COMP 6751 Sentence Sentiment Analysis Project 4 Report

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0. Expectations of originality

I certify that this submission is my original work and meets the Faculty's Expectations of Originality.
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1. Explain and critique grammar design for complex declarative sentences

1.1. Sentiment Feature

In the feature-based grammar, we have introduced a new notation that categories have **feature** called **SENTIMENT**. The value has three features: **positive**, **negative**, and **neutral**. We are using **?s** as a variable over values of **SENTIMENT**. It can be instantiated either to **positive**, **negative**, or **neutral**, within a given production. The example of sentiment feature in feature grammar is displayed as follows:

>>S[-INV, SENTIMENT=?s] -> NP[-WH, NUM=?n, PERSON=?p, SENTIMENT=?s] VP[TENSE=?t, NUM=?n, PERSON=?p, SENTIMENT=?s]
>>S[-INV, SENTIMENT=negative] -> S[-INV, SENTIMENT=positive] CC[CONJUNCTION=but] S[-INV, SENTIMENT=negative] | S[-INV, SENTIMENT=positive] CC[CONJUNCTION=but] S[-INV, SENTIMENT=neutral]

1.2. Negation Feature

We have introduced feature **negation** to adverbs. Negation is express the opposite sentiment meanings of the phrases or sentences. In sentences, negation words appear in verb phrases (e.g., I **do not like** the story.) and adjective phrase (e.g., The movie making is **not marvelous or inspiring**.). For the adverbs with negative meanings, we labeled: **RB[+negation]**. For the adverbs without negative meanings, we labeled **RB[-negation]**. Notice that some adverbs do not have negation feature but have negative sentiment value.

>>RB[+**negation**] -> 'not' | 'Not' | "n't"
>>RB[-**negation**, SENTIMENT=neutral] -> 'mainly' | 'too' | 'slightly' | 'more' | 'very' | 'much' | 'quite'
>>RB[-**negation**, SENTIMENT=negative] -> 'shamelessly'

1.3. Subordinate Clause

We have introduced subordinate clauses to enable the grammar to recognize more complex declarative sentences. Subordinate clauses defined as **SBAR** in the grammar, they are groups of words that is not a sentence but adds information to the main part of a sentence including sentiment values, as follows shown:

>>**which present here**
SBAR[SENTIMENT=?s] -> WP[+wh] V[+AUX] EX
>>**which is not perfect**
SBAR[SENTIMENT=positive] -> WP[+wh] V RB[+not] ADJP[SENTIMENT=negative] | WP[+wh] V RB[+not] JJ[SENTIMENT=negative]
SBAR[SENTIMENT=negative] -> WP[+wh] V RB[+not] ADJP[SENTIMENT=positive] | WP[+wh] V RB[+not] JJ[SENTIMENT=positive]
SBAR[SENTIMENT=neutral] -> WP[+wh] V RB[+not] ADJP[SENTIMENT=neutral] | WP[+wh] V RB[+not] JJ[SENTIMENT=neutral]
>>**which present several times**
SBAR[SENTIMENT=?s] -> WP[+wh] V[SENTIMENT=trans] NP[SENTIMENT=?s]
>>**a compelling story which present here**
SBAR[SENTIMENT=?s] -> S[SENTIMENT=?s] SBAR[SENTIMENT=?s]

1.4. Punctuation

We add punctuations to the grammar of sentence and adjective phrase to enrich the complexity of analysis sentences that the grammar cover. The addition grammar is displayed as follows:

>>**It is a compelling story, mainly because the story has gut-wrenching impact.**
S[-INV, SENTIMENT=?s] -> S[SENTIMENT=?s] COMMA S[SENTIMENT=?s]
S[-INV, SENTIMENT=positive] -> S[SENTIMENT=positive] COMMA S[SENTIMENT=?s] | S[SENTIMENT=?s] COMMA S[SENTIMENT=positive]
S[-INV, SENTIMENT=negative] -> S[SENTIMENT=negative] COMMA S[SENTIMENT=?s] | S[SENTIMENT=?s] COMMA S[SENTIMENT=negative]
>>**long, simple, and boring**
ADJP[SENTIMENT=?s] -> JJ[SENTIMENT=?s] COMMA ADJP[SENTIMENT=?s]

1.4. Auxiliary

We add auxiliary to the grammar of verb phrase to enrich the sentences that the grammar cover:

>>**may not perfect**
>>**may not have gut-wrenching impact**
>>**may not have the dramatic gut-wrenching impact of other holocaust films**

2. Explain and critique grammar design for conjunction of sentiment bearing adjectives or nouns

2.1. Adjective Phrase

We designed grammar for conjunction of sentiment bearing adjectives in adjective phrases.

The sentiment value of adjective phrases will be marked as **positive** if: **(1) For the AND conjunction**, the adjective before and conjunction together with the adjective after and conjunction both are positive, e.g., *This is a **marvelous and inspiring** story*; the adjective before and conjunction is positive, the adjective after and conjunction is neutral, e.g., *This is a **marvelous and long** story*; the adjective before and conjunction is neutral, the adjective after and conjunction is positive, e.g., *This is a **long and marvelous** story*. **(2) For the OR conjunction**, the adjective before or conjunction together with the adjective after or conjunction both are positive, e.g., *This is either a **marvelous or inspiring** story*; the adjective before or conjunction is positive, the adjective after or conjunction is neutral, e.g., *This is either a **marvelous or long** story*; the adjective before or conjunction is neutral, the adjective after or conjunction is positive, e.g., *This is either a **long or marvelous** story*. **(3) For the BUT conjunction**, the adjective before but conjunction is neutral, the adjective after but conjunction is positive, e.g., *This is a **long but marvelous** story*.

The sentiment value of adjective phrases will be marked as **neutral** if adjectives appear before and after the conjunction words (and, or, but) are all neutral, e.g., *This is a **long and gut-wrenching** story*.

The sentiment value of adjective phrases will be marked as **negative** if: **(1) For the AND conjunction**, the adjective before and conjunction together with the adjective after and conjunction both are negative, e.g., *This is a **horrendous and terrible** story*; the adjective before and conjunction is negative, the adjective after and conjunction is neutral, e.g., *This is a **horrendous and long** story*; the adjective before and conjunction is neutral, the adjective after and conjunction is negative, e.g., *This is a **long and terrible** story*. **(2) For the OR conjunction**, the adjective before or conjunction together with the adjective after or conjunction both are negative, e.g., *This is either a **horrendous or terrible** story*; the adjective before or conjunction is negative, the adjective after or conjunction is neutral, e.g., *This is either a **horrendous or long***; the adjective before or conjunction is neutral, the adjective after or conjunction is negative, e.g., *This is either a **long or rancid** story*. **(3) For the BUT conjunction**, the adjective before but conjunction is neutral, the adjective after but conjunction is negative, e.g., *This is a **long but manipulative** story*.

The sentiment value of adjective phrases with **negation**, when the negation word appears before the whole phrase, then the sentiment value of the phrase will change to opposite, e.g., *The movie making is **not marvelous or inspiring***. When the negation word appears after the conjunction, then only the part after the conjunction will change to opposite sentiment value, e.g., *The movie making is **long but not boring***.

2.2. Noun Phrase

We designed grammar for conjunction of sentiment bearing adjectives in noun phrases.

The sentiment value of adjective phrases will be marked as **positive** if: **(1) For the AND conjunction**, the noun phrase before and conjunction together with the noun phrase after and conjunction both are positive, e.g., *This is **a marvelous and inspiring story and a joyful and a funny movie making***; the noun phrase before and conjunction is positive, the noun phrase after and conjunction is neutral, e.g., *This is **a marvelous story and a general movie making***; the noun phrase before and conjunction is neutral, the noun phrase after and conjunction is positive, e.g., *This is **a common story and a perfect movie making**. **(2) For the OR conjunction**, the noun phrase before or conjunction together with the noun phrase after or conjunction both are positive, e.g., *This is either **a marvelous and inspiring story or a joyful and funny movie making***; the adjective before or conjunction is positive, the adjective after or conjunction is neutral, e.g., *This is either **a marvelous or a long story***; the noun phrase before or conjunction is neutral, the noun phrase after or conjunction is positive, e.g., *This is either a **long movie making or a marvelous story**. **(3) For the BUT conjunction**, the noun phrase before but conjunction is neutral, the noun phrase after but conjunction is positive, e.g., *This is a **long movie making but a marvelous story***.

The sentiment value of noun phrases will be marked as **neutral** if noun phrases appear before and after the conjunction words (and, or, but) are neutral, e.g., *This is a **long story and a gut-wrenching** movie making*.

The sentiment value of noun phrases will be marked as **negative** if: **(1) For the AND conjunction**, if both sides of and conjunction are negative, or one side is negative with neutral on the other side. **(2) For the OR conjunction,** if both sides of or conjunction are negative, or one side is negative with neutral on the other side. **(3) For the BUT conjunction,** if neutral appears on one side of but conjunction and negative noun phrase appear on the other side, then the whole noun phrase will be negative sentiment value.

The sentiment value of noun phrases with **negation**, when the negation word appears before the whole phrase, then the sentiment value of the phrase will change to opposite, e.g., *This is **not a marvelous story or an inspiring movie making***. When the negation word appears after the conjunction, then only the part after the conjunction will change to opposite sentiment value, e.g., *This is **a long story but not a boring story***.

3. Explain and critique grammar design for conjunction of sentiment bearing sentences

3.1. Conjunction AND of sentiment bearing sentence

The sentiment value of the whole sentence will be marked as **positive** if: (1) The sentence before together with the sentence after the AND conjunction are both positive, e.g., *This is a marvelous and inspiring story and it is a joyful and funny movie making*. (2) The sentence before the AND conjunction is positive, the sentence after the AND conjunction is neutral, e.g., *This is a marvelous and inspiring story and it is a common and general movie making.* (3) The sentence before the AND conjunction is neutral, the sentence after the AND conjunction is positive, e.g., *This is a long and common story and it is a marvelous and inspiring movie making.*

The sentiment value of the whole sentence will be marked as **negative** if: (1) The sentence before together with the sentence after the AND conjunction are both negative, *This is a horrendous and terrible story and it is a dull and boring movie making.* (2) The sentence before the AND conjunction is negative, the sentence after the AND conjunction is neutral, e.g., *This is a dull and boring story and it is a common and general movie making.* (3) The sentence before the AND conjunction is neutral, the sentence after the AND conjunction is negative, e.g., *This is a long and common story and it is a dull and boring movie making.*

The sentiment value of the whole sentence will be marked as **neutral** if the sentence before together with the sentence after the AND conjunction are both neutral, e.g., *This is a common and general story and it is a long and expensive movie making.* Situations are the same as mentioned above if there is punctuation between two sentences. Grammar about sentences with AND conjunction is defined as follows:

>>**Conjunction AND of sentiment bearing sentence**
>>>**It has gut-wrenching impact and it is a compelling story.**
S[-INV, SENTIMENT=positive] -> S[-INV, SENTIMENT=positive] CC[CONJUNCTION=and] S[-INV, SENTIMENT=positive] | S[-INV, SENTIMENT=positive] CC[CONJUNCTION=and] S[-INV, SENTIMENT=neutral] | S[-INV, SENTIMENT=neutral] CC[CONJUNCTION=and] S[-INV, SENTIMENT=positive]
S[-INV, SENTIMENT=negative] -> S[-INV, SENTIMENT=negative] CC[CONJUNCTION=and] S[-INV, SENTIMENT=negative] | S[-INV, SENTIMENT=negative] CC[CONJUNCTION=and] S[-INV, SENTIMENT=neutral] | S[-INV, SENTIMENT=neutral] CC[CONJUNCTION=and] S[-INV, SENTIMENT=negative]
S[-INV, SENTIMENT=neutral] -> S[-INV, SENTIMENT=neutral] CC[CONJUNCTION=and] S[-INV, SENTIMENT=neutral]

3.2. Conjunction OR of sentiment bearing sentence

The sentiment value of the whole sentence will be marked as **neutral** if (1) The sentence before together with the sentence after the OR conjunction are both neutral, e.g., *This is a common and general story or it is a long and expensive movie making.* (2) The sentence before the OR conjunction is the opposite sentiment value of the sentence after the OR conjunction, e.g., *It is hard to tell whether it is an attractive story or it is a boring story.*

>>**Conjunction OR of sentiment bearing sentence**
>>>**It has gut-wrenching impact or it is a compelling story.**
S[-INV, SENTIMENT=?s] -> S[-INV, SENTIMENT=?s] CC[CONJUNCTION=or] S[-INV, SENTIMENT=?s]
S[-INV, SENTIMENT=neutral] -> S[-INV, SENTIMENT=positive] CC[CONJUNCTION=or] S[-INV, SENTIMENT=negative] | S[-INV, SENTIMENT=negative] CC[CONJUNCTION=or] S[-INV, SENTIMENT=positive]

3.3. Conjunction BUT of sentiment bearing sentence

For the sentences with BUT conjunctions, we think that the sentiment value is mainly defined by the sentence after BUT conjunction, since it plays **a turning point part** in the whole sentence. As a result, the sentiment value of the whole sentence will be marked as **positive** if the sentence after the BUT conjunction is positive, e.g., *The story is long and horrendous but it is a joyful and funny movie making.* The sentiment value of the whole sentence will be marked as **negative** if the sentence after the BUT conjunction is negative, e.g., *The story is funny and joyful but it is a horrendous and terrible movie making.* The sentiment value of the whole sentence will be marked as **neutral** if the sentence after the BUT conjunction is neutral, e.g., *The story is joyful and funny but it is a common and general movie making.* Grammar is with BUT conjunction is defined as follows:

>> **Conjunction BUT of sentiment bearing sentence**
>>>**It does not have gut-wrenching impact but it is a compelling story.**
S[-INV, SENTIMENT=?s] -> S[-INV, SENTIMENT=neutral] CC[CONJUNCTION=but] S[-INV, SENTIMENT=?s]
S[-INV, SENTIMENT=?s] -> S[-INV, SENTIMENT=neutral] COMMA CC[CONJUNCTION=but] S[-INV, SENTIMENT=?s]
>>>**It has low impact but it is a compelling story.**
S[-INV, SENTIMENT=negative] -> S[-INV, SENTIMENT=positive] CC[CONJUNCTION=but] S[-INV, SENTIMENT=negative] | S[-INV, SENTIMENT=neutral] CC[CONJUNCTION=but] S[-INV, SENTIMENT=negative]
S[-INV, SENTIMENT=positive] -> S[-INV, SENTIMENT=negative] CC[CONJUNCTION=but] S[-INV, SENTIMENT=positive] | S[-INV, SENTIMENT=neutral] CC[CONJUNCTION=but] S[-INV, SENTIMENT=positive]
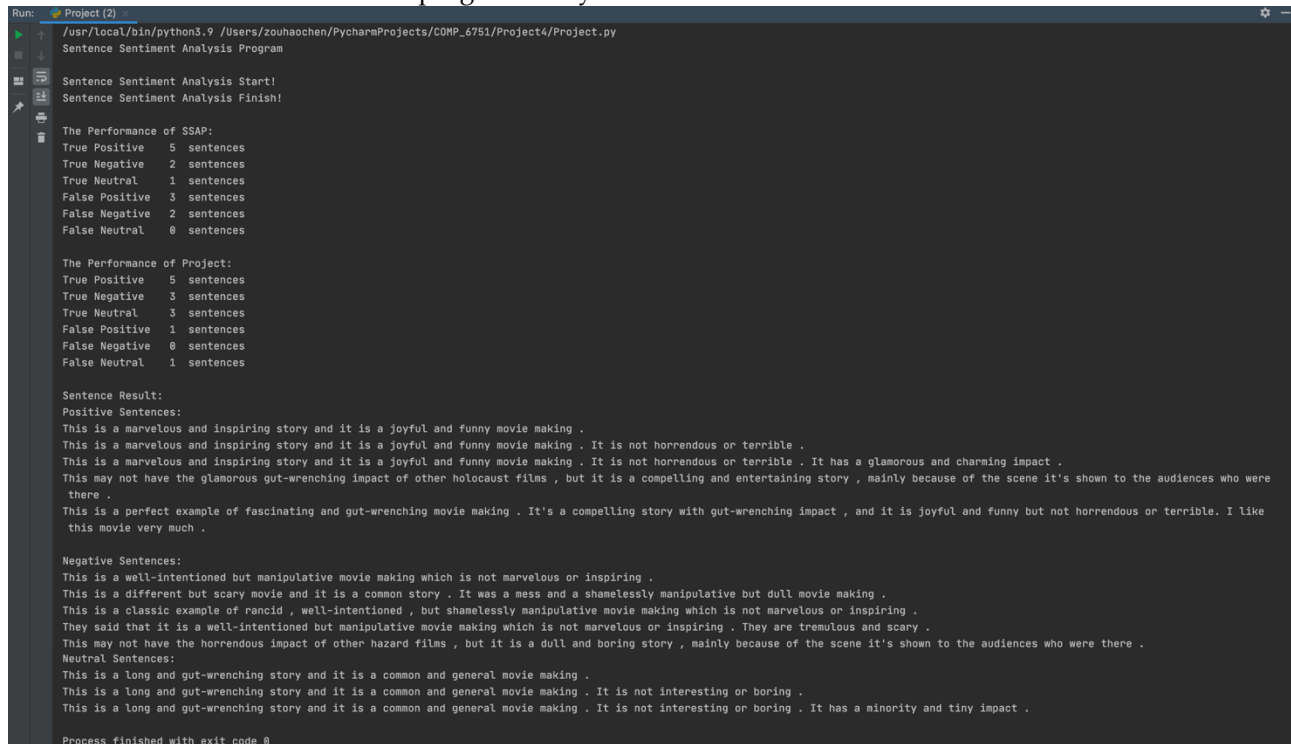>>>**It is a compelling story, but it has low impact.**
S[-INV, SENTIMENT=negative] -> S[-INV, SENTIMENT=positive] COMMA CC[CONJUNCTION=but] S[-INV, SENTIMENT=negative] | S[-INV, SENTIMENT=neutral] COMMA CC[CONJUNCTION=but] S[-INV, SENTIMENT=negative]
S[-INV, SENTIMENT=positive] -> S[-INV, SENTIMENT=negative] COMMA CC[CONJUNCTION=but] S[-INV, SENTIMENT=positive] | S[-INV, SENTIMENT=neutral] COMMA CC[CONJUNCTION=but] S[-INV, SENTIMENT=positive]

4. Comparison of SSAP and grammar-based sentiment analysis of small paragraphs of text

We designed five positive sentences, five negative sentences, and 3 neutral sentences, the sentiment value results of the sentences after program analysis are shown as follows:


```
/usr/local/bin/python3.9 /Users/zouhaochen/PycharmProjects/COMP_6751/Project4/Project.py
Sentence Sentiment Analysis Program

Sentence Sentiment Analysis Start!
Sentence Sentiment Analysis Finish!

The Performance of SSAP:
True Positive    5    sentences
True Negative    2    sentences
True Neutral     1    sentences
False Positive   3    sentences
False Negative   2    sentences
False Neutral    0    sentences

The Performance of Project:
True Positive    5    sentences
True Negative    3    sentences
True Neutral     3    sentences
False Positive   1    sentences
False Negative   0    sentences
False Neutral    1    sentences

Sentence Result:
Positive Sentences:
This is a marvelous and inspiring story and it is a joyful and funny movie making .
This is a marvelous and inspiring story and it is a joyful and funny movie making . It is not horrendous or terrible .
This is a marvelous and inspiring story and it is a joyful and funny movie making . It is not horrendous or terrible . It has a glamorous and charming impact .
This may not have the glamorous gut-wrenching impact of other holocaust films , but it is a compelling and entertaining story , mainly because of the scene it's shown to the audiences who were
 there .
This is a perfect example of fascinating and gut-wrenching movie making . It's a compelling story with gut-wrenching impact , and it is joyful and funny but not horrendous or terrible. I like
 this movie very much .

Negative Sentences:
This is a well-intentioned but manipulative movie making which is not marvelous or inspiring .
This is a different but scary movie and it is a common story . It was a mess and a shamelessly manipulative but dull movie making .
This is a classic example of rancid , well-intentioned , but shamelessly manipulative movie making which is not marvelous or inspiring .
They said that it is a well-intentioned but manipulative movie making which is not marvelous or inspiring . They are tremulous and scary .
This may not have the horrendous impact of other hazard films , but it is a dull and boring story , mainly because of the scene it's shown to the audiences who were there .
Neutral Sentences:
This is a long and gut-wrenching story and it is a common and general movie making .
This is a long and gut-wrenching story and it is a common and general movie making . It is not interesting or boring .
This is a long and gut-wrenching story and it is a common and general movie making . It is not interesting or boring . It has a minority and tiny impact .

Process finished with exit code 0
```

The sentences with good annotations which the sentiment value results of SSAP and program are the same is written in the **Good** file and the sentences with false annotations which the sentiment value results of SSAP and program are different is written in the **False** and displayed as follows (sentences only):

(1)　【Sentence for Analysis】

This is a classic example of rancid , well-intentioned , but shamelessly manipulative movie making which is not marvelous or inspiring .

【Initial Forecast Sentiment Value】

negative

【Program Analysis Sentiment Value】

neutral

(2)　【Sentence for Analysis】

They said that it is a well-intentioned but manipulative movie making which is not marvelous and inspiring . They are tremulous and scary .

【Initial Forecast Sentiment Value】

negative

【Program Analysis Sentiment Value】

negative

The differences of sentiment value between SSAP and the sentiment analysis program mainly because when the sentence contain multiple sentiment parts and different pars sentiment values are different or opposite, then the program will have difficulty in analyzing these sentences. For example, in the first sentence False file: "This is a classic example of rancid, well-intentioned, but shamelessly manipulative movie making which is not marvelous or inspiring." The sentence contains **three parts**: (1) This is a classic example of (neutral); (2) rancid, well-intentioned, but shamelessly manipulative movie making (negative, BUT conjunction); (3) which is not marvelous or inspiring (negative, Negation).

The sentiment value of the whole sentence should be negative as the SSAP analysis. However, in the result of the program, it concerns that the sentiment value of the sentence is neutral since the first part of the sentence is neutral (This is a classic example ……). To sum up, the SSAP can analysis sentence sentiment value more accurately then the program especially in a complicated sentence.