SentiMind: A Deep Neural Network Based Emotion Classifier

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Abstract

SentiMind is a emotion classifier, which leverage the power of deep neuron network, to generate a sentiment analysis of sentences. This model can be practically helpful to summarize social media comments, analyzing public opinion trends, identifying conflicts and strengthening the quality of verbal communication. SentiMind will involve multiple deep learning techniques, including FNN and CNN, incorporate with online sentiment dataset from Hugging Face, to produce reliable and rapid sentiment analysis to a string of words. (String of words: one or more sentences).

1 Introduction

It is crucial to understand the emotions behind human-written text in this modern era. What we put on the internet through the keyboard often reflects our knowledge, our position, and more importantly, our sentiment behind it. When sentiments echo within a certain group of people, they quickly spread and reinforce, and rapidly reach everywhere, influencing our decision and mindset. Although we actively become part of the spread of emotions every day online, accurately interpreting the tone behind the flow of text is still not an easy task to do. Our project, SentiMind, is a deep learning project that aims to address the sentiment behind every human text, and accurately classify the true tone of the input. Our implementation involves first tokenizing input sentences, applying transformer encoder to produce context-aware embeddings, and then feeding into a convolution neuro network, then applying softmax to predict the sentiment based on predefined categories. It will be trained on Huggingface labelled dataset to ensure accuracy. We expect it to offer a convenient and efficient way to detect the sentiment behind every human writing and provide a practical solution to understanding emotional nuances in text.

2 Preliminaries and Problem Formulation

We wish to design and train a model, that takes a string of words as input, and generate the emotion category as the output.

- **input:** Just an employee, just stressed that it takes so long to save 10k for example and even that is nothing! Should of brought more bitcoins
  output: 9 (Disappointment) Refer to Appendix A for class to ID chart.

- **input:** Lol so petty, I kinda love it. I probably wouldn't actually do that but it's tempting.
  output: 0 (Admiration), 1 (Amusement)

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- **input:** No problem at all, glad I could help :) Cheers!
  output: 17 (Joy)

3 Solution via Deep Learning

To develop SentiMind, we first split the dataset into training, validation, and test sets in proportions of 70%, 20%, and 10%, respectively. We utilize Convolutional Neural Networks (CNN) enhanced with transformers to model the emotional tone conveyed in text. The text data is pre-processed using GloVe to generate word embeddings, which provide a representation of words that captures their meanings and semantic relationships. We use cross-entropy as the loss function because the task is multi-classification. Training involves feeding batches of these embeddings into the CNN, where the convolutional layers learn to identify and interpret the emotional content of sentences. The hyperparameters of the CNN, such as depth, are optimized during the validation step, using the separate validation dataset to assess model performance and make adjustments to prevent overfitting. This ensures the model generalizes well to new, unseen data. Finally, testing the model on the test dataset evaluates the accuracy, reliability, and generalization of the model.

4 Implementation

You explain the details of your design, plot diagrams if needed and name the key components. You also name the algorithms you have used for each component and include pseudo-code if necessary. If an algorithm is new, you should briefly explain it. You may also name the specific modules and/or libraries you have used for implementation.

5 Numerical Experiments

You explain the experiments you have conducted to check your implemented design. You must also specify all values and parameters you have considered in the simulation, plot the learning curves or show the test values in the form of tables. If you have a demo test, you could also present it here. Also, if you compare your implementation against a benchmark or a reference setting, you should explain what the benchmark is and specify how you got the results for the benchmark (it's all OK if you get the result for the benchmark from an already implemented code or copy it from a paper, you should just cite them).

5.1 Including Figures

6 Answer Research Questions

You may include answer to research questions here.

7 Conclusions

You should shortly conclude what you learned during project. Also, if you have any idea for further improvement of the results or extension, you may mention it here.

References

Include all references here. It's important to have your references cited.

[1] Alexander, J.A. & Mozer, M.C. (1995) Template-based algorithms for connectionist rule extraction. In G. Tesauro, D.S. Touretzky and T.K. Leen (eds.), *Advances in Neural Information Processing Systems 7*, pp. 609–616. Cambridge, MA: MIT Press.

[2] Bower, J.M. & Beeman, D. (1995) *The Book of GENESIS: Exploring Realistic Neural Models with the GEneral NEural SImulation System.* New York: TELOS/Springer–Verlag.

[3] Hasselmo, M.E., Schnell, E. & Barkai, E. (1995) Dynamics of learning and recall at excitatory recurrent synapses and cholinergic modulation in rat hippocampal region CA3. *Journal of Neuroscience* **15**(7):5249-5262.

Appendix

Emotion Class ID	Emotion
0	Admiration
1	Amusement
2	Anger
3	Annoyance
4	Approval
5	Caring
6	Confusion
7	Curiosity
8	Desire
9	Disappointment
10	Disapproval
11	Disgust
12	Embarrassment
13	Excitement
14	Fear
15	Gratitude
16	Grief
17	Joy
18	Love
19	Nervousness
20	Optimism
21	Pride
22	Realization
23	Relief
24	Remorse
25	Sadness
26	Surprise

Table 1: Emotion Class ID Chart