To feel or not to feel: Emotion Detection in Shakespeare's plays

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1 Introduction

The aim of this project is to creatively use large language models to perform emotion detection on literary works. In particular, I used a fine-tuned version of DistilBERT and use it to gain insights into the emotion expressed in the plays of William Shakespeare.

Three are the main tasks which I explore throughout the project:

1. Using the language model to build an "emotional profile" of a character and to compare the emotional profiles of different characters;
2. Gain insights into the emotional evolution of each character through the text;
3. Investigate the relationship between characters and whether characters emotionally influence each other.

1.1 What does Psychology tell us about emotion?

The analysis of emotion in psychology has a long history that dates back to Darwin's *The Expression of the Emotions in Man and Animals* (1872). In computational analyses of emotions, two are the main emotion models that have been used and investigated: categorical and dimensional models of emotions. On the one hand, models based on Ekman's theory of emotions group emotions into six basic emotional categories (anger, disgust, fear, happiness, sadness and surprise), but the list has sometimes been extended to include trust and anticipation. On the other hand, models based on Rusell's Circumplex Model of Affect see emotions as points in a two-dimensional space spanned by the valence dimension (which measures how much pleasant vs unpleasant an emotion is) and arousal dimension (which measures how much activated vs deactivated it is).

I limit the scope of this project to categorical models of emotions, both because of their easier tractability and because of higher availability of pre-trained large language models based upong categorical classification. However, this analysis could be easily extended to explore dimensional models.

1.2 The role of emotions in fiction

According to a growing body of evidence in Psychology, emotions play a crucial role in reading and understanding fictional works. Experimental evidence suggests that the experience of reading a novel influence the emotional and cognitive state of the reader, for example by enhancing Theory of Mind (ToM) performance (Kidd and Castano 2013), i.e. the ability of detect other people's emotions ("affective ToM") or their beliefs and intentions ("cognitive ToM"). Moreover, experiments suggest that an emotional transportation of the reader into the story is a necessary condition for the improvement of abilities such as empathy (Bal and Veltkamp 2013): if a person reads a novel and is emotionally involved in the story, her empathy is shown to significantly increased in the subsequent period. These findings suggest that emotions expressed in the text are a fundamental aspect of the psychological experience of reading a fictional work.

Therefore, it is both interesting and important to investigate the emotional dimension of works of fiction, and the possibility of using computational approaches and language models poses exciting challenges and opportunities to our comprehension of works of art.

2 Data and models

2.1 Shakespearian plays

I use text from Shakespearian plays, retrieved from Kaggle [1]. The Kaggle dataset contains all the plays by the famous author, along with indications of the line, the act and the character who is speaking.

The choice of the play among the different types of fictional works is motivated by two facts:

- The structure of a play allows to easily understand who is speaking and, therefore, it allows to easily detect who is feeling the emotion expressed in the text;
- A typical play, moreover, is organized in acts, which are usually homogeneous with respect to the set of the scene, the theme that is explored and the events that take place on the stage. Therefore, it is realistic to assume that emotions expressed in the play change from act to act.

Among the many plays that Shakespeare wrote (37!), I focus on Romeo and Juliet, for the variety of emotions that the text expresses. Both the methodolgy followed and the code produced could be easily extended to other plays and to other fictional texts outside of Shakespeare's corpus.

2.2 Transformers and Emotion Detection

In emotion detection tasks, Machine Learning models are usually preferred to lexicon-based approaches (Canales and Martínez-Barco 2014). Recently, transformers and, in particular, BERT-based LLMs have been used extensively in the field of emotion detection (Acheampong, Nunoo-Mensah, and Chen 2021).

In this project, I used a pre-trained Distilbert-base-uncased model fine-tuned on the Emotion Dataset from Twitter and retrieved from Hugging Face[2]. The fine-tuned model is based on Ekman's theory of emotions.

[1] https://www.kaggle.com/datasets/kingburrito666/shakespeare-plays
[2] https://huggingface.co/bhadresh-savani/distilbert-base-uncased-emotion

3 Results

Figure 1 displays some initial experiments using our model to classify the emotions expressed by famous quotes from Romeo and Juliet. The result is quite satisfying: the model seems to be quite good at detecting the emotion expressed by the sentence, despite the fact that sentences are written using a 16-th century English.

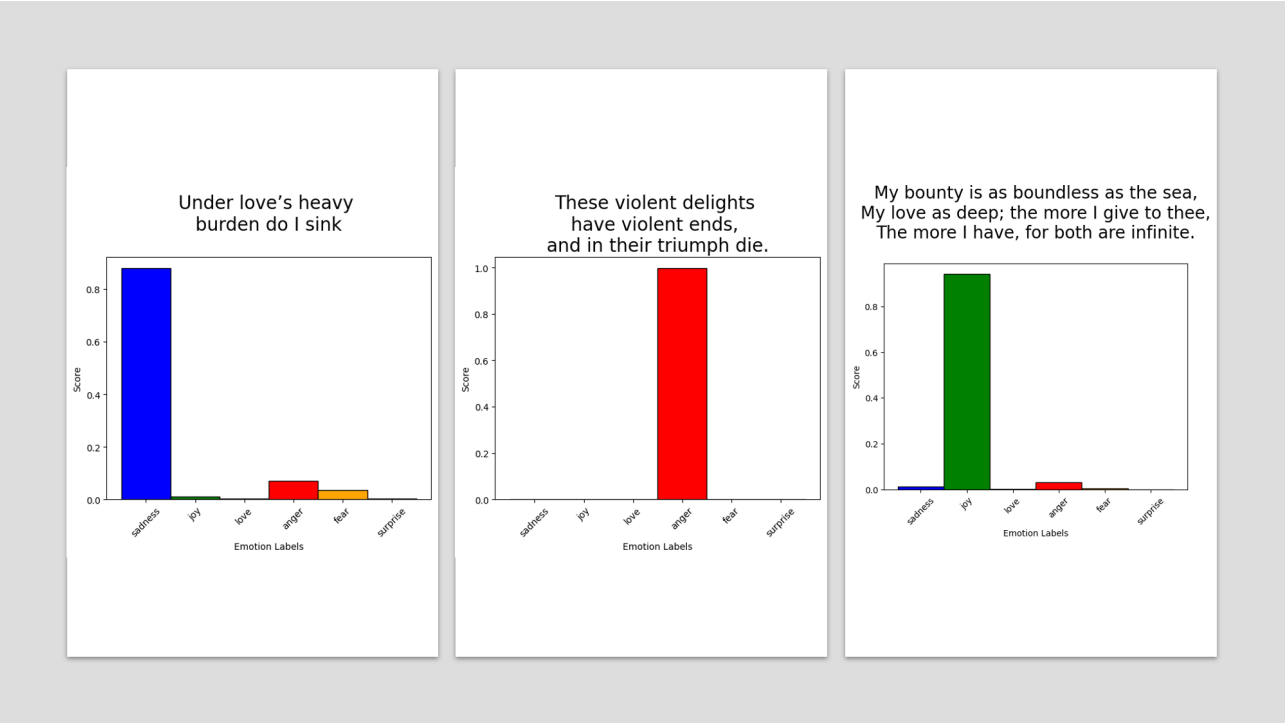

Figure 1: Classification of some famous quotes from Romeo and Juliet

3.1 Romeo and Juliet's emotional profile

To study the emotional profile of the play's characters, I classify each line using the categorical emotional model previously described. For each emotion, I therefore define an "emotional score" as the fraction of lines classified as belonging to that emotion over the whole lines played by the character.

The results for the emotional scores of Romeo and Juliet are displayed in Figure 2. As we can see from the plot, the two profiles of Romeo and Juliet mostly overlap. Quite surprisingly, love is not the predominant emotion expressed by their lines (with respect to the classification provided by our model). Anger and joy are indeed the most prevalent emotions.

3.2 Evolution of the emotions in the play

Figure 2 displayed in the previous subsection do not gave us any insight into the evolution of the emotions over the plots. Therefore, I performed the same classification for each of the 5 act composing the play and plotted as time series the "emotional evolution" of the two main characters. Results are displayed in Fig.3 for Romeo and Fig.4 for Juliet.

Anger and joy are the most prevalent emotions throughout the entire play. However, they seem to be curiously alternated both in Romeo's and in Juliet's lines.

3.3 Charachters interactions

To study the characters interactions through the play and the interplay of their emotions, I set up two different methodologies, which led to two different experiments: on the one hand, I treated the emotional evolution of

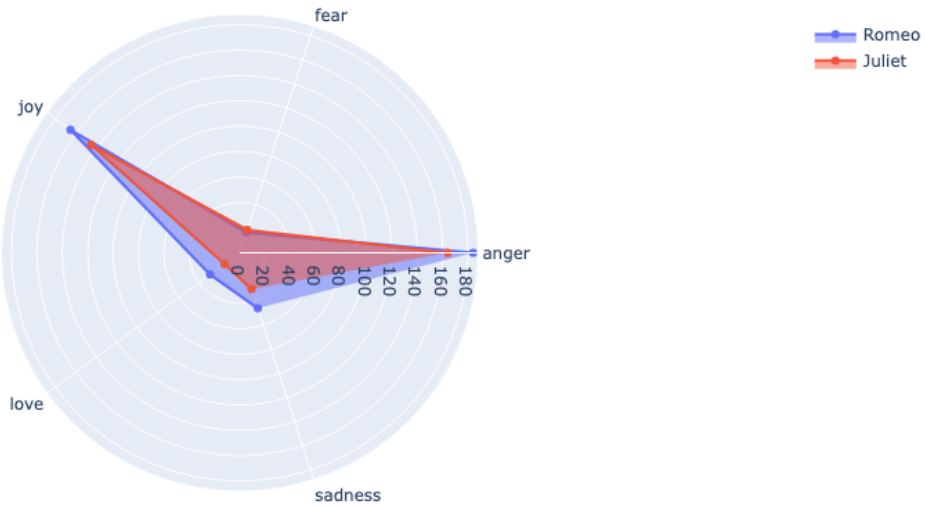

Figure 2: Emotional profiles of Romeo and Juliet

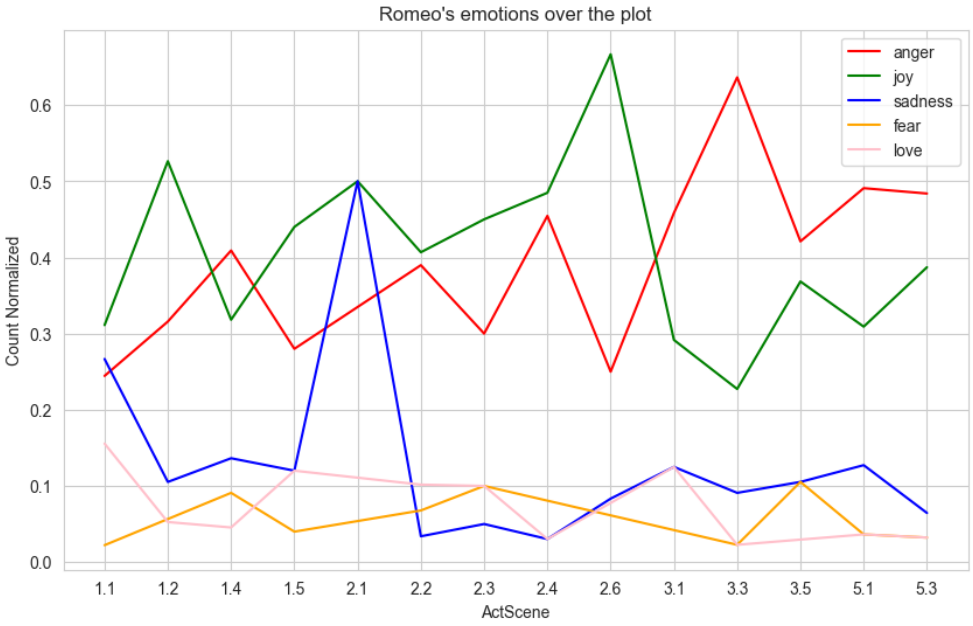

Figure 3: Evolution of Romeo's emotions

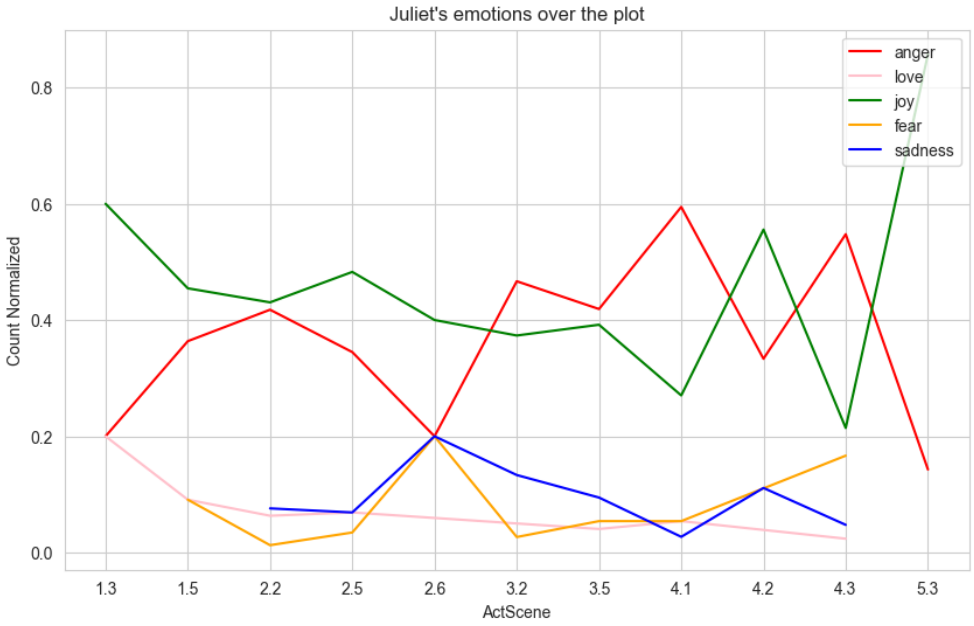

Figure 4: Evolution of Juliet's emotions

the characters as times series and tested their reciprocal influence using a Granger Causality test; on the other hand, I built an "emotional" social network of the play's characters.

3.3.1 Granger Causality Test

Granger-causality is a operational definition of causality that is often used in times-series econometrics. The idea of Granger causality, intuitevely speaking, is that -given two variables X and Y evolving over time- X Granger-causes Y if predictions of Y based on past values of Y improve if we include in the prediction also past values of X. Granger causality suffers from conceptual difficulties, namely, the fact that if X helps in forecasting Y, then we cannot infer that X causes Y. However, this definition is often helpful when considering relationships among times series.

In the context of this analysis, I applied Granger causality test on the times series composed by emotions of Romeo and Juliet over the plot. The assumption that emotions can be modeled as times series is realistic, since it is reasonable to think as emotions as auto-correlated variables, where the current "emotional state" is not independent from the previous one, but is determined by it.

Table 1: Granger causality test for Romeo's anger and Juliet's joy

	ROMEO_anger_x	**JULIET_joy_x**
ROMEO_anger_y	1	0.1262
JULIET_joy_y	0.0788	1

Table 1 displays the result of the Granger causality test with respect to Romeo's anger and Juliet's joy. We can note that, because the p-value is above 0.05, we cannot reject with 95% confidence the null hypothesis that either of the two series does not Granger-cause the other. Therefore, based on our data, we cannot conclude that the series influence each other. The significance of this result, however, is affected by the shortness of the series.

3.3.2 Social network of Romeo and Juliet's characters

The second experiment I performed with respect to the interaction of the character throughout the play is to build a social network based on the play. In our directed graphs with multiple edges between nodes, nodes will therefore be the network's characters and edges will link different actors. An edge will point from character A to character B if character A speaks to character B in one of her lines. Edges are labelled with the emotion the line expresses with respect to our classification.

Very naively, the concept of "speaks to" has been implemented by checking if -inside the line of character A- the name of character B (and only of character B) is present. This concept could be further defined and improved in following works.

Figure 5 displays the result of this experiment. We can see that Romeo and Juliet are the characters with higher centrality, and -from our results- we conclude that Romeo speaks to Juliet mainly with joy, while she mainly speaks angrily to him.

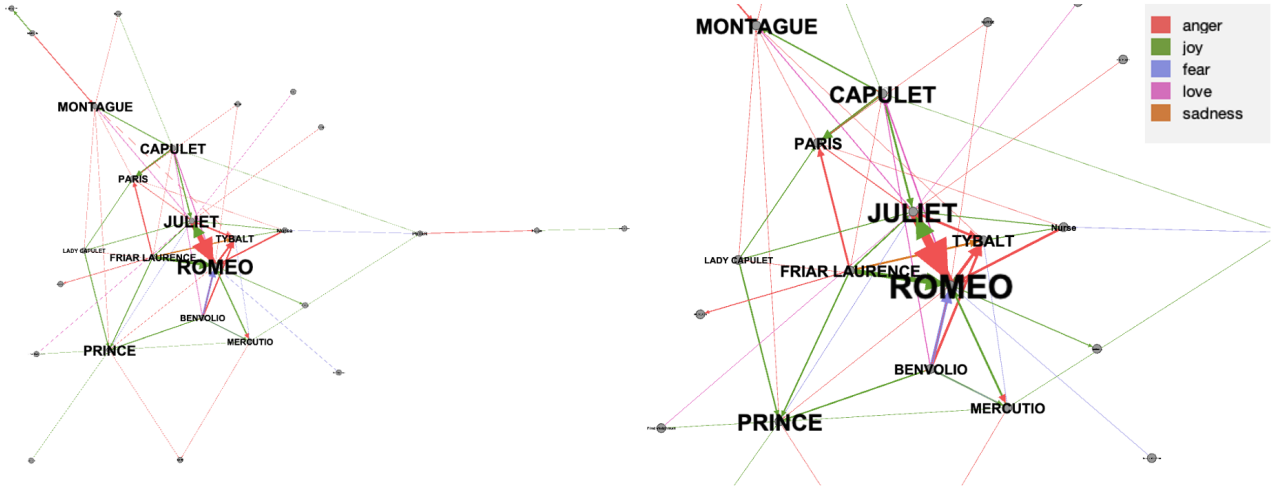

Figure 5: Romeo and Juliet: an emotional social network

4 Conclusions

This project has focused on using large language models to gain some insights into the emotions expressed by literary works. In particular, using a fine-tuned version of BERT and the famous "Romeo and Juliet" by Shakespeare, three tasks were addressed: (1) analyzing the emotional profile of a character, (2) studying the evolution of this emotional profile throughout the plot, (3) understanding the emotional connections between characters. For each task, I proposed a methodology and performed some experiments.

This project as some clear limitations, in particular, we do not have a precise estimate of the quality of the results. However, I believe that the proposed methodologies could be a good starting point for future works. Further improvements could be easily built upon the solutions proposed and refinements could be easily integrated in the code developed.

References

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