Understanding mental health concepts derived from Cognitive Behavioural Therapy

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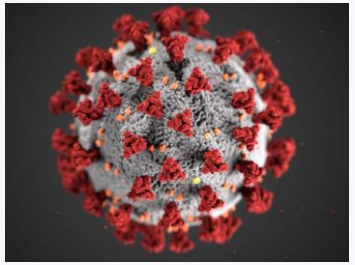
The Motivation

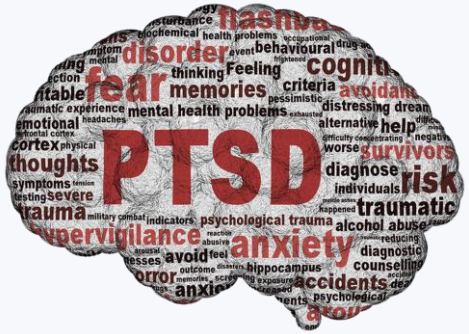
01
The Pandemic



02
Deteriorating Mental Health

03
Peer Pressure

04
Trauma



The Pandemic, Deteriorating Mental Health and increasing mental pressures

- WHO estimates that about 7.5 per cent Indians suffer from some mental disorder and predicts that by end of this year roughly 20 per cent of India will suffer from mental illnesses.
- Around 56 million Indians suffer from depression and another 38 million Indians suffer from anxiety disorders.

Objective

- To develop a framework that can identify thinking errors, emotions and situations corresponding to any sentence fed to it results of which may be obtained after analyzing a given sentence which would be a vital cog in the process of automation of Cognitive Behavioural Therapy.

Basics of CBT

Thinking Error

- Black and White
- Blaming
- Catastrophizing
- Comparing
- Disqualifying the positive
- Emotional Reasoning
- Fortune Telling
- Jumping to a negative conclusion
- Labelling
- Low Frustration Tolerance
- Inflexibility
- Mental filtering
- Mind-reading
- Over-generalizing
- Personalizing

Situation

- Bereavement
- Existential
- Health
- Relationships
- School/College
- Work
- Life
- Other

Emotion

- Anger
- Frustration
- Depression
- Grief/Sadness
- Guilt
- Hurt
- Jealousy
- Loneliness
- Suicidal
- Shame

Data Collection and Expansion

Social Media Platforms

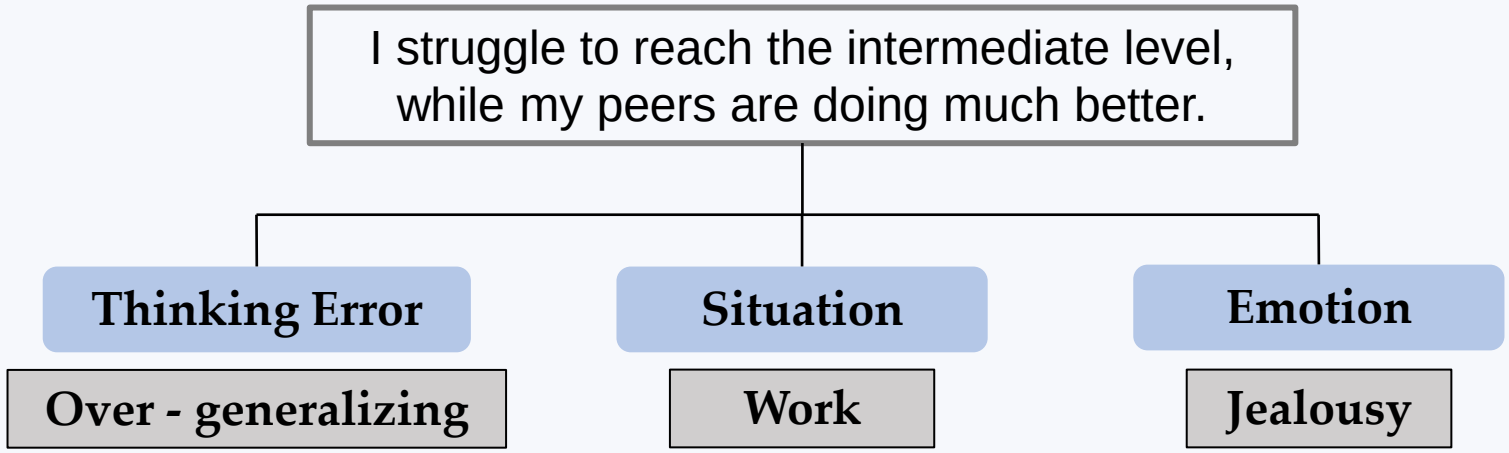
Discussion Forums

Community Forums

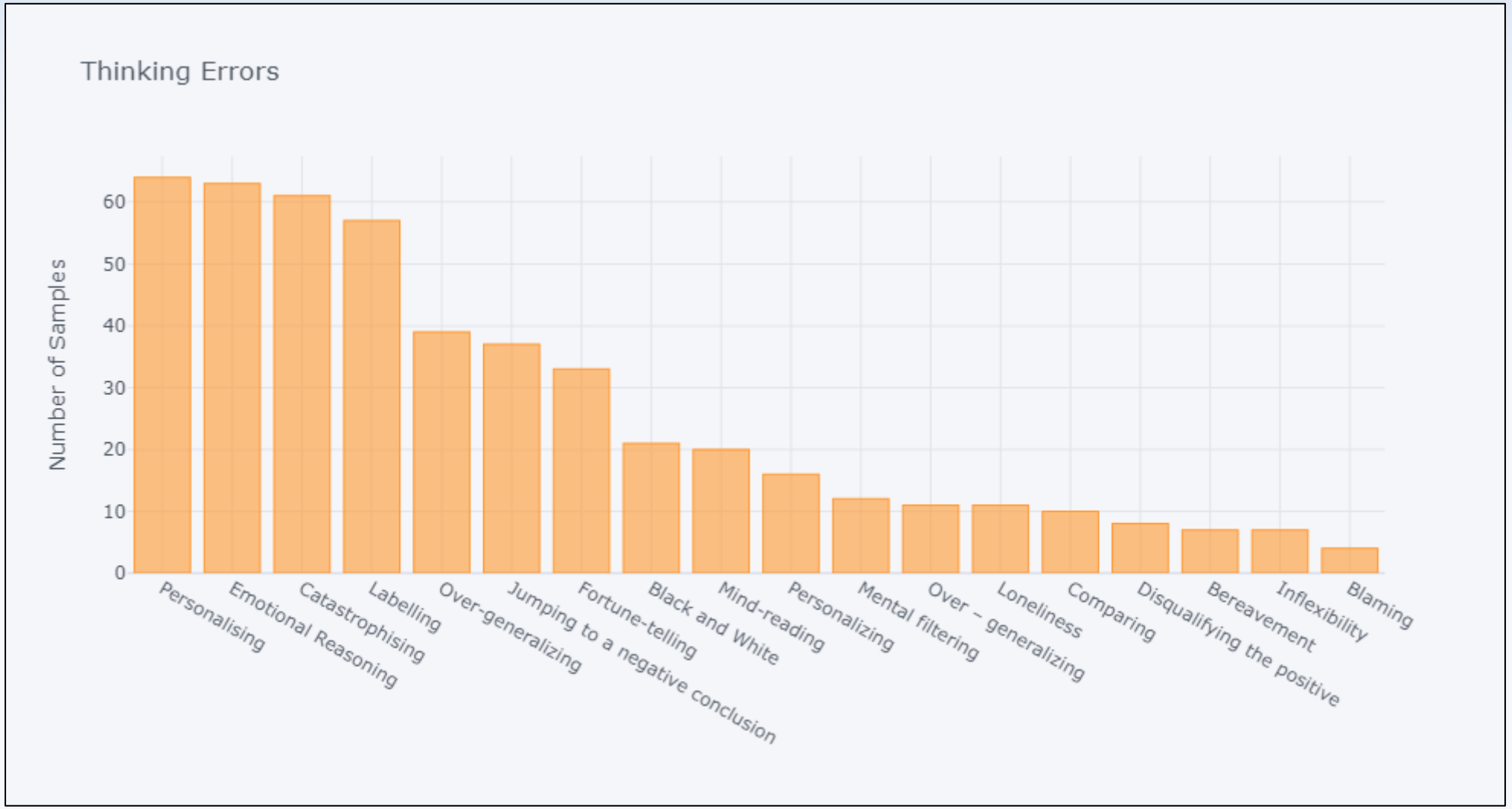
Text Generation

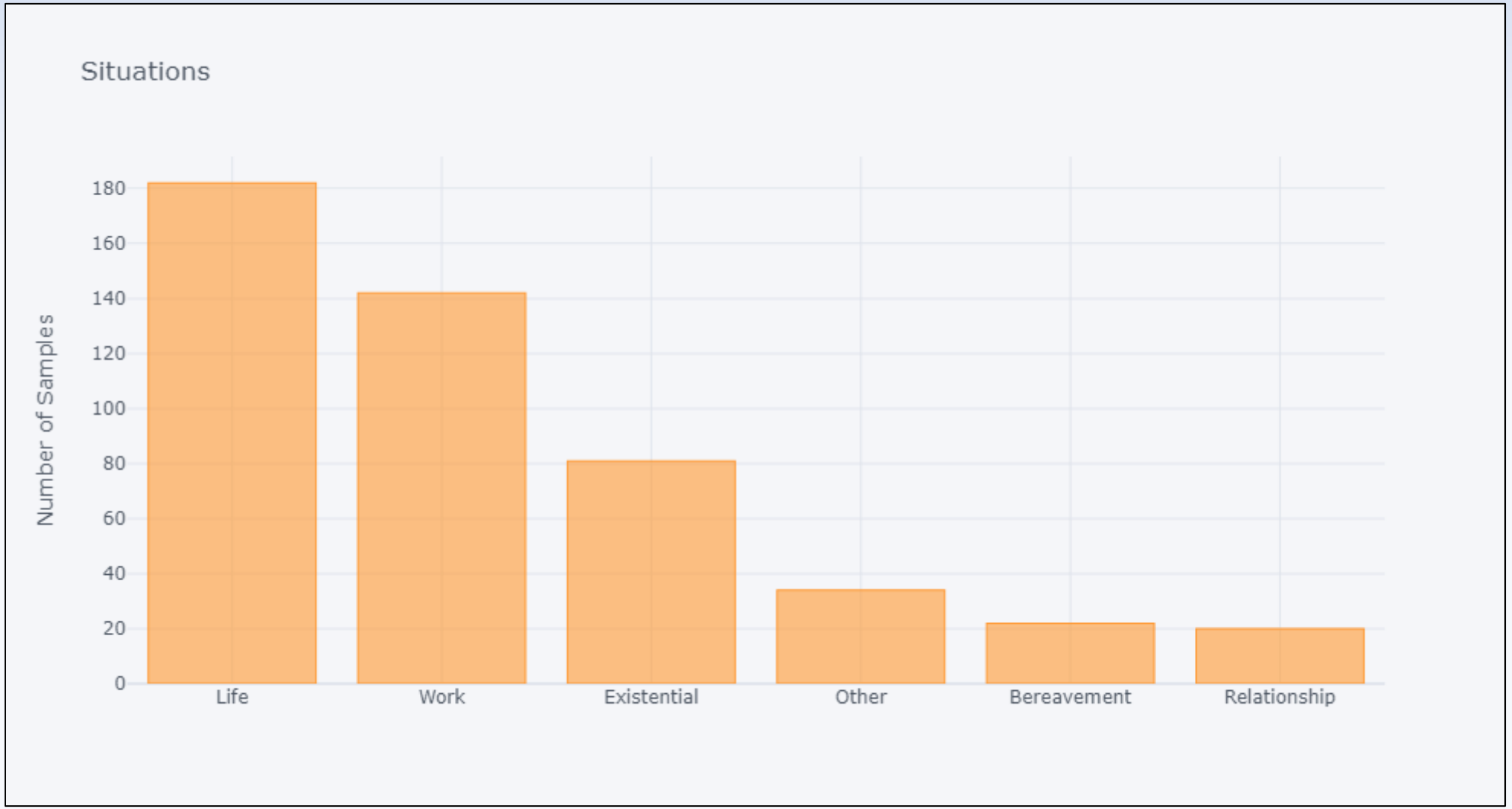
Back Translation

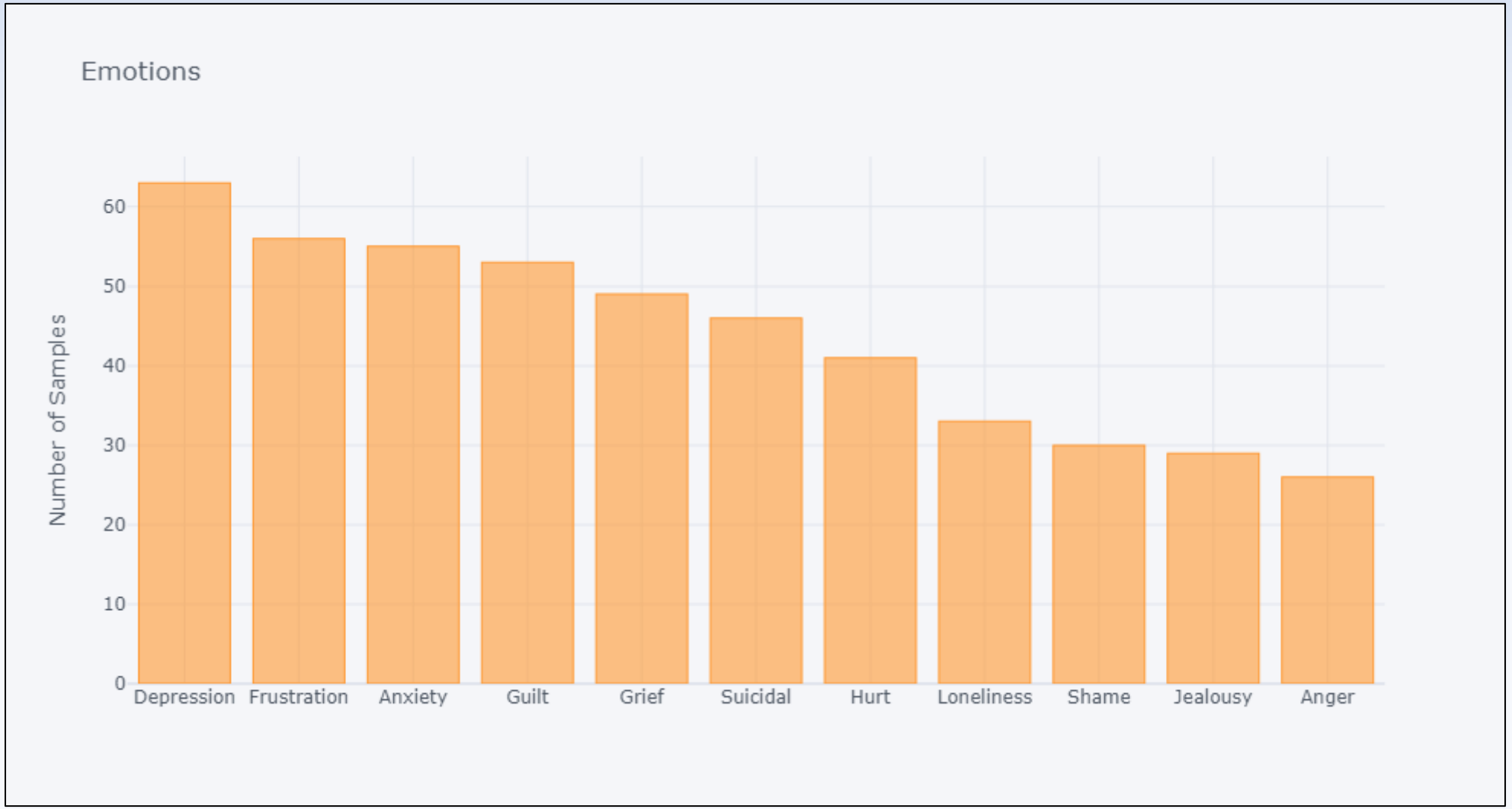
Annotation Example



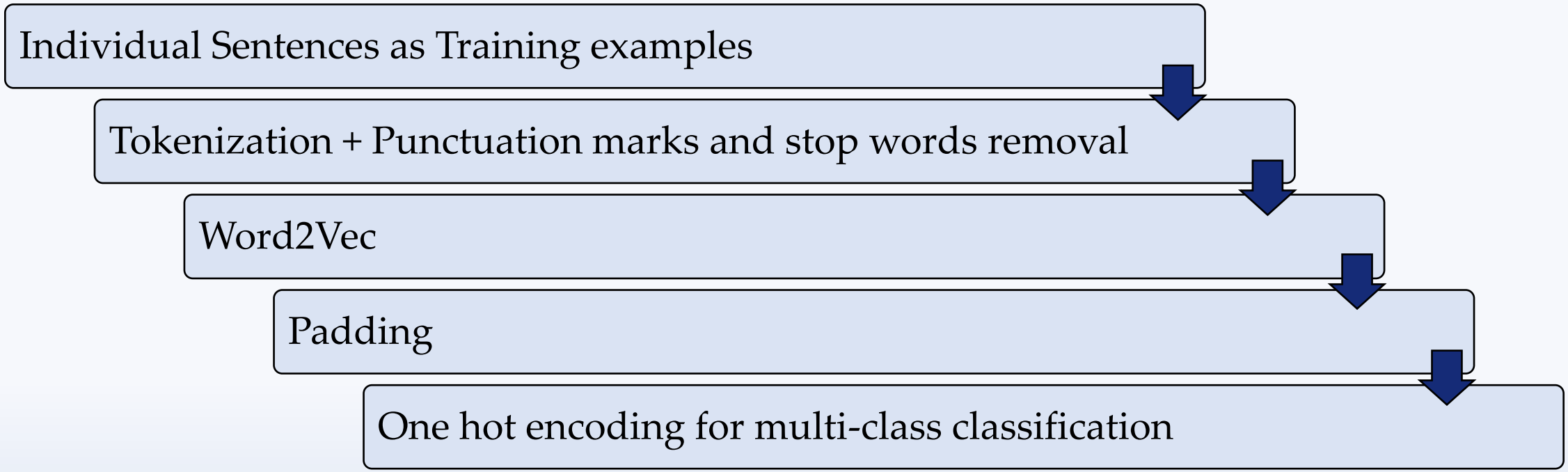
Data distribution and composition



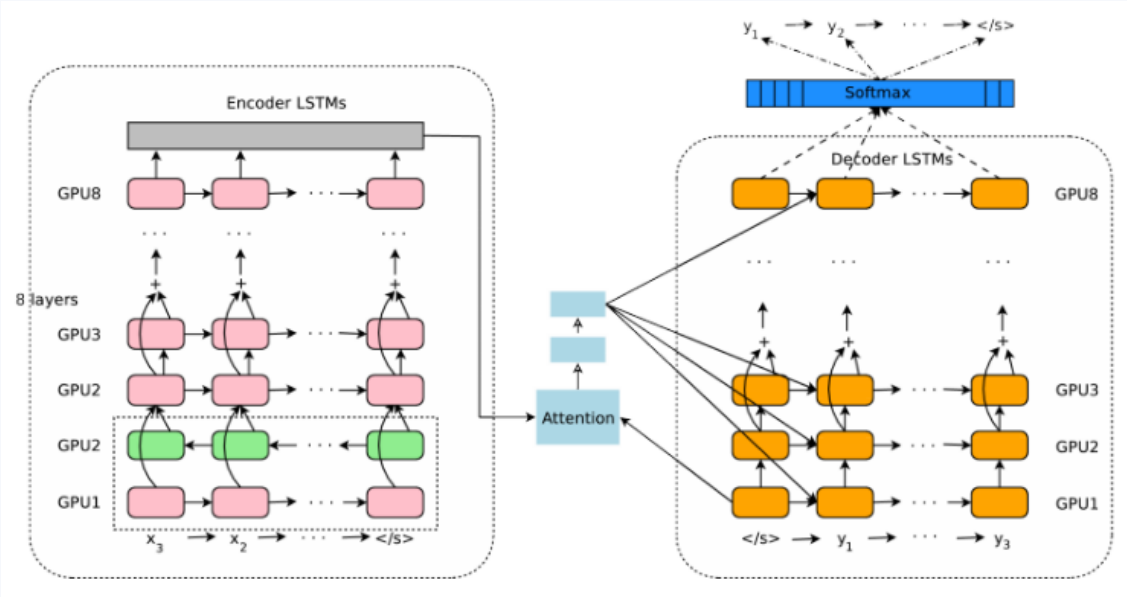

Situations
Number of Samples
180
160
140
120
100
80
60
40
20
0
Life
Work
Existential
Other
Bereavement
Relationship


Emotions
Number of Samples
0
10
20
30
40
50
60
Depression
Frustration
Anxiety
Guilt
Grief
Suicidal
Hurt
Loneliness
Shame
Jealousy
Anger

Preprocessing

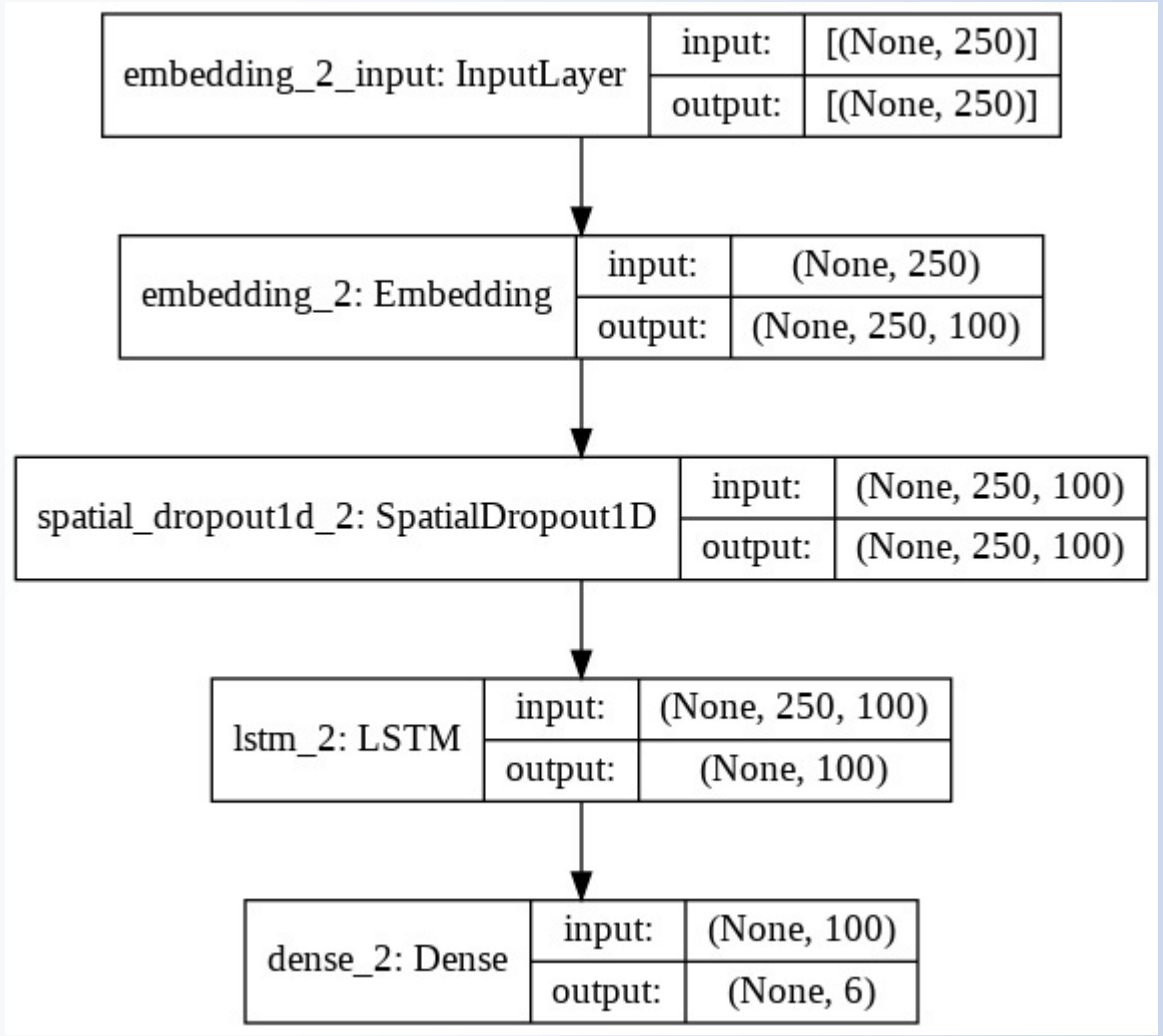


Proposed Architecture



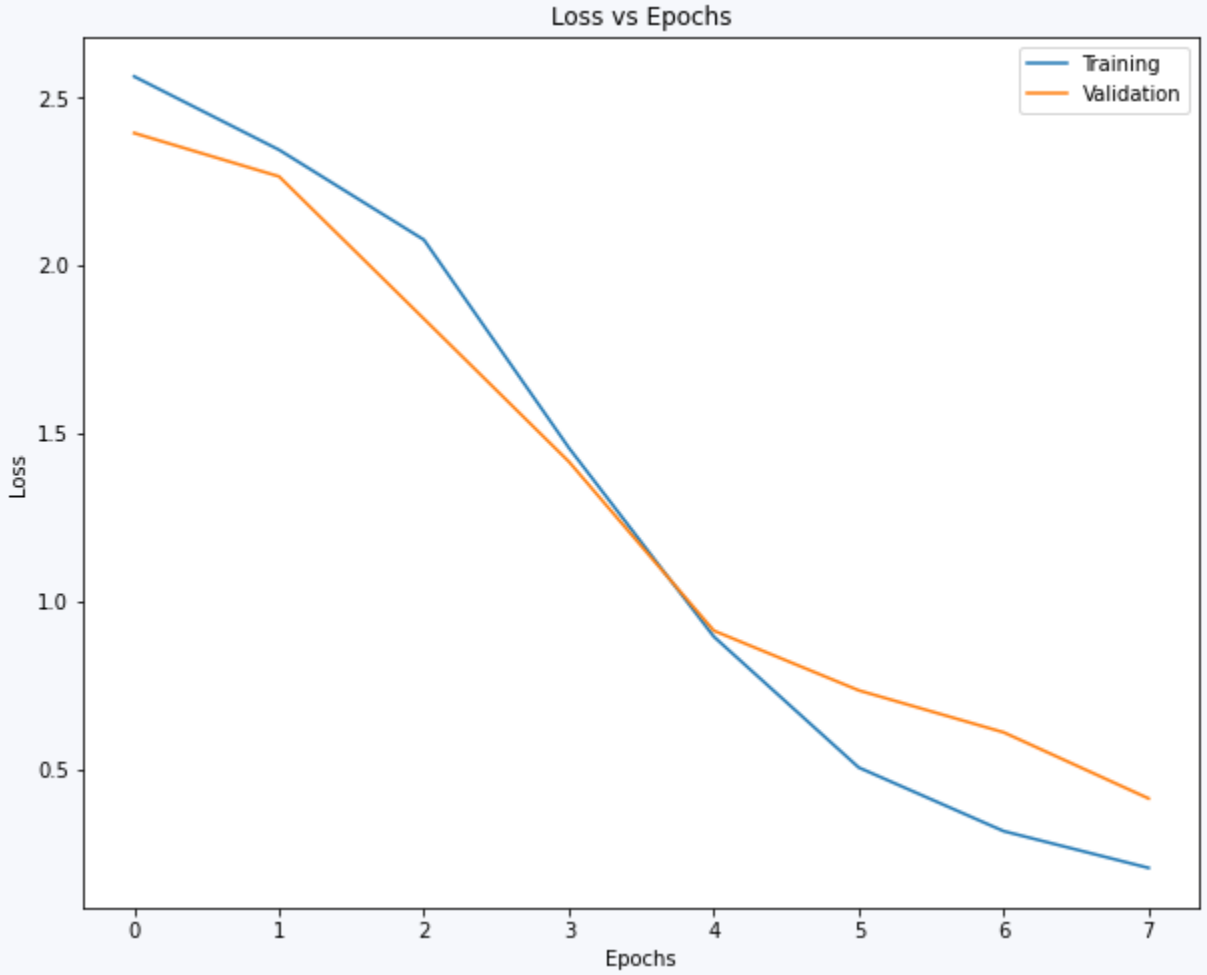
Back Translation – Google Neural Machine Translation

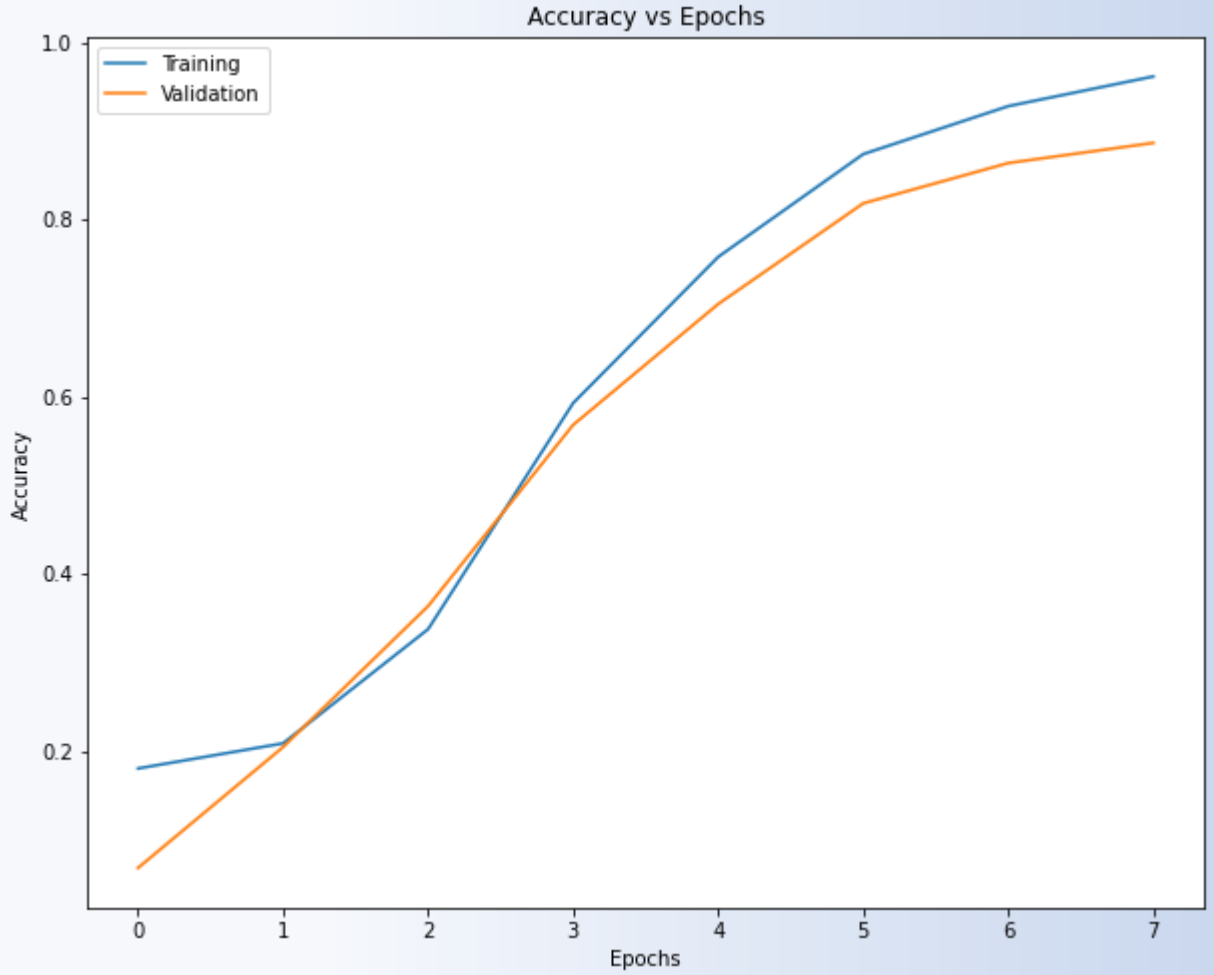
Sentence Classification



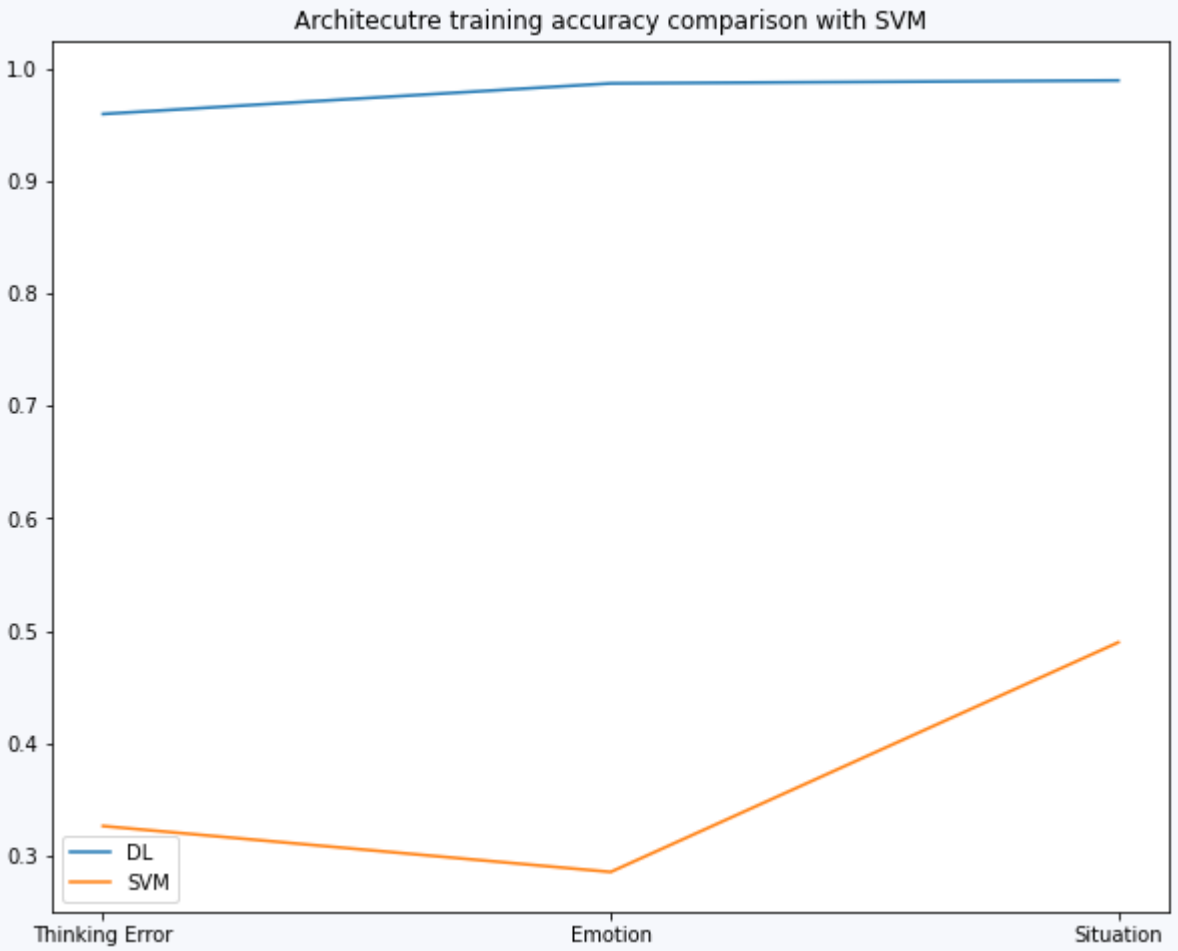
Experimentation and Results

Training Phase
Epochs = 8
Number of training examples = 431
Size of Validation set: 43





Comparison with SVM



Result obtained for Unseen Test Data

Size of Test set = 49

```
2/2 [==============================] - 0s 177ms/step - loss: 0.7461 - accuracy: 0.7347
Thinking Error: Test set
  Loss: 0.746
  Accuracy: 0.735
2/2 [==============================] - 0s 177ms/step - loss: 0.4483 - accuracy: 0.9184

Emotion: Test set
  Loss: 0.448
  Accuracy: 0.918
2/2 [==============================] - 0s 196ms/step - loss: 0.3320 - accuracy: 0.9184

Situation: Test set
  Loss: 0.332
  Accuracy: 0.918
```

Inference

	0	Thinking Error (actual)	Thinking Error (predicted)	Situation (actual)	Situation (predicted)	Emotion (actual)	Emotion (predicted)
0	every day there are funerals that i mourn for ...	Comparing	Labelling	Other	Other	Guilt	Guilt
1	joy is a state of mind and i have not experien...	Emotional Reasoning	Emotional Reasoning	Life	Life	Grief	Grief
2	i have no one to converse with when i have all...	Emotional Reasoning	Mind-reading	Work	Work	Frustration	Frustration
3	i'm being bullied by everyone	Over-generalizing	Over-generalizing	Life	Life	Hurt	Hurt
4	i have a nice family friends but i don't feel ...	Loneliness	Loneliness	Existential	Existential	Anger	Anger
5	life is all but sad	Black and White	Over-generalizing	Life	Life	Grief	Grief
6	with the burden of all these difficulties inse...	Emotional Reasoning	Emotional Reasoning	Work	Work	Frustration	Frustration
7	i'm just distressed and stuck with a disorder ...	Labelling	Labelling	Life	Life	Depression	Depression
8	every day is a funeral i mourn my old self	Comparing	Personalizing	Other	Other	Guilt	Guilt
9	i am deprived of love since my childhood	Blaming	Labelling	Bereavement	Bereavement	Grief	Grief
10	i feel very lonely at school at home and every...	Catastrophising	Catastrophising	Work	Work	Loneliness	Loneliness
11	its been a long time since i have hated life	Labelling	Labelling	Life	Life	Hurt	Grief
12	i have major anxiety and visual problems every...	Personalizing	Personalizing	Life	Life	Anxiety	Anxiety
13	everyone thinks i am sufferring from a bad day...	Emotional Reasoning	Emotional Reasoning	Life	Life	Frustration	Frustration
	i struggle to reach the intermediate level						

Drawbacks

- Data has been taken from social media platforms on voluntary basis so it may contain the same biases.
- The dataset is small and unbalanced.
- The dataset is self-annotated. Since, this is a field of mental healthcare and requires high expertise, a more generic result could be obtained if the annotations are done by a certified psychiatrist.
- The model is not able to give good results with sentences that contain words which are not in the training set corpus.

Conclusion and Future Scope

- The problem that has been targeted is challenging. It takes a lot of knowledge, experience and hard work for psychiatrists to perform cognitive behavioural therapy on their patients.
- This project is aimed at helping in automating the process so that it can reach to the masses and psychiatric help can be democratized.
- The model implemented does achieve a good accuracy and inference, however, is subject to errors when dealing with sentences that contain words which are not in the training set corpus.
- To solve this purpose, reinforcement learning algorithms may be used which keep on updating the model based on new inputs. Further, the dataset can be expanded to include more diverse examples for the algorithm to perform better.
- Efforts can be made towards developing a chat – bot which integrates the model predictions at the backend and can act as a medical aide gaining insights about people from their conversations and helping them out if they are in distress.

Acknowledgement

We would like to thank our professor, Dr. Snehasis Mukherjee for providing us with the opportunity to learn about a challenging problem in the field of Deep Learning. We learnt a number of new concepts and framework tools to implement this project successfully. His focus on concepts and constant guidance and support throughout the course helped us a lot. The course, its assignments, evaluation and the project, all have contributed to a great learning experience for us.

References

[1] arXiv:1906.02448
[2] Lina Rojas-Barahona1 , Bo-Hsiang Tseng1 , Yinpei Dai1 , Clare Mansfield2 Osman Ramadan , Stefan Ultes , Michael Crawford and Milica Gasi “Deep learning for language understanding of mental health concepts derived from Cognitive Behavioural Therapy” 2018

Q&A