

# MENTAL HEALTH CHATBOT

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# AGENDA FOR TODAY

**1. Introduction  
of Project**

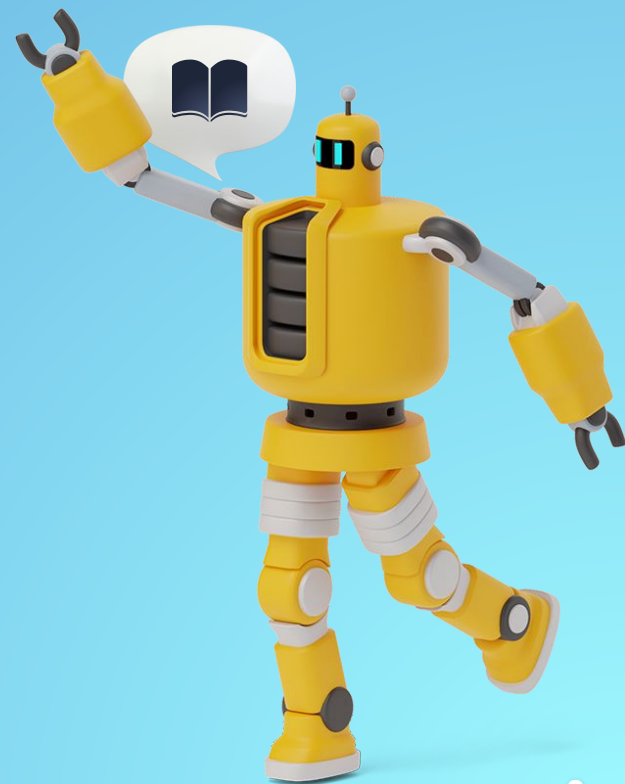
**2. Background  
- Woebot**

**3. Example Data  
Format Used -  
Input, Outputs**

**4. All Three  
Models**

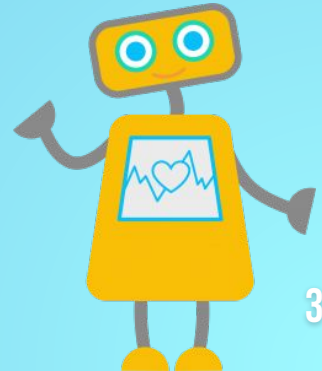
**5. Future Projects**

**6. Conclusion**



# INTRODUCTION OF PROJECT

- With there being thousands of individuals who cannot afford treatment there has been research and work on creating chatbot apps like Woebot that provide support to individuals struggling with mental health issues
- Focused first on creating simple rule-based program as a starting point for a chat box
- Focused on advancing model by trying to use sequence models like RNNs and LSTMs
- Lastly focused on using SOTA to create a more conversational human like conversation



# WOEBOT

- Psychotherapy chatbot
- Cognitive Behavioral Therapy

I'm worried about doing well at my presentation tomorrow. I want it to go well.

So how did your re-write go?

I tried

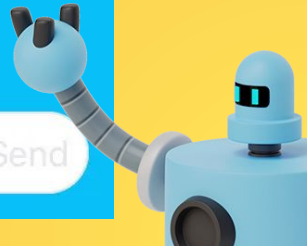


NICE!

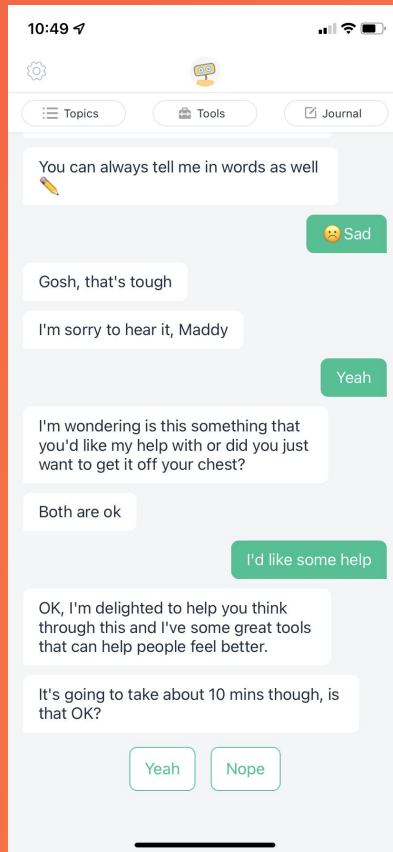
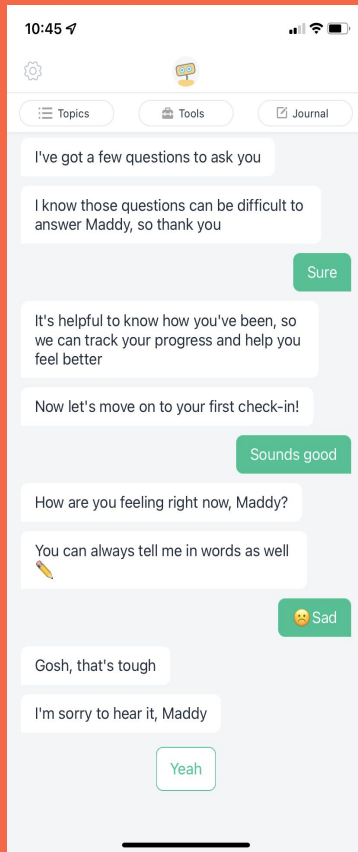
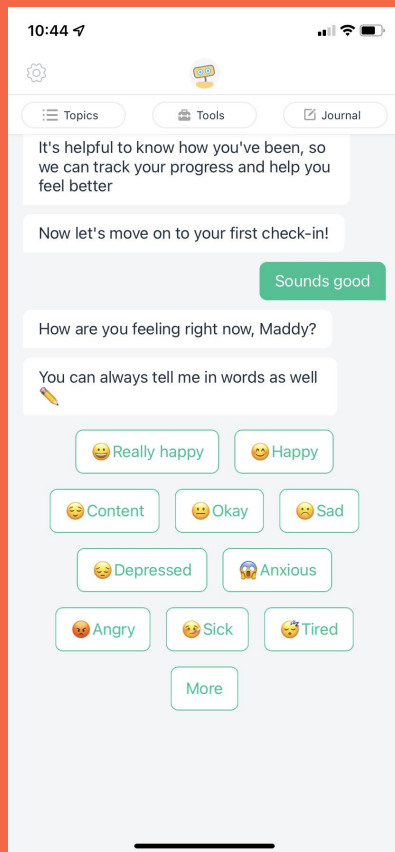


Type a message

Send

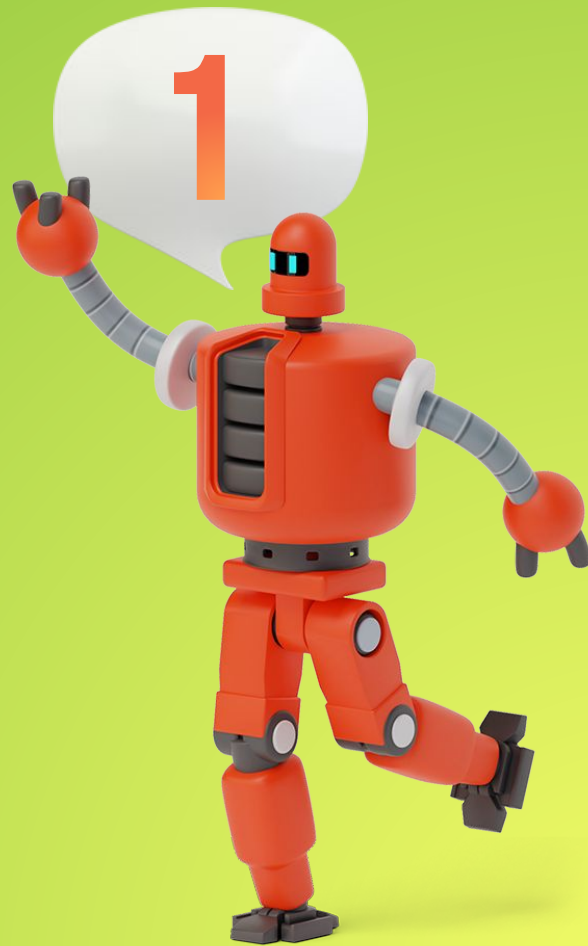


# SAMPLE OUTPUTS



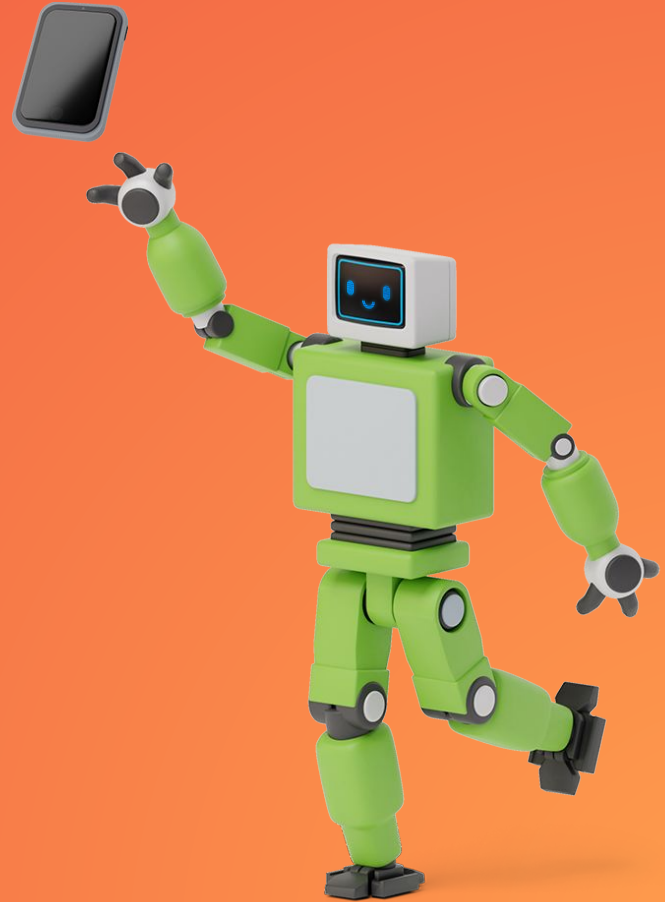
# ELIZA

A simple rule-based chatbot that holds small conversations



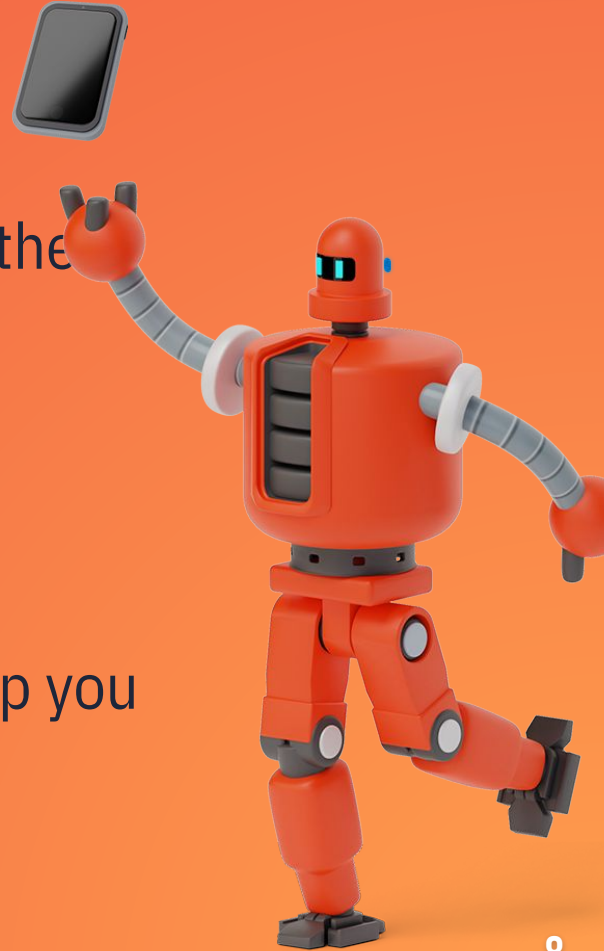
# ELIZA

- Based on Rogerian psychotherapy
- The “therapist” repeats what the patient says back to them in the form of a question or request for more information.



# SAMPLE CONVERSATION

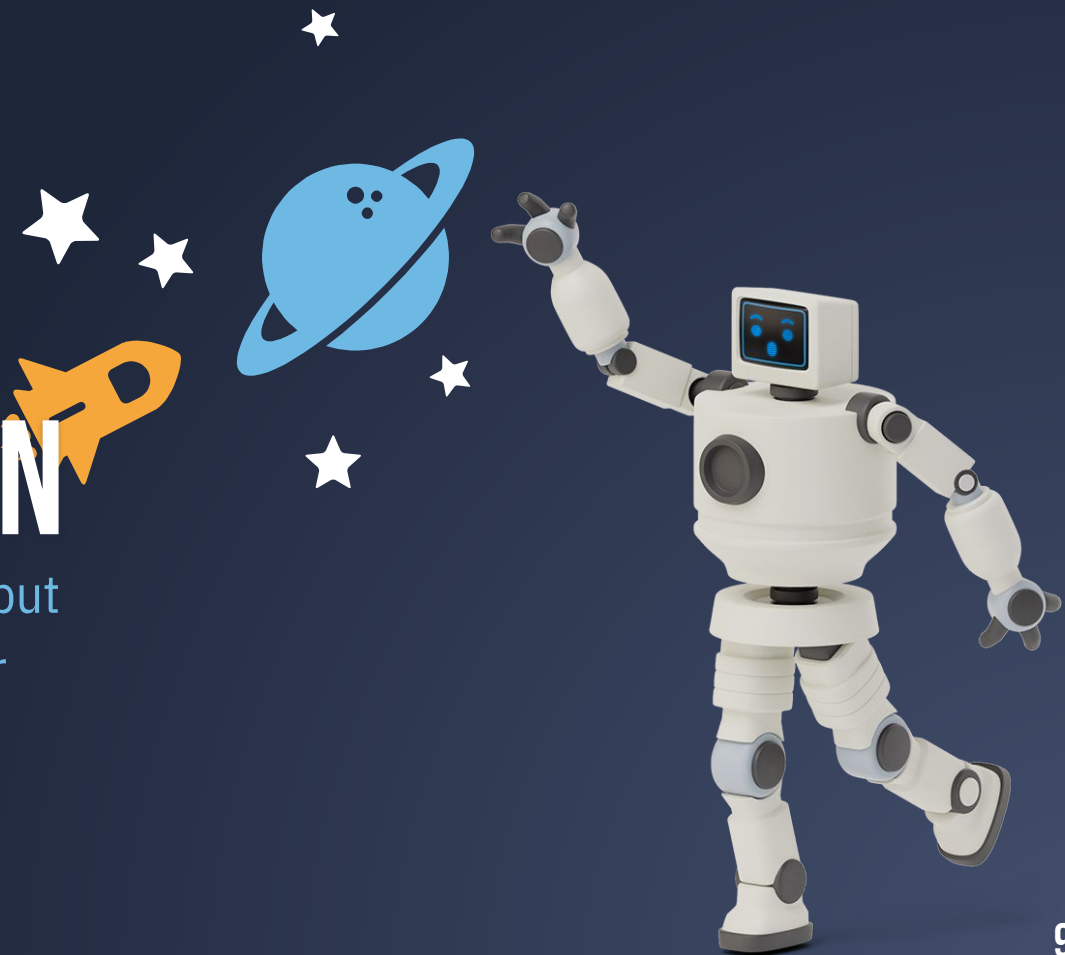
- **Person** : He says I'm depressed much of the time.
- **ELIZA** : I am sorry to hear that you are depressed.
- **Person** : It's true. I am unhappy.
- **ELIZA** : Do you think coming here will help you not to be unhappy?





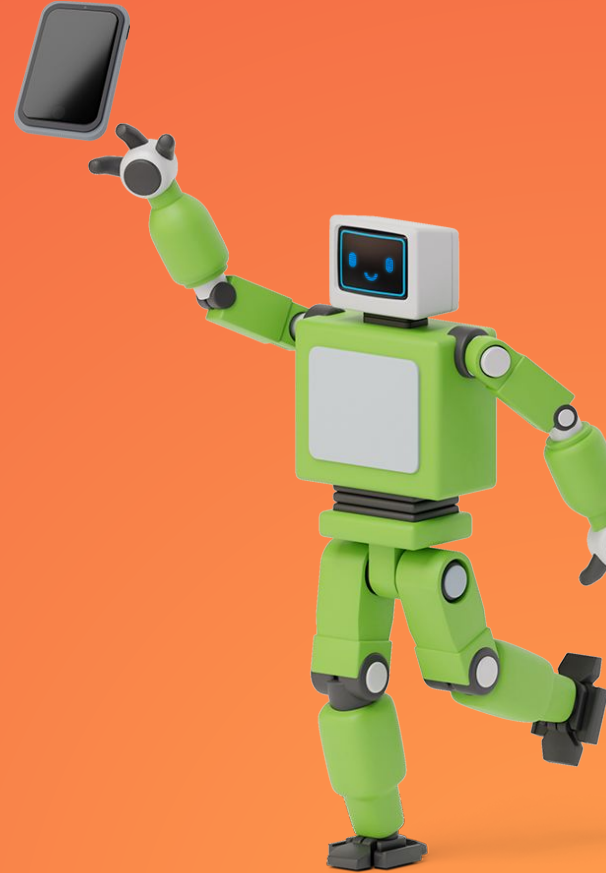
# TOKENIZATION

Turning the chatbot user's input  
into a form that the computer  
can interpret.



# SUPPORTING CODE ESSENTIALS

- **User input:** String "Hello, I really like computers!",
  - **Tokenizer Output:** List ["Hello", ",", "I", "really", "like", "computers", "!"]
- OR
- ["Hello", "I", "really", "like", "computers"]



# SUPPORTING CODE ESSENTIALS FOR RESPONDING

- ❑ Using lists and variables to hold keywords for potential inputs and outputs
- ❑ Simple if, elif, and for loops

Example:

```
hello_keywords = ['Hello', 'hi', 'howdy', 'hello',  
'morning']
```

```
default_response = 'Sorry do you mind clarifying  
that?'
```



# NLP- RNN- LSTM

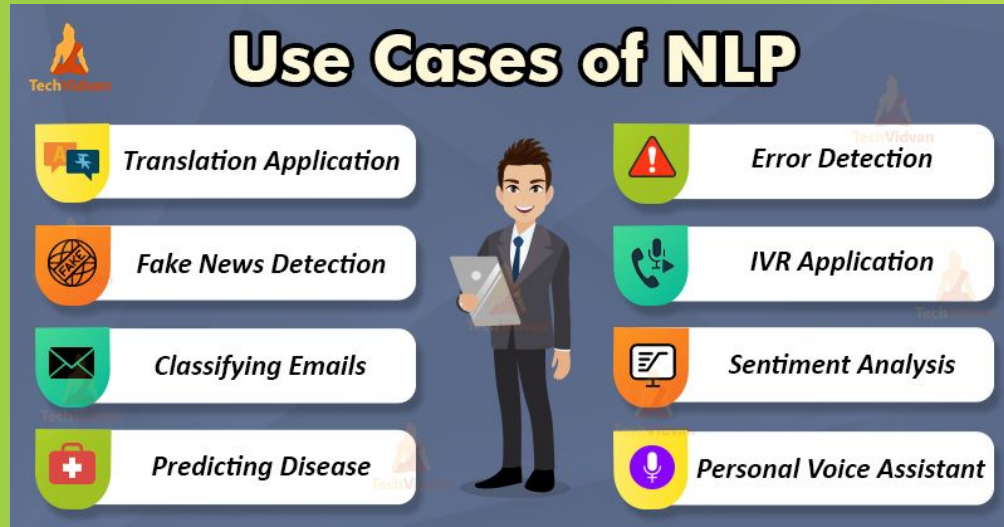
A more advanced chatbot utilizing  
sequence models



# NLP

## Natural Language Processing:

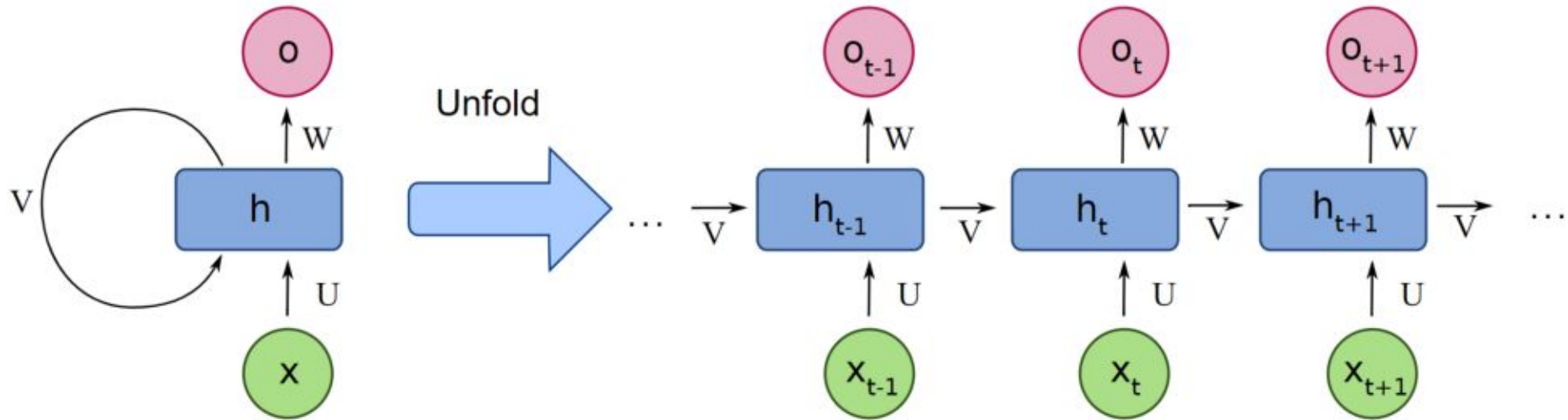
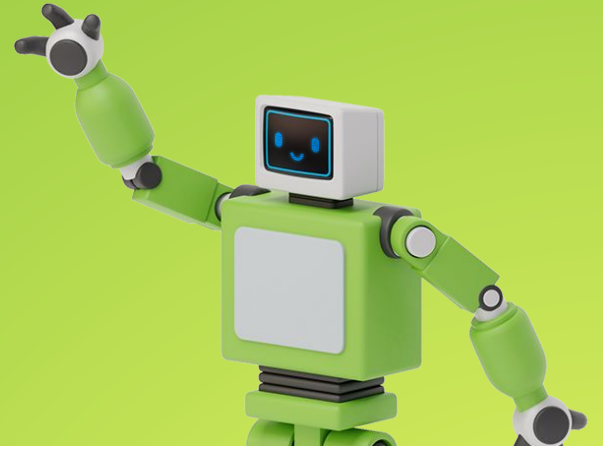
Using computers to process, model, generate, and understand human language (spoken and written)



# RNN

## Recurrent Neural Network:

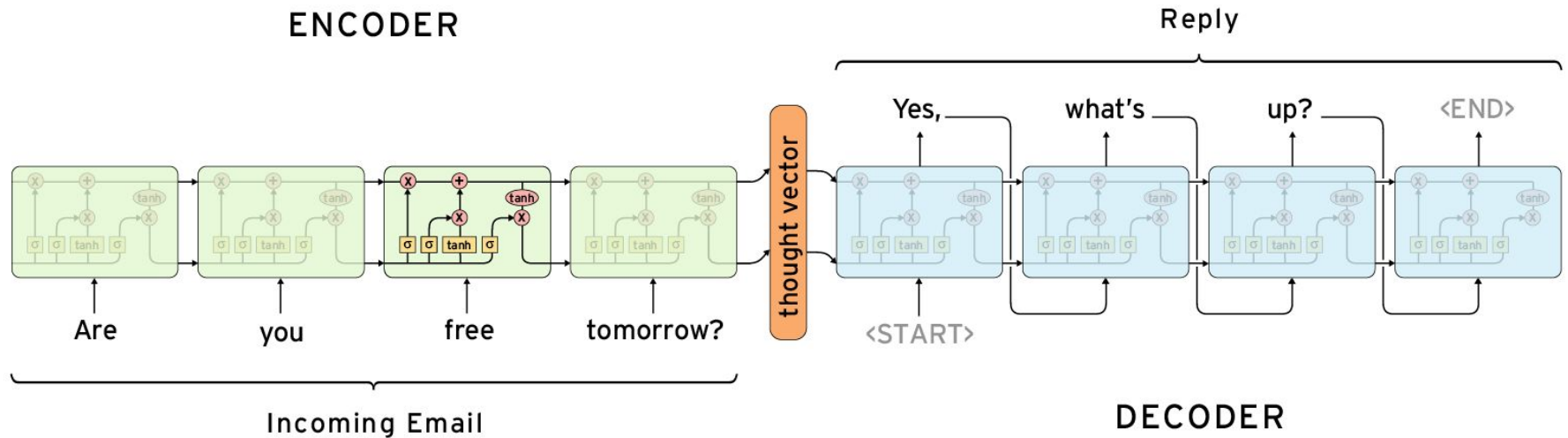
Designed for sequence data



# LSTM

## Long-Short Term Memory Network:

Specialized RNN

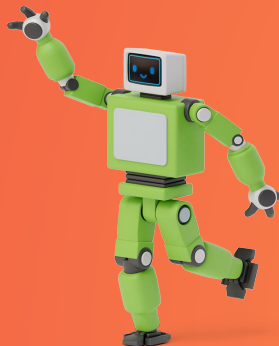


# OUR DATA

```
chat_data.head(5)
```

Unnamed: 0	questionID	questionTitle	questionText	questionLink	topic	therapistInfo	therapistURL	answerText	upvotes	views	split
0	0	0	Can I change my feeling of being worthless to everyone?  I'm going through some things with my feelings and myself. I barely sleep and I do nothing but think about how I'm worthless and how I shouldn't be here. I've never tried or contemplated suicide. I've always wanted to fix my issues, but I never get around to it. How can I change my feeling of being worthless to everyone?	<a href="https://counselchat.com/questions/can-i-change-my-feeling-of-being-worthless-to-everyone">https://counselchat.com/questions/can-i-change-my-feeling-of-being-worthless-to-everyone</a>	depression	Sherry Katz, LCSW Couples and Family Therapist, LCSW	<a href="https://counselchat.com/therapists/sherry-katz-lcsw">https://counselchat.com/therapists/sherry-katz-lcsw</a>	If everyone thinks you're worthless, then maybe you need to find new people to hang out with. Seriously, the social context in which a person lives is a big influence in self-esteem. Otherwise, you can go round and round trying to understand why you're not worthless, then go back to the same crowd and be knocked down again. There are many inspirational messages you can find in social media. Maybe read some of the ones which state that no person is worthless, and that everyone has a good purpose to their life. Also, since our culture is so saturated with the belief that if someone doesn't feel good about themselves that this is somehow terrible. Bad feelings are part of living. They are the motivation to remove ourselves from situations and relationships which do us more harm than good. Bad feelings do feel terrible. Your feeling of worthlessness may be good in the sense of motivating you to find out that you are much better than your feelings today.	1	2899	train

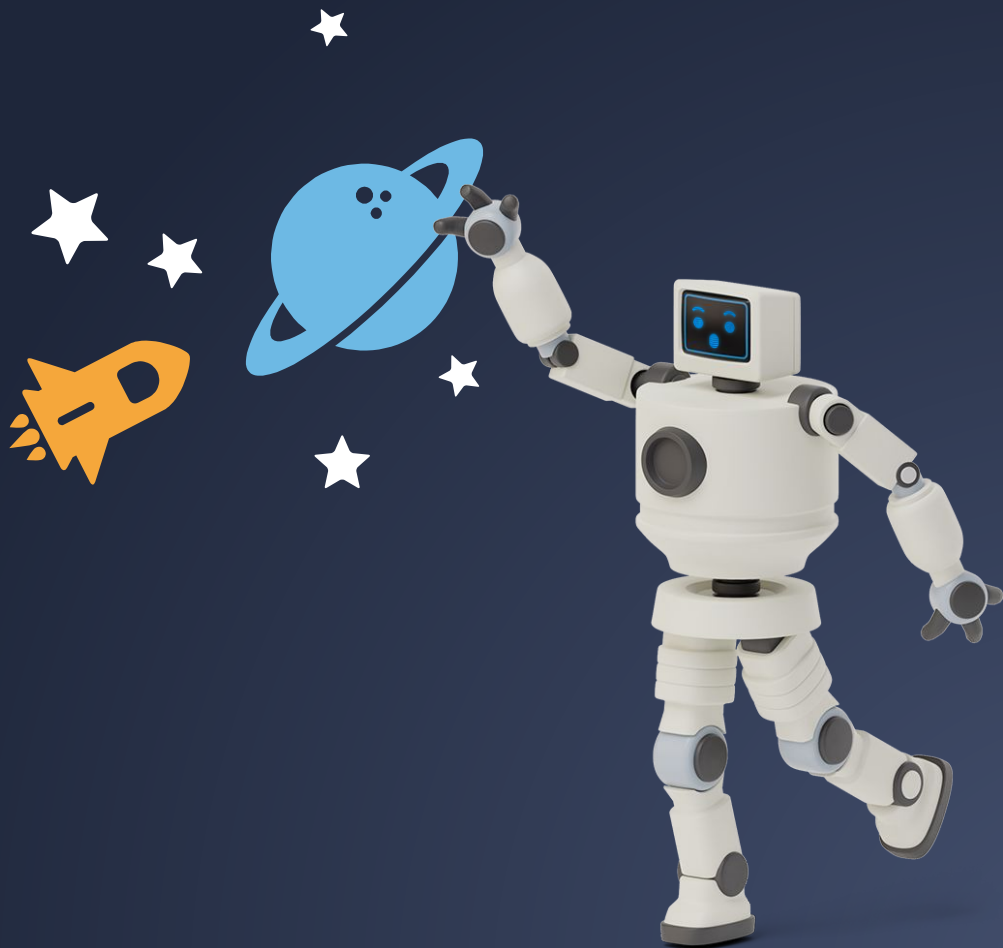
- Our features:
  - Input (X) - 'questionText'
  - Output (y) - 'answerText'





# CLEANING DATA

Why do we need to clean the  
data before processing it?

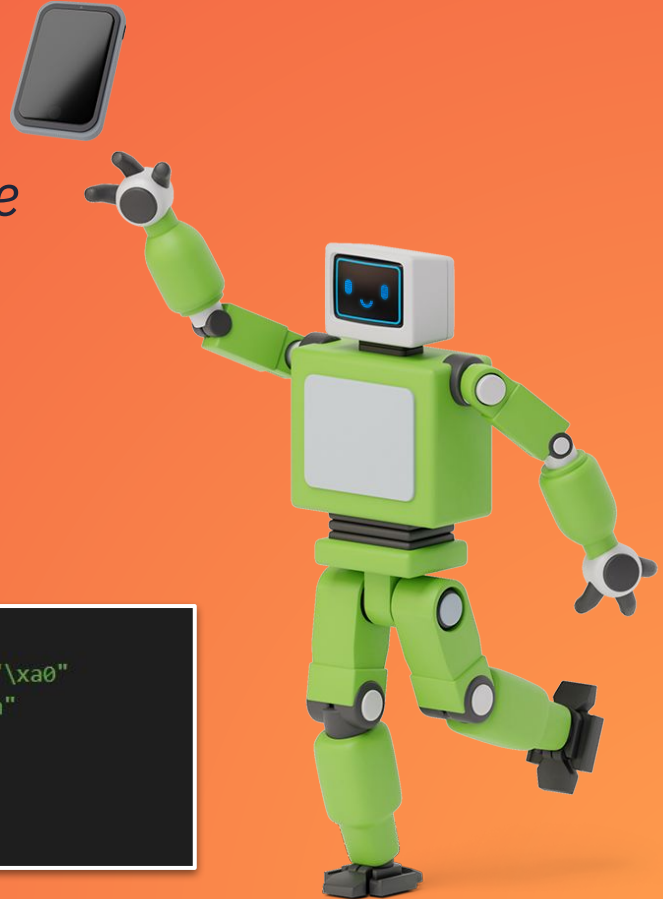


# CLEANING THE DATA

- Computers can't understand *language data*
- Regular expressions perform pattern matching

*Sample cleaning of the data*

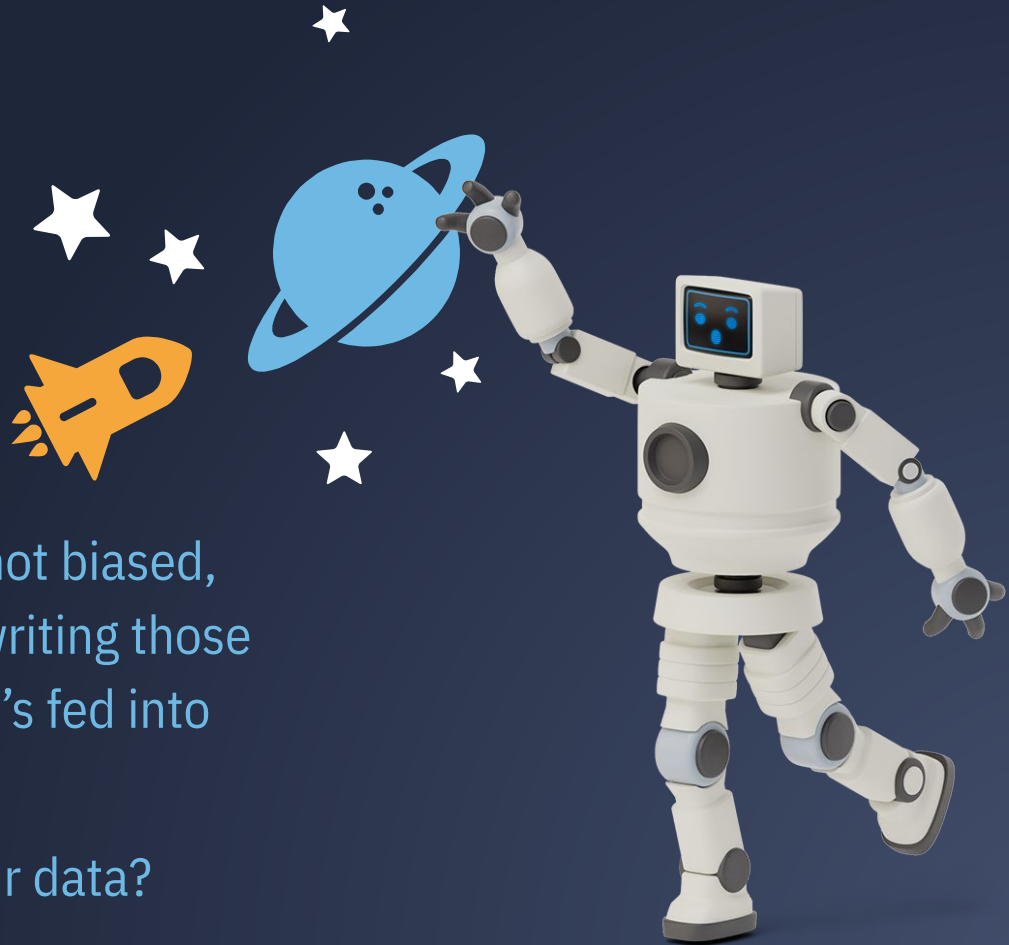
```
[ ] def preprocess_text(phrase):  
    phrase = re.sub(r"\xa0", "", phrase) # YOUR CODE HERE: get rid of "\xa0"  
    phrase = re.sub(r"\n", "", phrase) # YOUR CODE HERE: get rid of "\n"  
    phrase = re.sub("[.]{1,}", ".", phrase) # removes duplicate "."s  
    phrase = re.sub("[ ]{1,}", " ", phrase) # removes duplicate spaces  
  
    return phrase
```



# BIAS

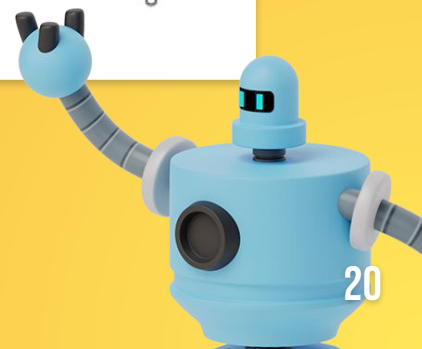
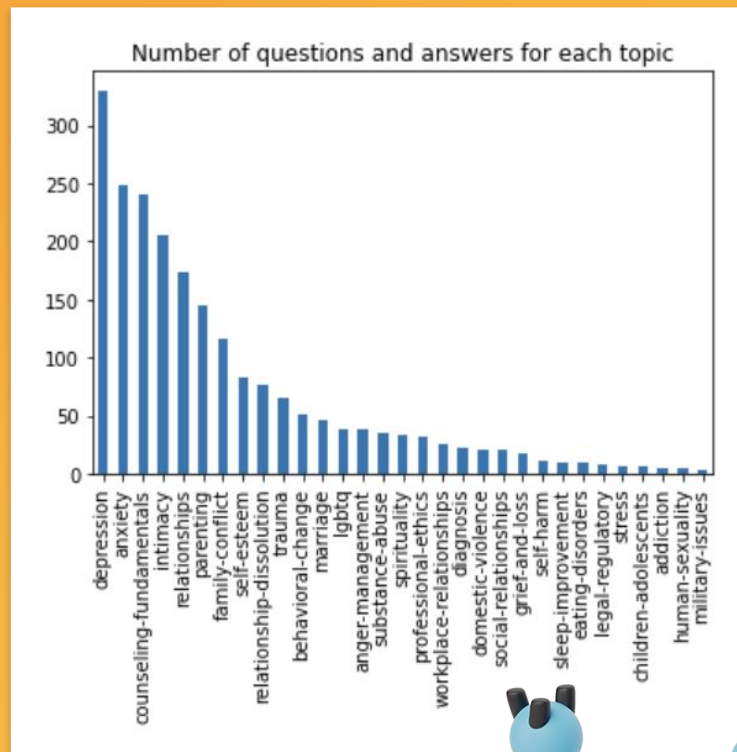
Algorithms themselves are not biased, but what about the people writing those algorithms and the data that's fed into them.

What might create bias in our data?



# BIAS IN OUR DATA SET

- A large gap in questions and answers per topic.
- Leads to the algorithm being better at answering certain questions more accurately.



# HOW WE ACCOUNTED FOR BIAS

- Added in padding into our input and output to create equal length sentences
- However, did not create equal weight of input related to certain diagnosis categories

```
sentence_arr = sentence.split(" ")
start_token = ['<SOS>']
end_token = ['<EOS>']
padding = ['<pad>']
diff = max_len - (len(sentence_arr) + 2)

if diff > 0: # if too short, add padding + start/end tokens
    ## BEGIN YOUR CODE HERE
    tokenized_sentence = start_token + sentence_arr + end_token + (padding*diff)
```

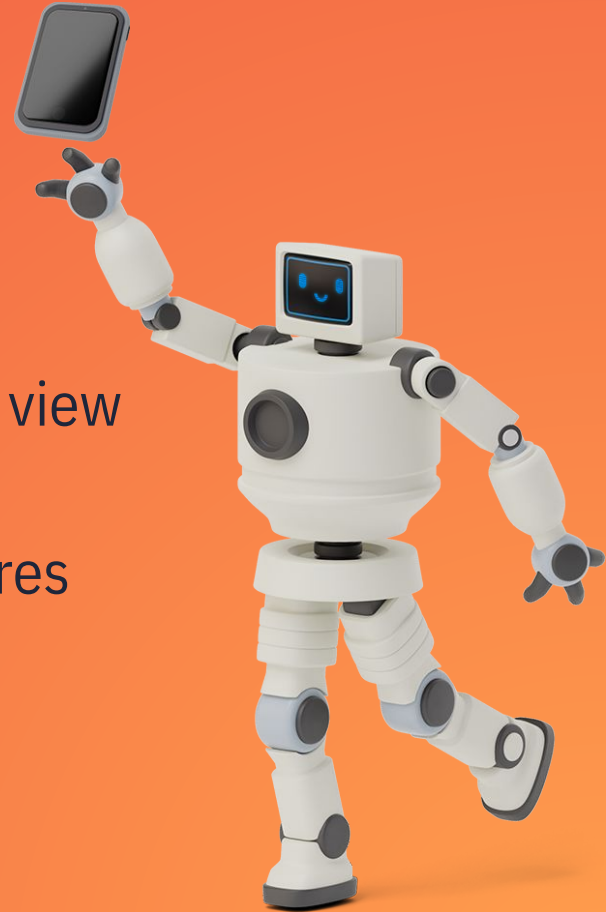
# SOTA

“State of the Art” machine learning model  
that pays attention to certain words



# MASKING & TRANSFORMERS

- **Transformers:** A neural network that is taught to pay attention to certain words
  - Multi-Headed Attention lets the model view the data from different perspectives
- **Masking:** covering up fillers so model ignores these words
  - E.g - <pad> is a placeholder word



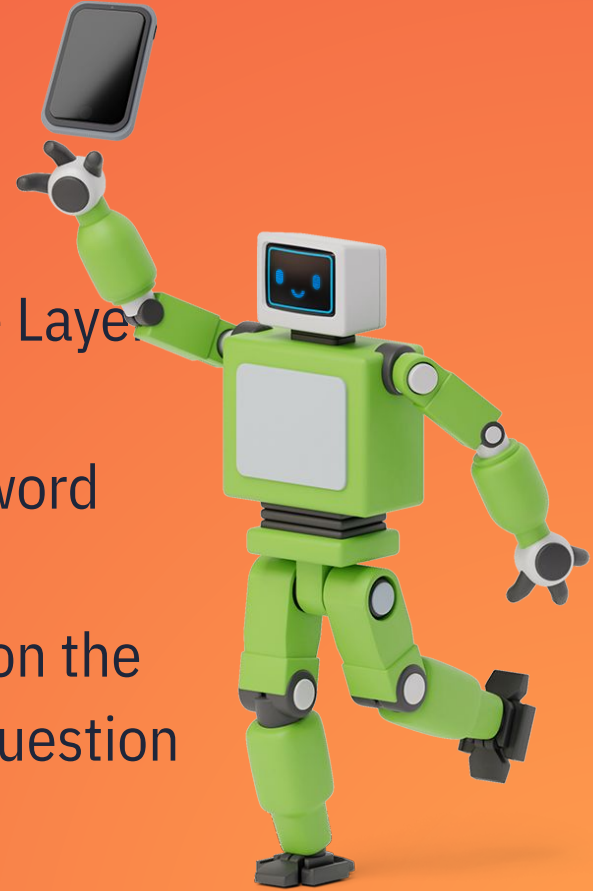
# ENCODERS & DECODERS

- **Encoders**

- Input: Multi-Headed Attention, Dense Layer and Batch Normalization layers
- Output: matrix of the weight of each word

- **Decoders**

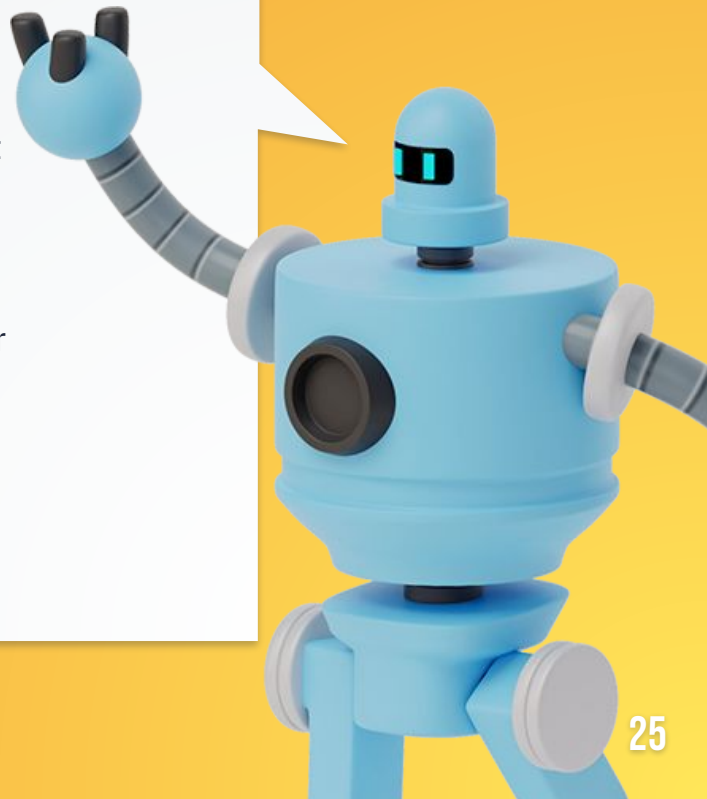
- Learns the therapist response based on the weight of each word in the patient's question





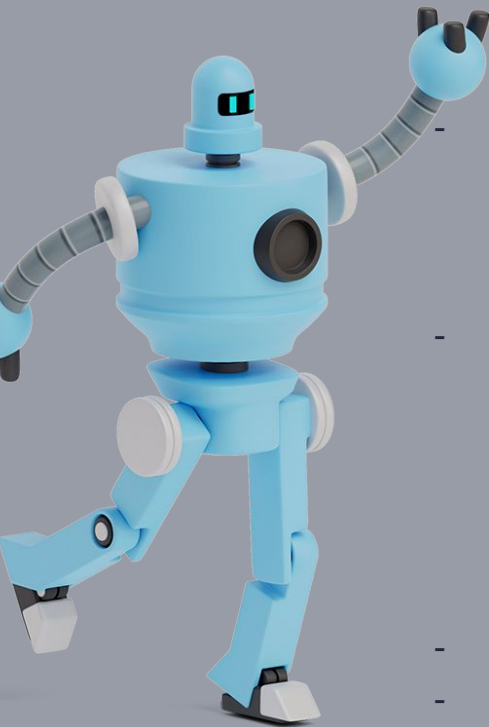
# THE FUTURE

- Far from perfect- future steps:
  - Look for more data sets
  - Potential combine datasets together allows for more training data
  - Test with data that is from a large variety of individuals not just one group
  - Create a default setting that triggers for certain keywords. For example, words related to SI system gives user emergency mental health resources or if prompted by user gives user a list of mental health professionals near by the user that would accept their insurance
  - Potentially turn into an app



# CONCLUSION

- BIAS is important!
- ELIZA:
  - Simple rule-based architecture
  - Not very effective
- NLP- RNN- LSTM:
  - Better then ELIZA
  - Use sequences
  - Keeps context from previous outputs
- Sota:
  - More advanced neural networks that build on top of RNNs and LSTMs
  - Use sequences-> keeps context
  - TRANSFORMERS- “Attention” Mechanism
  - More conversational
  - Model not fully performing as intended
- Continue improving our model
- Another mental health resource



# ANY QUESTIONS?

