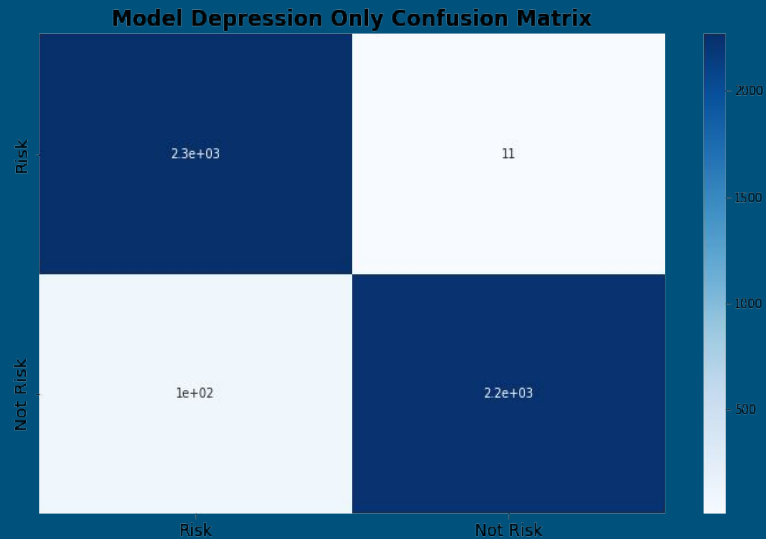# Model 1: BERT ~ *Functional API*

1) Download pre-trained model

2) Pre-process & encode as input layer

3) Neural layers

4) Output layer

Model (inputs, outputs)

Model 1: BERT ~ *Results*

Model	Accuracy	Recall
Baseline (both)	0.83	0.85
Suicidal Ideation	0.98	0.98
Depression	0.98	0.96

Model Depression Only Confusion Matrix

Validation w/ Model 1 (User text + BDI-II)

1) User text from archived tumblr "Depression & Disorders"
2) Beck Depression Inventory II
3) Neutral text

Model1.1 ~ Suicidal Ideation (only):

"yeahhhh i will go to the gym after 6 months pause"
The risk probability of this text is: 0.99*

*Note: This model gave high risk scores for any neutral input; so decided not to use

Model 1.2 ~ Depression (only):

"yeahhhh i will go to the gym after 6 months pause"
The risk probability of this text is: 0.31

"Depression is not something to be happy about. I hate the fact that everything I just said, is only a quarter of what I feel. Some people get excited when they're diagnosed with depression. 'Oh I'm going to tell my friends, maybe I'll get some sympathy .' No you stupid c***. It is the worst thing, that's why, when I was diagnosed with depression. I felt crazy. Because I'm not normal. I'm depressed, and pain lives in me, and I can't escape it. That's the sad thing. No one takes it seriously."
The risk probability of this text is: 1.0

"I blame myself for everything bad that happens."
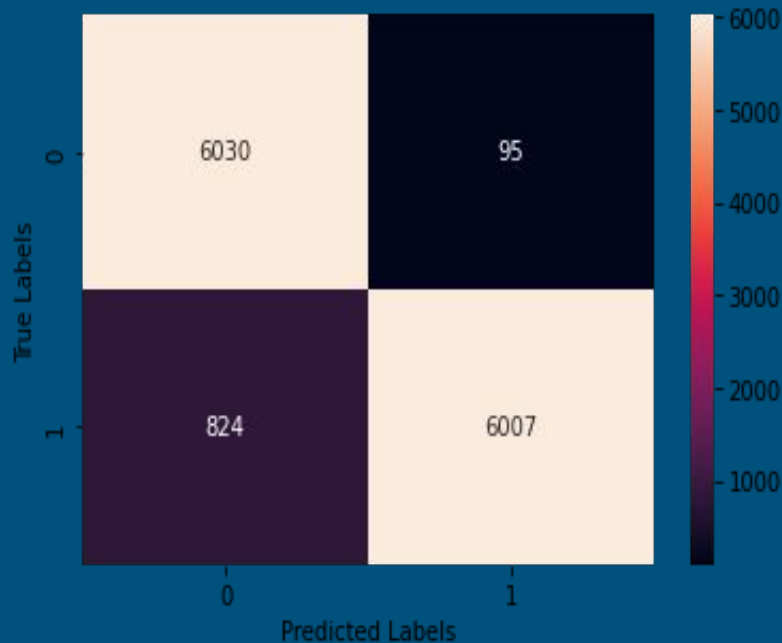*The risk probability of this text is: 0.99*

Model 2: Glove

Model 2: Glove ~ Results

Model	Accuracy	Recall
Baseline	0.80	0.81
Best Model	0.90	0.89

Model 2: Glove ~ *Validation*

1) User text from archived tumblr "Depression & Disorders"
2) Beck Depression Inventory II
3) Neutral text

Im freaking out. please help. okay so i have severe depression and i cut and have ednos and i purge sometimes and im kind of suicidal. anyway my friend went and talked to a psych behind my back bc she saw i was getting rlly bad and now she is gonna talk to my parents and i just dont know how to deal with this. they will hate me even more and think that they have a f******g psycho in their family.. i just dont know :'(

model predicts: 0.9887378

I have lost all of my interest in other people.

model predicts: 0.9269188

Happiness is when what you thin, what you say and what you do are in Harmony.

model predicts: 0.25244677

Future Directions

Conclusion:

- Possible to detect extent of depression through user text
- Risk for self-injurious behavior more difficult to parse out
- Nuances difficult to pick up
    - Many "positive" words used in negative posts (i.e. 'not good/ 'have not been happy')
    - Many self harm as a coping mechanism w/o any suicidal ideation

Limitations:

- Context difficult to determine (i.e. sarcastic posts)
- Privacy concerns (may be less inclined to share openly when being 'watched')

Applications:

- Text-based risk detection app for concerned family/friends
- Personal mental health app that can connect to resources based on risk

Thank you!
Questions?