Sentiment Analysis

Digital Humanities: Hands on Data
LHU002P05.2020-2021.1B

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1 Introduction

Historically, women in film have been used as props that push the male protagonist's arc forward (Mulvey, 1989). Although such reductionist narratives are slowly being phased out, genius women in film have been shown to be used in stereotypical ways such as emphasising their physical appearance (Steinke, 2005). However, Steinke's (2005) endeavour is already over a decade old. Moving beyond representation, there still remains a gender-gap in male dominated fields generally considered to be intellectually demanding (Ayuso et al., 2020). This separation begins as early as at the age of 15 (Botella, Rueda, López-Iñesta, & Marzal, 2019). This is around the age when representations in film play an important role in the identity formation process (Steinke, 2005). Thus, I wanted to answer the question, " Are the stories of highly intellectual characters depicted in gendered ways in contemporary films?".

2 Methodology

For this purpose, the "opinionated document model" (Chen & Zimbra, 2010) of sentiment analysis was used. Sentiment analysis can provide us with an idea of

the opinions and emotions exhibited in relation to a specific discourse (Saldaña, 2018). Films pass judgement on the actions of its characters. This may be displayed through the character facing consequences, through the diegetic response of other characters, or through self-reflection. Sentiment analysis would be able to provide an overall trend for the emotions expressed in the film. Thus, sentiment is treated as a proxy for the narrative's treatment of the character.

2.1 Corpus

The first step of the selection process entailed the shortlisting of films which centred around intelligent protagonists. This was done based on the author's personal experience and the suggestions of various digital articles (staff, 2016; Ucciferri, 2018; Dunn, 2018). The short-listed films were then cross-referenced against the selection criteria:

- The films must have been release in the year 2000 or later.
- The story followed one (at most two) primary character(s).
- The character was a genius, where genius refers to the quality of being a prodigy in a certain field, whether that is linguistics or murder.
- Their talent did not come from supernatural elements or artificial augmentation such as in Limitless (2011) and Lucy (2014).
- Their talent had to have been developed by them.
- Their talent had to have been the focus of the movie.

The final corpus consisted of 10 films - 5 following female geniuses and 5 following male geniuses.

- Women:
  - Arrival (2016)
  - Erin Brockovich (2000)
  - Gone Girl(2014)
  - Joy (2015)
  - The Devil Wears Prada (2006)

- Men:
  - Steve Jobs (2015)
  - The Imitation Game (2014)
  - The Man Who Knew Infinity (2015)
  - The Social Network (2010)
  - Whiplash (2014)

Furthermore, the decision was made to use subtitles rather than scripts since scripts were not always publicly available. Additionally, scripts represented a stage of the film which might not necessarily correspond with the final product.

2.2 Model Selection

The Valence Aware Dictionary and sEntiment Reasoner (VADER) model of sentiment analysis was used. This model can use the use of punctuation to deduce the intensity of the sentiment expressed (Saldaña, 2018).

I tried to tune the parameters that controlled the window for the rolling average, the minimum data-points required for the rolling average, and normalisation. The following parameters allowed for the best comparison of the collective sentiment arcs:

```
window=500, min_periods=50, normalize=False,
scale=False, name=None
```

It did not seem productive to compare the sentiment arcs of the corpus with the 6 basic shapes of stories as found by Reagan et al. (Reagan, Mitchell, Kiley, Danforth, & Dodds, 2016) since that would entail the forceful fitting of diverse sentiment arcs to reductive shapes that might not accurately depict the change in sentiment (Swafford, 2016).

2.3 Model Validation

To check the accurate functioning of the VADER model, two people manually annotated one of the films in the corpus - The Social Network (2010). The two annotators exhibited a statistically significant value of correlation in their coding ($r_s = 0.63$, p = 0.01) (see appendix A). Visually, it is clear that the

two annotators had matching peaks and valleys although they varied in their intensity.

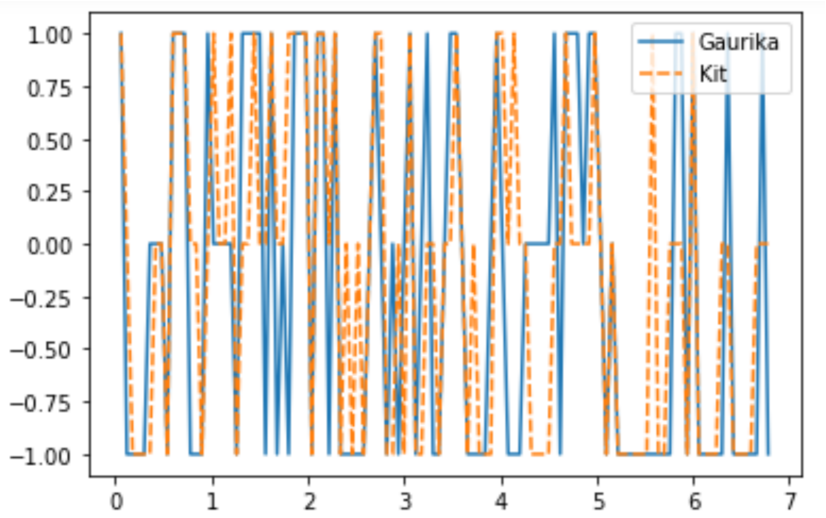

Figure 1: Comparison of manual annotations.

Comparing these annotations to VADER's predictions about the film, VADER exhibited an accuracy of 0.45 and 0.37. Looking at the graph, for the most part, VADER's predictions about the changes in sentiment matched those exhibited in the manual annotation. Curiously, there were instances of VADER predicting the sentiment to be positive whereas both annotators found it to be negative.

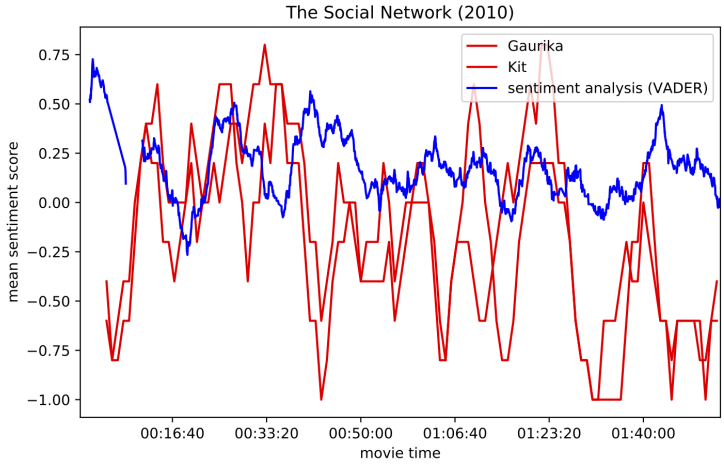

Figure 2: Comparison of manual annotations and VADER predictions.

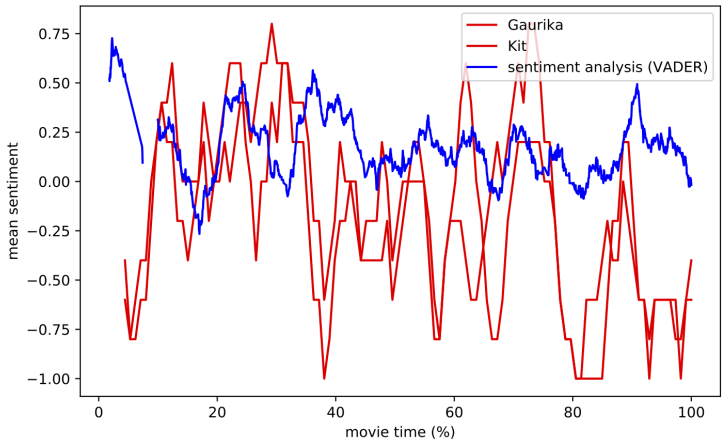

Figure 3: Comparison of manual annotations and VADER predictions normalised.

The histogram of VADER's predicted values show a skew towards positive values.

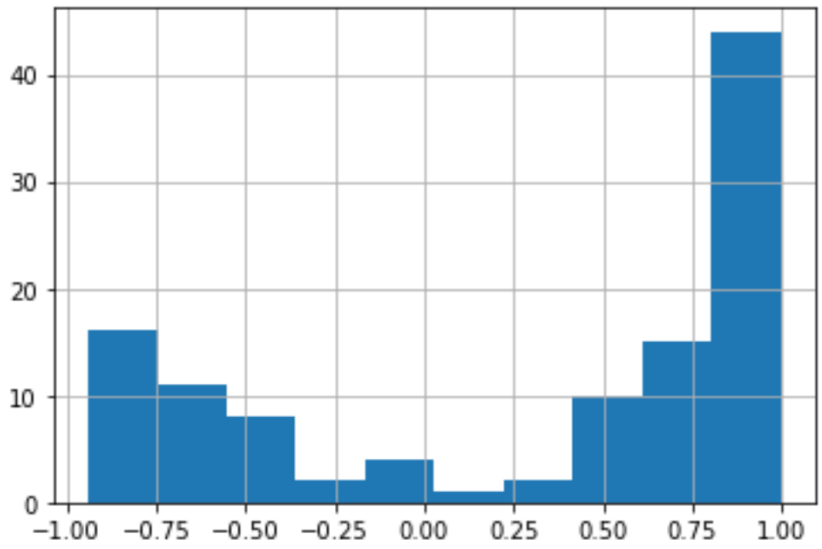

Figure 4: Histogram of VADER's predicted values distribution.

Looking at the confusion matrices, VADER appears to overestimate the amount of positive sentiment present in the film.

Predicted	-1	0	1
Actual			
-1	18	7	30
0	6	10	9
1	6	4	23

Figure 5: Confusion matrix for annotator Gaurika.

Predicted	-1	0	1
Actual			
-1	16	8	19
0	11	8	25
1	3	5	18

Figure 6: Confusion matrix for annotator Kit

3 Results

Broadly, the sentiment of the films remained on the positive side, specifically between 0-0.4.

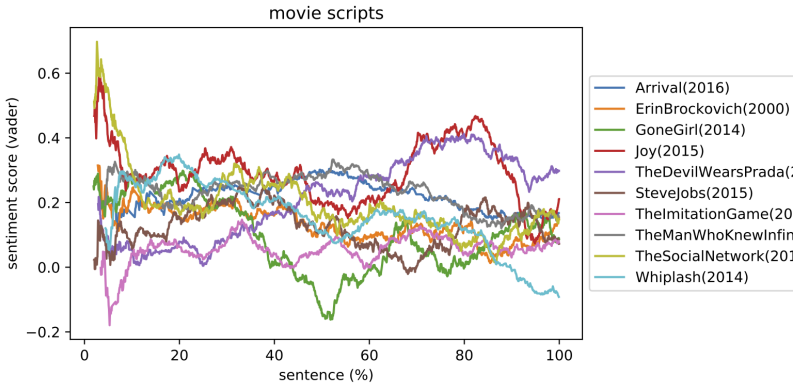

Figure 7: Sentiment arcs for all films without normalisation.

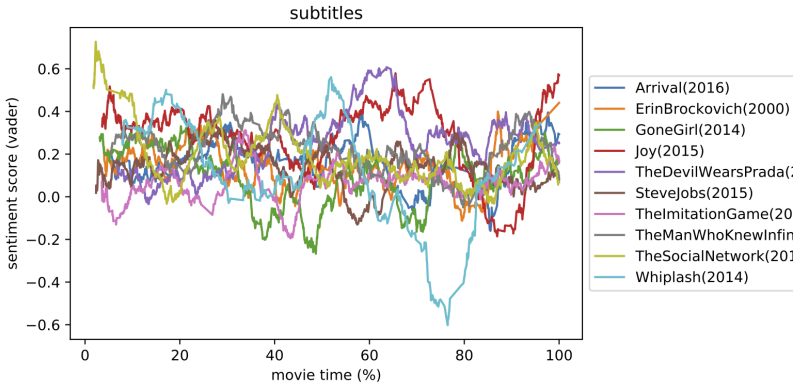

Figure 8: Sentiment arcs for all films with normalisation.

In the case of male-centric films; The Social Network (2014), Whiplash (2014), and Steve Jobs (2015) follow very similar arcs between 20% to 60% (see figure 9). This may indicate a typical narrative shift in dealing with such characters. Perhaps there is some formulaic way of representing the stories of prodigies.

Furthermore, male-centric films tended to end on a lower or equal sentiment score as at the beginning of the film (see Appendix B for individual sentiment arcs). Male-centric films show a range of sentiment scores in the beginning, between 0-0.6. However, this decreases by the end of the film with sentiment scores lying between 0-0.2.

Whiplash (2014) and The Social Network (2010) show extreme values. The Social Network begins at a high of around 0.6 whereas Whiplash dips to around -0.6.

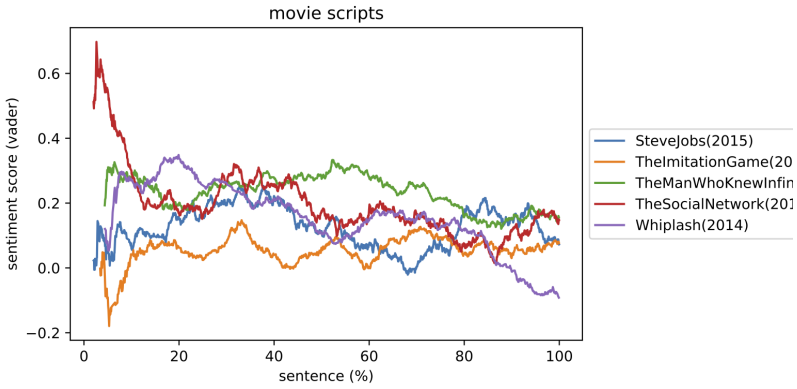

Figure 9: Sentiment arcs for male-centric films without normalisation.

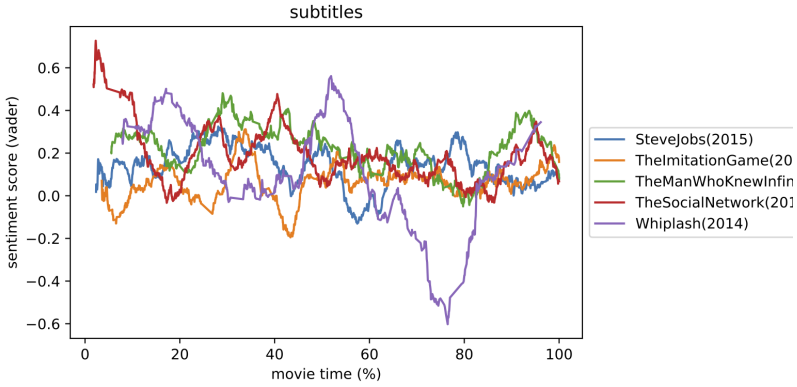

Figure 10: Sentiment arcs for male-centric films with normalisation.

The female-centric films exhibited more variance in sentiment arcs as com-

pared to the male-centric films, especially later on in the narrative. Likewise, female-centric films began at moderate scores between 0-0.4 but showed great variance later on with scores between 0-0.6. Female-centric films also tended to end with a higher sentiment score as compared to their beginning.

Arrival (2017) and Joy (2015) exhibit extreme values; both reach a high of around 0.6

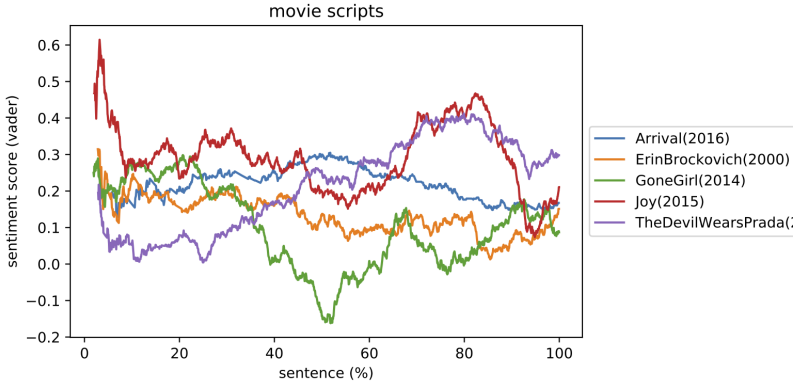

Figure 11: Sentiment arcs for female-centric films without normalisation.

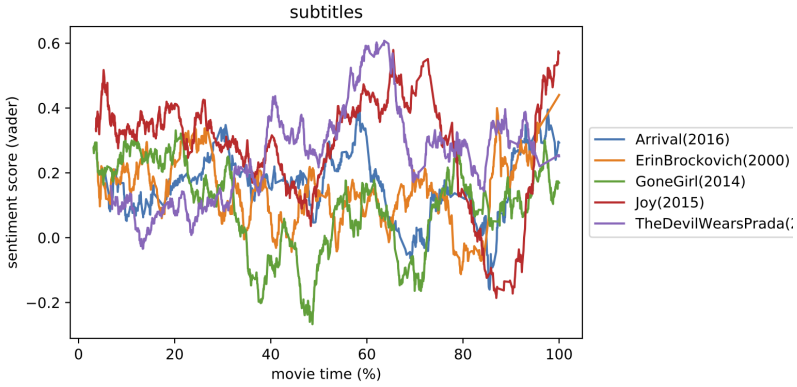

Figure 12: Sentiment arcs for female-centric films with normalisation.

4 Analysis

Contemporary representations of genius men problematize their behaviour and usually end on a local drop in sentiment. The narrative is based on a conflict between the behaviour they associate with their success and its conflict with personal well-being. For example, in Whiplash (2014), the protagonist is pushed and pushes themselves to physical harm to perfect their skills as a drummer.

Dissimilar to male-centric films, representations of genius women often end on a local positive sentiment. In these films, the narrative is based on a conflict between success and societal expectations of women. For example, Joy (2015) follows the story of a woman with a profitable idea trying to maintain control over her intellectual property in the face a male-dominated industry which wants to take it away.

5 Limitations

Although sentiment analysis provides us with useful insights, it a disadvantageous method when applied to an audiovisual medium such as film. Films do not entirely rely on text and much of the sentiment is communicated through non-verbal means such as body language of the actors, mise-en-scène, lighting, etc.

Furthermore, representations of prodigies often comes with its fair share of irony and sarcasm as ways of showing of the character's self-perception as superior. Unfortunately, figurative language such as the aforementioned are difficult for sentiment analysis models to catch (Farias & Rosso, 2017).

Moreover, using sentiment as a proxy for the film's opinion of the character comes with the issue that it cannot be accurately ascertained that the film always talks about the character. Films often emphasise the perspectives of various other characters which makes finding the "opinion target" (Chen & Zimbra, 2010) challenging.

Due to the above limitations and the VADER's low accuracy score, the findings of this project should be taken with a grain of salt.

6 Conclusion

The above findings suggest that there does exist a gendered way of representing intelligent characters. For men, a critical lens has been put on the toxic behaviours previously considered good in a man to be successful. For women, more emphasis has been put on hopeful narratives of triumph in a society biased against them. Although both are useful representations, I believe the feminist cause would benefit from positive representations of successful men maintaining a healthy balance between their personal and professional lives.

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Appendix A
Correlation Between Annotators

The results of the correlation analysis run between the two annotators.

Correlations

				Sentiment_A	Sentiment
Sentiment_A	Pearson Correlation			1	,629**
	Sig. (2-tailed)				,000
	N			114	114
	Bootstrap[b]	Bias		0	,003
		Std. Error		0	,060
		95% Confidence Interval	Lower	1	,496
			Upper	1	,740
Sentiment	Pearson Correlation			,629**	1
	Sig. (2-tailed)			,000	
	N			114	114
	Bootstrap[b]	Bias		,003	0
		Std. Error		,060	0
		95% Confidence Interval	Lower	,496	1
			Upper	,740	1

**. Correlation is significant at the 0.01 level (2-tailed).

b. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Figure 13: Correlation between annotators

Appendix B
Individual Sentiment Arcs

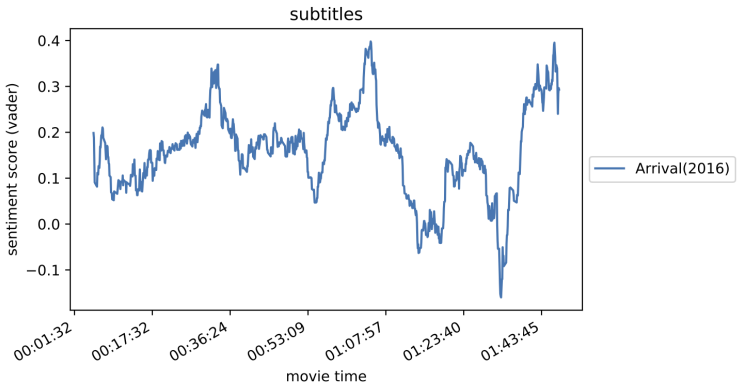

Figure 14: Individual sentiment arc for Arrival (2017).

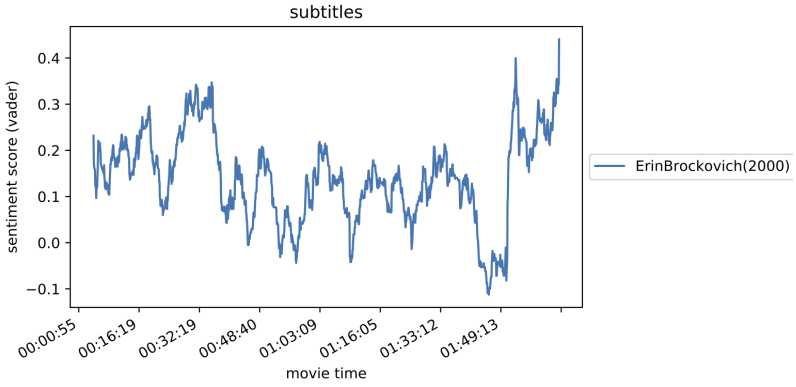

Figure 15: Individual sentiment arc for Erin Brockovich (2000).

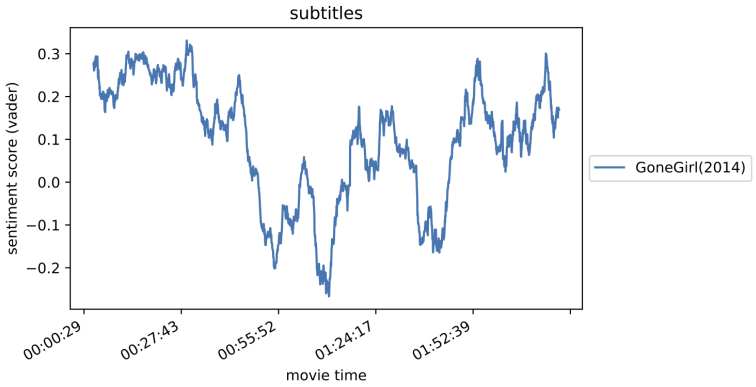

Figure 16: Individual sentiment arc for Gone Girl (2014)

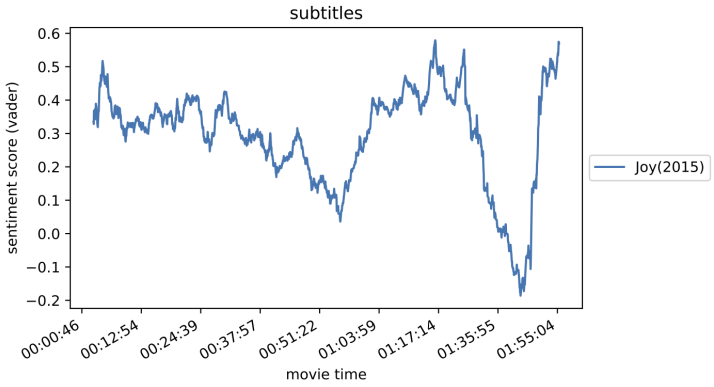

Figure 17: Individual sentiment arc for Joy (2015)

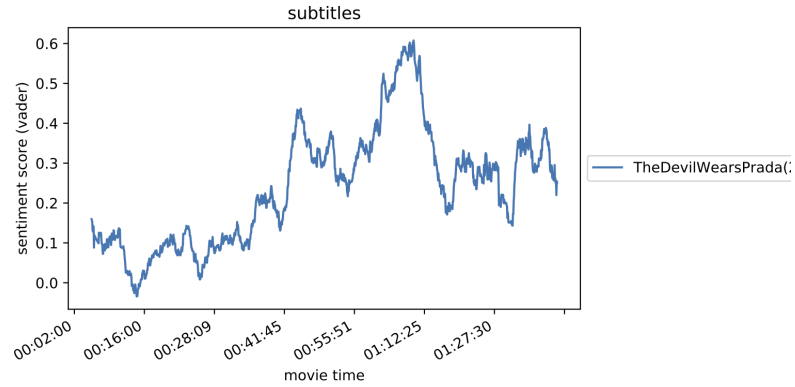

Figure 18: Individual sentiment arc for The Devil Wears Prada (2006).

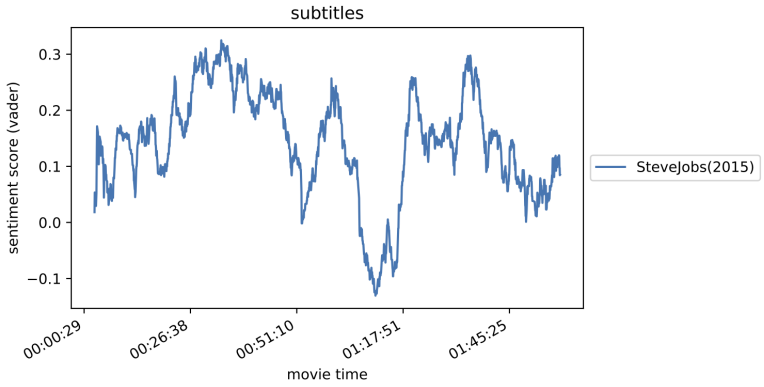

Figure 19: Individual sentiment arc for Steve Jobs (2015).

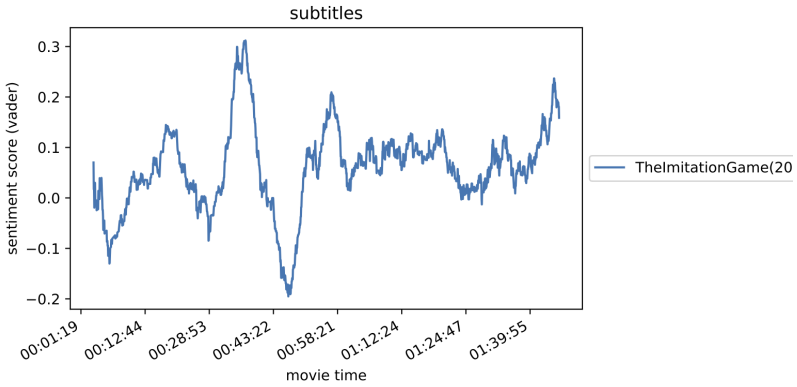

Figure 20: Individual sentiment arc for The Imitation Game (2014).

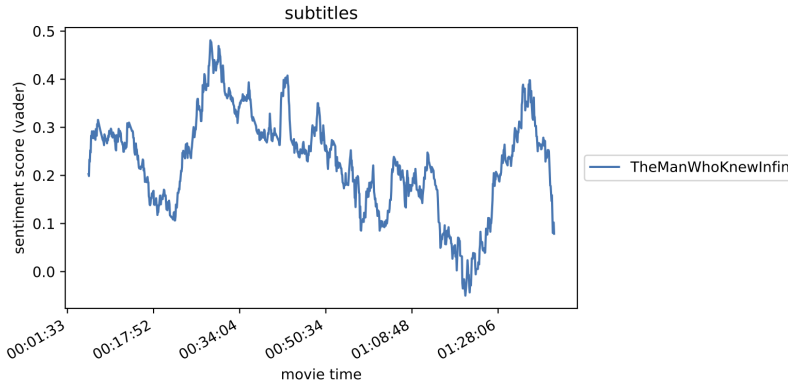

Figure 21: Individual sentiment arc for The Man Who Knew Infinity (2016).

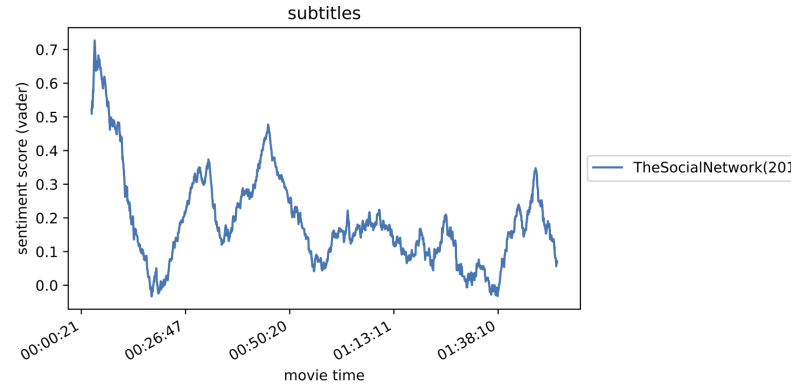

Figure 22: Individual sentiment arc for The Social Network (2010).

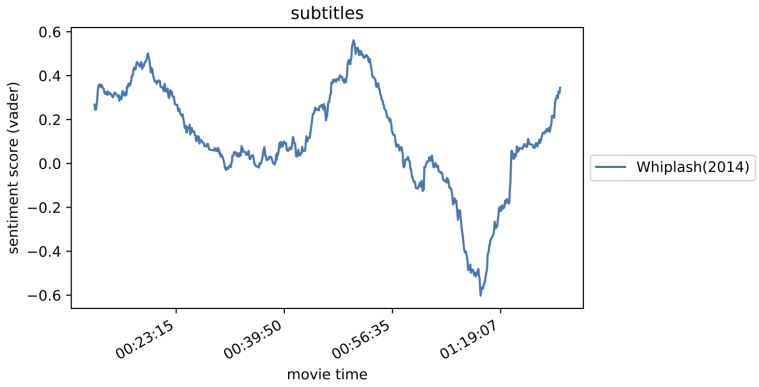

Figure 23: Individual sentiment arc for Whiplash (2014).