User Response Classification Challenge

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Abstract

Abstract Text

I. Introduction

Chatbots are used in many applications today: customer support, flight booking, scheduling meeting, ordering food and many more. The application of a chatbot explored in this dataset is for a therapy chatbot. These types of chatbot, while very effective, may require human intervention. Determining when a human should intervene can be quite important, in this case when a person requires help in dealing with a complex situation, and requires tools to identify these situations.

The data set contains 80 examples of responses entered into a therapy chatbot. Each of these responses contains an id as well as an identification. The identification is either "flagged" if the response was flagged for human intervention or "not flagged" if not.

The task at hand was to create an AI agent to classify the user response.

II. Tools

The following tools and modules were used to complete this task:

- python 3.
- pandas
- dy-net (for the RNN)
- scikit learn (for the Random Forest)
- numpy
- tqdm (for progress bars)
- csv (For reading the csv embeddings to pandas)
- re (regular expressions) (for cleaning the data)

III. Preparing Data

The input data being sentences had to be cleaned up before passing into the models.

The first step was to load the csv file into a pandas dataframe and see what the data looked like. The data was, as mentioned above, a label as well as a sequence of words (not an array implementation yet). Due to the inherent nature of natural language processing both the label and sequence of words had to be converted to something which the machine could understand. That is, the label had to be converted from "flagged" or "not flagged" to 1 or 0 respectively and the sequence had to be converted to a series of word embeddings where each embedding represented a single word.

The models were created to do the conversion from label to 1 or 0 and from sentence of words to sequence of embeddings. The embeddings used were the GloVe embeddings due to their versatility, however another embedding which could have been used is the word2vec embedding.

IV. Models

i. RNN

When looking at sentence classification, one of the first thought was too look at an RNN encoder that would encode the sentence word by word and the computing a probability of being "flagged" or "not flagged". The label with the highest probability would then be applied to the sentence input.

i.1 RNN Description

DESCRIPTION OF RNN AND IMAGE/SKETCH OF THE MODEL CRATED

i.2 Tuning Parameters

When the model was created, the different parameters were tuned:

- Embedding Dimmension
- Hidden Dimmension Size
- Number of Epochs Run

The results for all of these tuning experiments are shown in the results section.

ii. Random Forest

After getting results for the RNN encoder and finding the

V. Results

i. RNN

i.1 hidden dimmension

The hidden dimmension test was done by keeping all parameters of the RNN constant except for the hidden dimmension of the RNN. The following figure shows the results for the hidden dimmension test performed. The test was performed by changing the size of the embedding dimmension from 0 to 9 dimmensions in steps of 1. The training loss, dev set true positive , dev set true negative , dev set false positive and dev set false negative were computed for each of the models run and a graph was created showing the true positive rate and the false positive rate.

	type	test	filename	maxEpochs	num_layers	embeddingSize	hiddenDim	train_loss	accuracy	truePos	trueNeg	falsePos	falseNeg
0	RNN	hidden_dimm	hidden_dimm_stats0.csv	400	1	50	0	36.1499	0.716667	0	17.2	6.8	0
1	RNN	hidden_dimm	hidden_dimm_stats1.csv	400	1	50	1	5.5576	0.579167	2.2	11.7	5.5	4.6
2	RNN	hidden_dimm	hidden_dimm_stats2.csv	400	1	50	2	0.886681	0.504167	2.6	9.5	5.7	6.2
3	RNN	hidden_dimm	hidden_dimm_stats3.csv	400	1	50	3	0.00841726	0.591667	2.4	11.8	5.3	4.5
4	RNN	hidden_dimm	hidden_dimm_stats4.csv	400	1	50	4	0.00756414	0.483333	2	9.6	5.1	7.3
5	RNN	hidden_dimm	hidden_dimm_stats5.csv	400	1	50	5	0.00441678	0.529167	1.9	10.8	4.9	6.4
6	RNN	hidden_dimm	hidden_dimm_stats6.csv	400	1	50	6	0.00633066	0.5375	1.6	11.3	4.6	6.5
7	RNN	hidden_dimm	hidden_dimm_stats7.csv	400	1	50	7	0.00421989	0.558333	1.9	11.5	5.8	4.8
8	RNN	hidden_dimm	hidden_dimm_stats8.csv	400	1	50	8	0.00384365	0.5125	1.9	10.4	6.1	5.6
9	RNN	hidden_dimm	hidden_dimm_stats9.csv	400	1	50	9	0.0032208	0.491667	2.3	9.5	5.2	7

Figure 1: *Shows the table of hidden dimmension tests for the RNN*

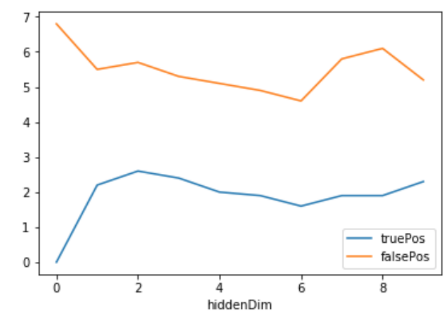

Figure 2: *Shows the graph of true positive count vs hidden dimmension of RNN*

While this graphs shows the true positive count, the more interesting metric which can be derived fromt he true positive count and the false negative count is the true positive rate (tpr) which shows how much of the truth the model captures.

The following figure shows the tpr for the RNN model for different hidden dimmensions.

Please note that, because the

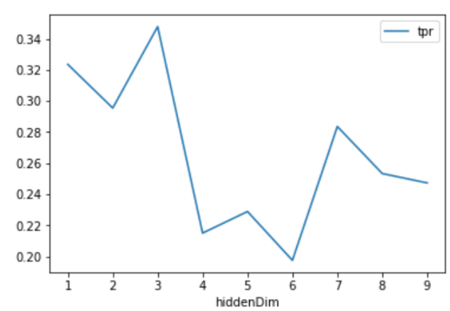

Figure 3: *Shows the graph of true positive rate vs hidden dimmension of RNN*

From this figure, we can clearly see that the tpr is greatest when the hidden dimmension is 3. Thus, the hidden dimmension will be set to 3 for the other models.

i.2 GloVe embedding size

ii. Random Forest

Table 1: *Example table*

Name		
First name	Last Name	Grade
John	Doe	7.5
Richard	Miles	2

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$$e = mc^2 \tag{1}$$

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VI. Discussion

i. Subsection One

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ii. Subsection Two

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References

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