

CLASSIFYING 6 BASIC EMOTIONS USING DIFFERENT PRE-TRAINED TRANSFORMER MODELS

by

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I declare that this dissertation is my own work and that the work of others is acknowledged and indicated by explicit references.

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Abstract

The process of extracting emotions out of a piece of text will be of a great importance to better identify and understand the users online in this digital world. As this has many benefits such as getting a sense of the general emotion that the crowd of users leaning towards, especially towards news and events through comments. However, creating machine learning algorithms to accurately classify the emotion of a text is a challenge that many are facing with any classification. Therefore, this dissertation's aim is to search for a better models, mainly transformers models to compare and contrast, which model works the best. This will be in terms of accuracy, f1-score, confusion matrix and any evaluation functions. The main models that this project will focus on will be miniLM and Llama2, as proposed mechanisms will use multiple attention layers. These reveal the relationships of each word towards each other which have not been investigated before. In which sparks my motivation to take on this project to further investigate fine-tune different pre-trained transformers models.

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Abbreviations

NLP	Natural Language Processing
GPU	Graphic Processing Unit
LLM	Large Language Model
CPU	Central Processing Unit
RAM	Random-access Memory
FEC	Forward Error Correction
JPEG	Joint Photographic Experts Group
MPEG	Moving Pictures Experts Group
SER	Symbol Error Rate
SNR	Signal to Noise Ratio

Chapter 1

Introduction

1.1 Chapter Overview

This chapter will mainly focus on the introduction of the project. It will discuss the background of this project, its aims and objectives as well as its overview and its limitations that will later face.

1.2 Project Background

"What is emotion?" According to the Oxford English dictionary, it means a strong feeling deriving from one's circumstances, mood, or relationships with others (*akrasia*, n. n.d.). One's emotion can be portrayed through facial expressions, speaking and writing. Nowadays with the ever rising popularity of social media such as Tiktok and X (previously named Twitter) provide a way to post their opinions, mood and emotions online. In which they could also express contempt towards another. Therefore the task of identifying the emotion that the other party's feeling toward the contempt-filled post or both parties are necessary as emotion is a fundamental part of human life, influencing both physical and mental health (Ameer, Bölücü, Siddiqui, Can, Sidorov & Gelbukh 2023). Emotion classification is a context-based device therefore with visual and vocal along with text, will be easier to identify. However, in a world without other two inputs (facial expressions and tone of voice), it is harder for the classification to accurately output the correct emotion of the person behind the text, even for humans.

Sentiment Analysis is used to classify the overall sentiment of the text in terms of positive, negative and neutral, and is one of the fields in NLP which is a machine learning algorithms with statistical computation of human Language (computational linguistics) to generate text and speech (*What is natural language processing (NLP)?* n.d.). Sentiment Analysis is utilised in many companies in their marketing and services online to see the trend and mood of their consumers as well as potential consumers and it is proven to be very useful. Nevertheless, emotion classification goes deeper and aims to identify underlying emotion in a given sentence. This is a problem for single-label classification as the given statement could have different dimension but single out to one output. For example, a given statement could have more than one emotions but it is reduced down to single emotion. These emotions include six basic emotions such as sadness, joy, love, anger, surprise and fear, and many more. For this project, The dataset (Saravia, Liu, Huang, Wu & Chen 2018) found is labelled only with six basic emotions mentioned previously.

In which could give a broader sense of emotion as it classifies only one emotion.

1.3 Project Overview

This project is to attempt to compare different pre-trained models of transformers to find which of them are the best model for classifying the emotion of the english twitter (now called 'X') messages within the bounds of six basic emotions. This project will begin with the literature reviews about the research papers similar to this project and different pre-trained transformer models that will be compared and implemented into this project. The general theory behind transformer architecture and how different the models that are implemented from their former architecture and with each other will be discussed. This project will then break down the problems for each of the models and their technical parts of the implementation. After that, the results will be presented at the end. Furthermore, The gathered results will be analysed and compared to find the best single-label emotion classification models on the applicable dataset.

1.4 Project Aims & Objectives

The overall aims of the project is to compare and demonstrate relatively newer transformer models that will be implemented in this project will be better at detecting emotion in the given piece of text. The followings below are the list of objectives for this project:

- Explore different pre-trained transformers models that are relatively new in the fields of NLP.
- Review the relevant or similar literatures for emotion classification and the usage of different transformer models.
- Discover suitable dataset for training and testing.
- Implement the two or more pre-trained models and use the dataset collected to train and test the models implemented.
- Provide a critical comparative analysis of the different models used to determine which give the best single-label emotion classification results.

1.5 Limitations

For the resources to carry out this project, Google Colab and Vscode will be two primary platforms for coding, training and testing. Google Colab have limited GPU runtime which hindered the progress of the implementation therefore local gpu is used to progress further. However, some models like Large Language Models (LLMs) and large datasets will use more GPU power as well as CPU and amout of RAM given which slow down the training process.

Furthermore, this project and dataset unfortunately do not account for or identify sarcasm which could result in wrong emotion for the sarcastic statements.

Chapter 2

Literature Review

2.1 Multi-Label Emotion Classification

2.2 Using L^AT_EX

2.2.1 Supported platform

2.2.2 Adding figures

2.2.3 Adding tables

2.2.4 Adding equations

2.2.5 Adding code fragments

2.2.6 Adding references

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