WDPS Assignment 2 Report

Web Data Processing Systems Assignment 2

Group 27

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Introduction

Our project is aimed at **Genshin Impact**, an open-world, action RPG, analyzing the public opinion of the comments under each trailer video(PV) [1] published on the video platform (Youtube, bilibili..) by its official account.

Through our processing process, we will output the most interested concerns of audience for each video, the most discussed topics, and the emotional tendency of the comments. This can be a general public opinion analysis method. Even if the user is not familiar with the game, he can also quickly learn the game terminology, player's concerns and emotional feedback from the results. This kind of analysis may be useful in game business analysis job, game operation job, etc.

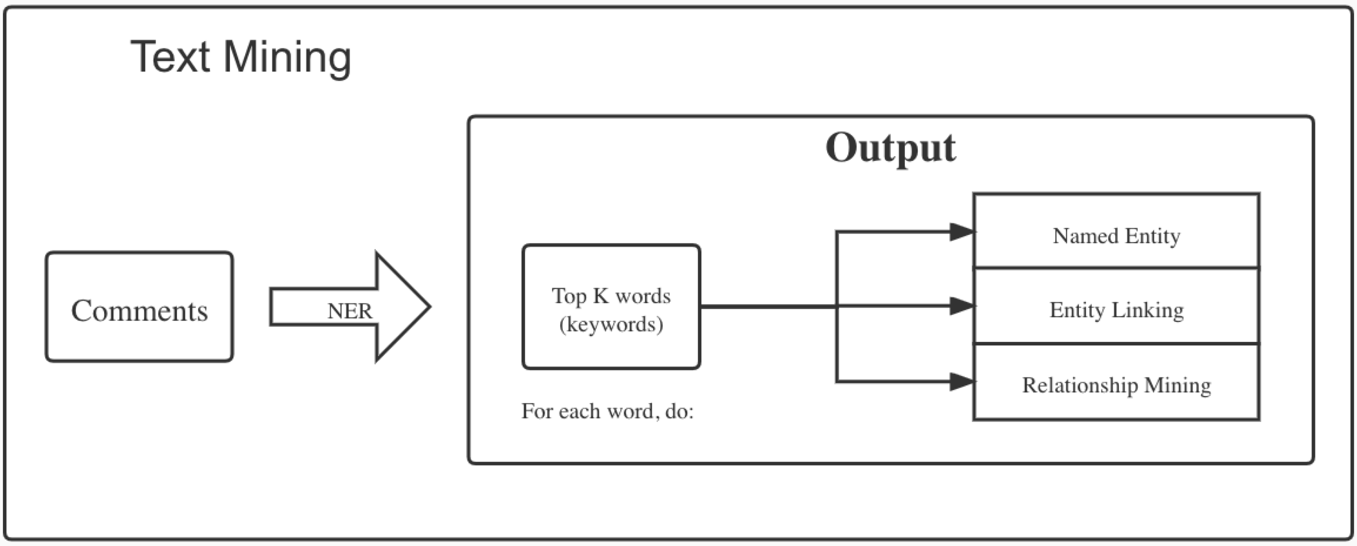
Moreover, we also applied the same method to the Chinese video platform to compare whether players in different language communities have similar concerns and emotional feedback

Run Code Instructions

- Git: https://github.com/97Simei/wdps27_final.git
- See `README.md`

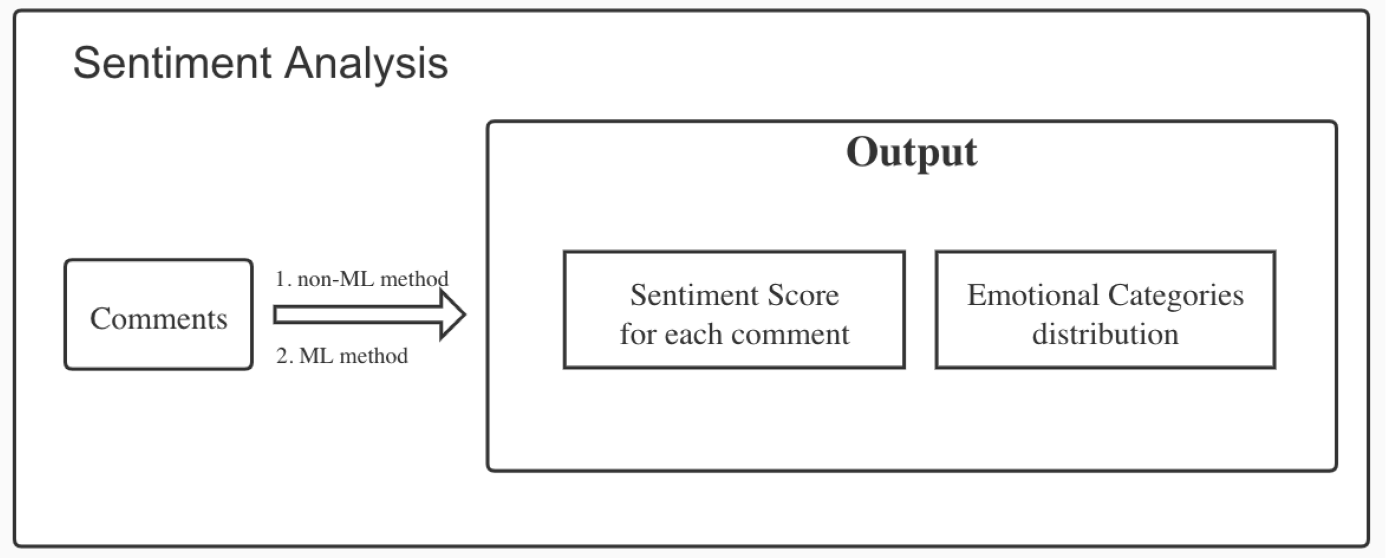
Goals

Text Mining



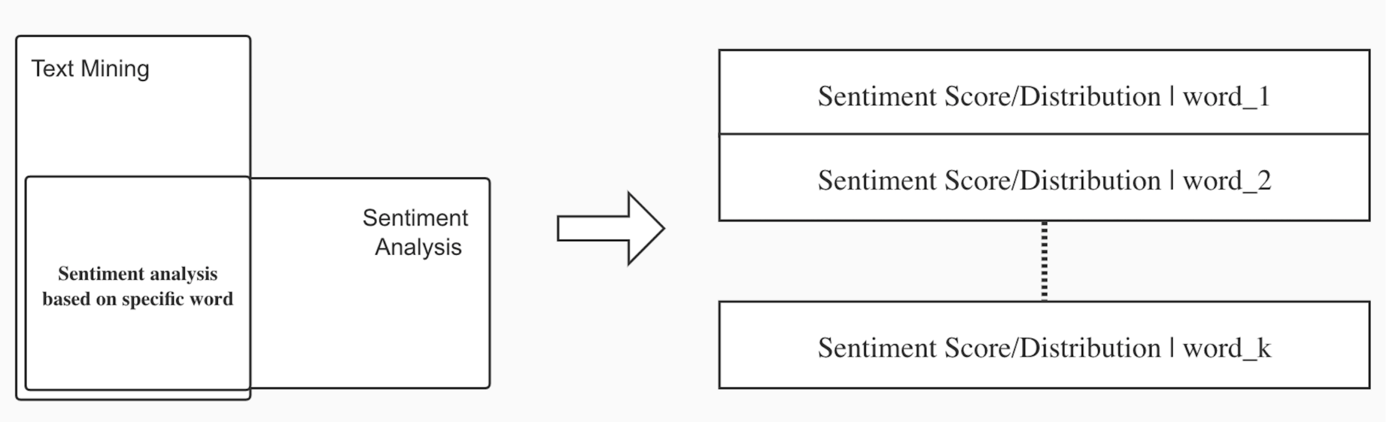
- In text mining part, we do NER for comments and count the number of occurrences of each entity. We select the top 20 entity words as the manifestation of players' interests.
- For each entity, we do entity linking to a wiki page so that anyone can know what the entity is.
- For each entity, we try to find the related words to each entity.

Sentiment Analysis


Sentiment Analysis
Output
Comments
1. non-ML method
2. ML method
Sentiment Score for each comment
Emotional Categories distribution

- In sentiment analysis part, we score each comment sentimentality and label them into 5 categories based on the score: <Positive, Semi-Positive, Normal, Semi-Negative, Negative>
- Results are showed in pie chart. We also compare the results of several videos horizontally (emotional trend) to reflect the changes in players' emotion over time.

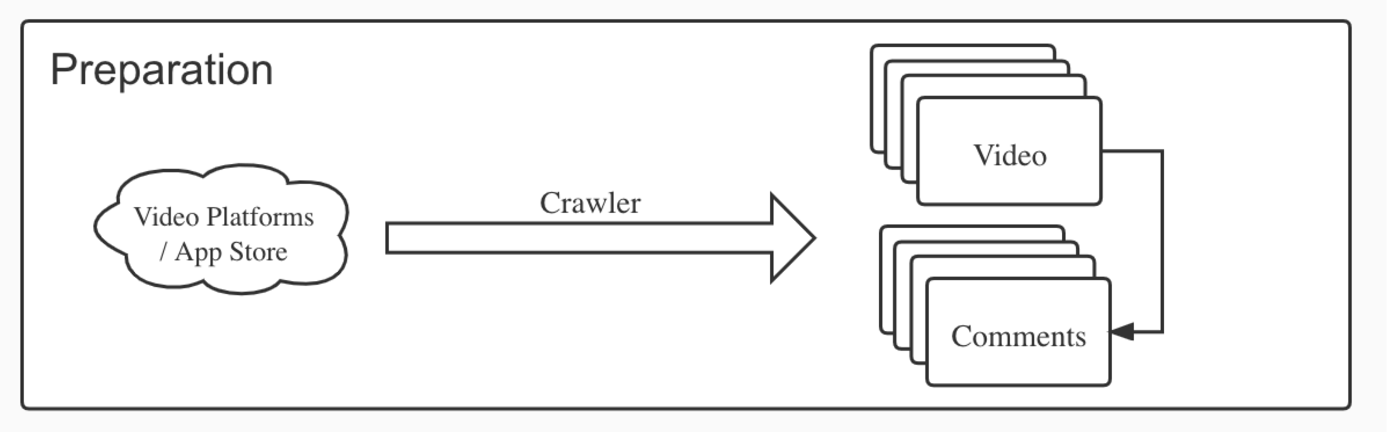
Text Mining + Sentiment Analysis


Text Mining
Sentiment analysis based on specific word
Sentiment Analysis
Sentiment Score/Distribution | word_1
Sentiment Score/Distribution | word_2
Sentiment Score/Distribution | word_k

- Filtering the comments by each entity word and performing sentiment analysis, the result can be regarded as the player's feedback on a certain character/activity/storyline.

Pipeline

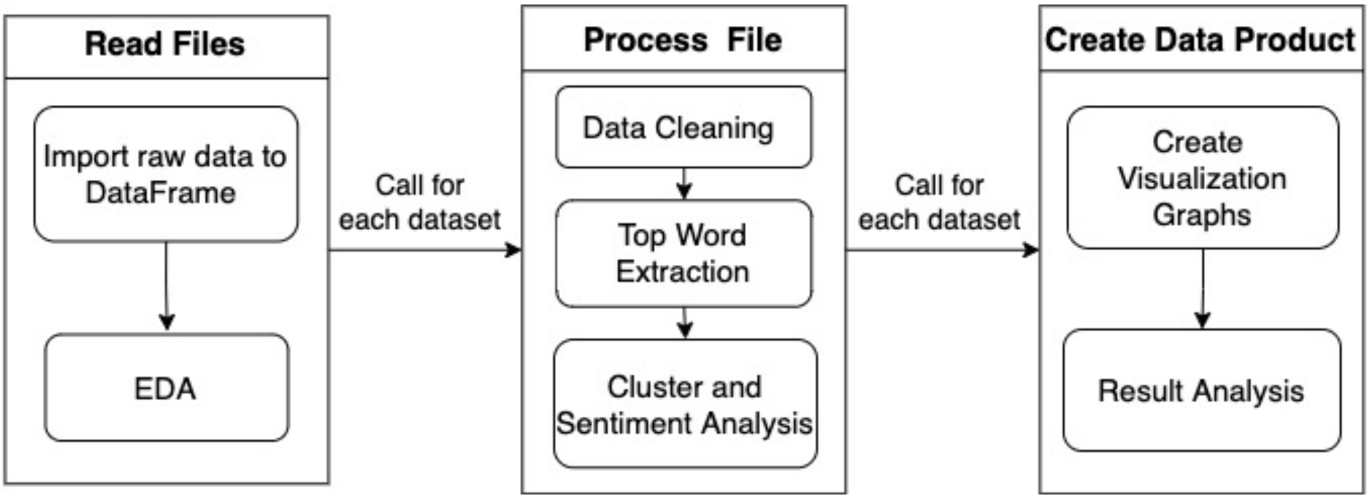
Data Preparation



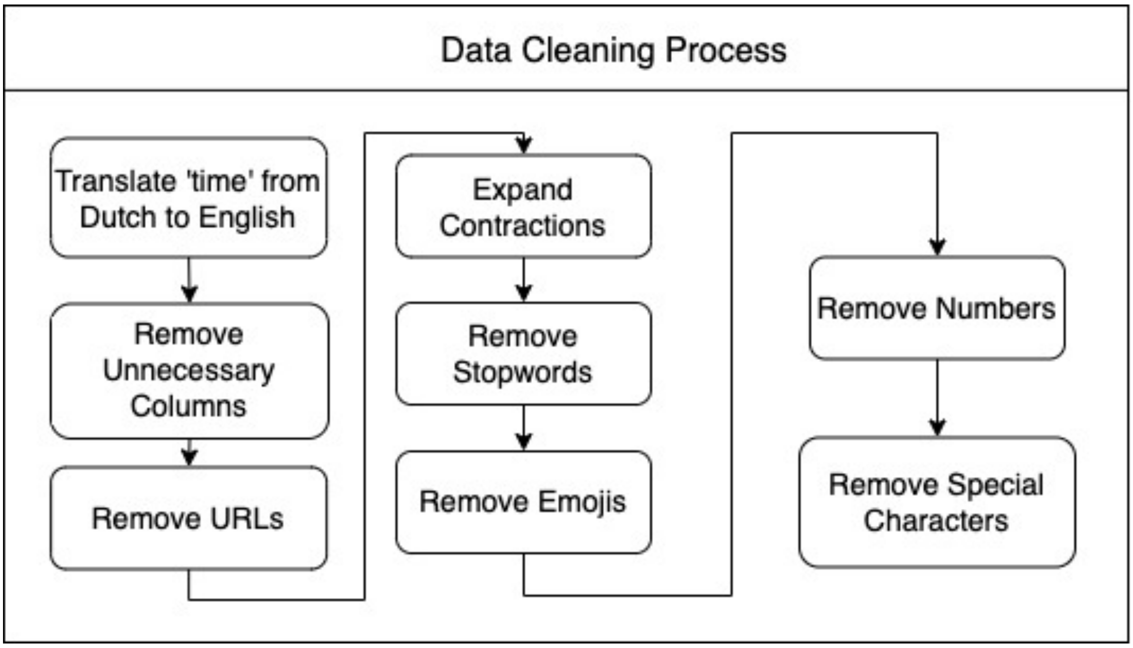
- To get the YouTube Video's comment data, we reproduced the script from the Ahmed Shahriar Sakib' github. The script requires the *pandas* and *request* modules to support the data extraction. The script will finally dump the YouTube video comments to a CSV form. The user can also easily be sorted by popularity or timestamp when downloading the data. The data set contains 8 columns.
- A handmade crawler to bilibili and GooglePlay Store through given website api.

For videos, we collect all the comments of the latest 6 trailer videos(2.3, 2.2, 2.1, 2.0, 1.6, 1.5), representing 6 different game versions in 270 days.

Text Mining

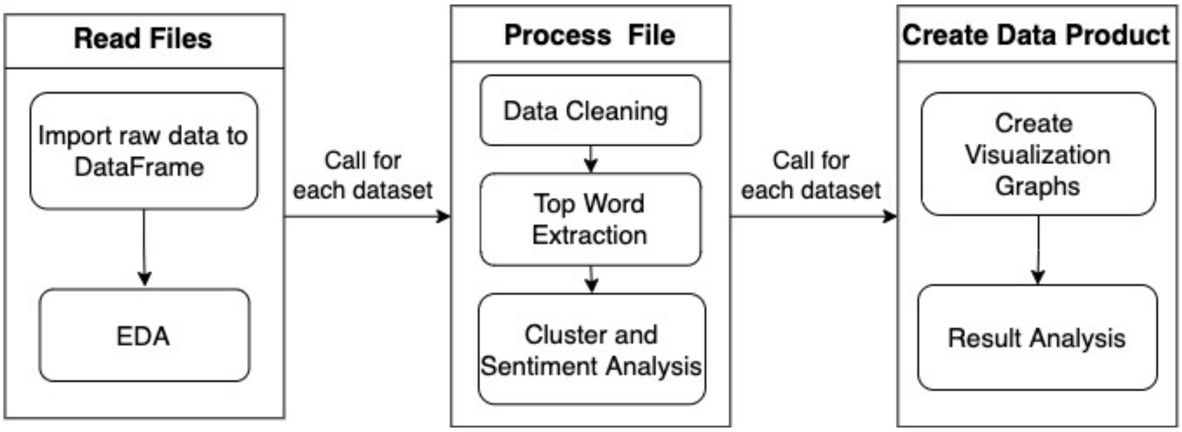


1. Data Cleaning
   - Data Cleaning is an essential step which could provide cleaned and meaningful data sources to the top word extraction pipeline.The main steps of the data cleaning process is shown in figure below.
   - For the YouTube data set, every 'time' value should be translated from Dutch to English. Next, unnecessary columns ''cid','photo' and 'channel' will be dropped from our data frame. Some comments may include URLs and special characters such as "@user" will also be dropped. After expending the contractions, stop words like "the" will be dropped. Finally, we also dropped the emojis and numbers.



2. NER
   - The project used the spacy and sentence-transformer packages to do the NER process. During the experiment, the former package has a better recognization result on the PERSON,ORGANIZATION and LOCATION result. But the former process has a longer processing time. We finally used the spacy to done with our NER, because the "popular" entity will always ranked high with its high frequency
3. Entity Linking
   - We link the Genshin Impact Fandom Wiki to the named entities we've selected. Fandom is a repository of entertainment culture. By examining if the web page is incorrect, we may determine whether this entity is affiliated to Genshin Impact. Because the usage of the same name during game development will be avoided, the word disambiguation will not be involved.
4. Top words Extraction
   - In this project, we have adopted two methods to extract top words from the document. First method calculated the frequency of the words and phrases,and rank the word or phrases based on the frequency. Secondly, we selected the top words based on the similarity and the word frequency.
   - 4.1 Extract Top Words Based on Word Frequency
     - After the process 4.1, though data is already cleaner than the raw data, there still remains the pronoun and subject which is not very meaningful to represent the comments' main idea. As a result, we import the spacy package and use the inside pipeline "en_core_web_sm". After the Part of Speach (POS) process, we can easily extract the noun from each comment's string. The new POS extract result will become the corpus input of the "getTopMentionByFrequency" function. At first we use the "CountVectorizer" to create the bag of words data structure, next based on the vector array, we could use "sum" function to calculate the frequency of the words/triples. We could decide the size of phrase manually, in this paper we set the size as 2. After doing several experiments, it is a big problem that there are always similar bigrams in the result. For example "A,B" and "B,A" actually should be the same bigrams, they only have the different order of the word, the symantic meaning between the bigrams are same. To solve the problem, we compared similarities between bigrams, and combined the bigrams,which means that we added the frequency of the similar

bigrams. Fig5 shows the difference before combining the bigrams and after combining the bigrams. As we can see in the Fig5, most of the duplicate results are eliminated. For example, "omicron anagram" and "anagram moronic" is combined into "omicron anagram". More top words could be extract, such as "pcr test". Also top words like "for the" and "it the" is removed. Though they have a high frequency, they can't represent the center meaning of the comments.

- 

- 4.2 Extract Top Words Based on Similarity
  - In the second method to extract top words, we used the algorithms called Maximal Sum Similarity. The distance between pairs of data is defined as the pairs of data for which the distance between them is maximized. In the paper, what we intend to do is to maximize the candidate top words' similarity to the document, in the meanwhile, minimizing the similarity between the candidate top words. In our project, we calculated the distance using `cosine_similarity()` function. So the first step should be rank the top words candidate based on the cosine similarity, and the next step will be calculate the combination of words that are the least similar to each other.

Sentiment Analysis

1. Data cleaning and reorganization
   - Remove special punctuation (e.g. emoji) and non-English symbol
   - According to whether quoting the original lines in the PV video, the comments are separated, and only the player's own text is selected.
   - Remove the comments that are too long or too short
   - Remove duplicate comments
2. Score and Labeling
   - Use `TextBlob` to calculate the sentiment polarity(score) and subjectivity. Remove the comments with no subjectivity.
   - Label the comments into 5 categories, <Positive, Semi-Positive, Normal, Semi-Negative, Negative>, according to its score.
3. Machine Learning method to scoring and labeling
   - Motivation: Textblob is only focusing on the meaning of a single word, rather than "understand" the meaning of a sentence. Sometimes a word can significantly influence the result of a sentence. Therefore, we may have better classification accuracy of emotions by training a sentiment classification model using labeled comments in the same game.
   - Solution: We use crawler to obtain some comments in the google play store about this game, and each comment has a labeled rating. We get about 2000 comments and break them into training

and testing data. We have tried Logistic Regression, SVM and Naive Bayes model. The best accuracy of model is about 75% under the Naive Bayes classifier, which considers the connection of words in the sentence.

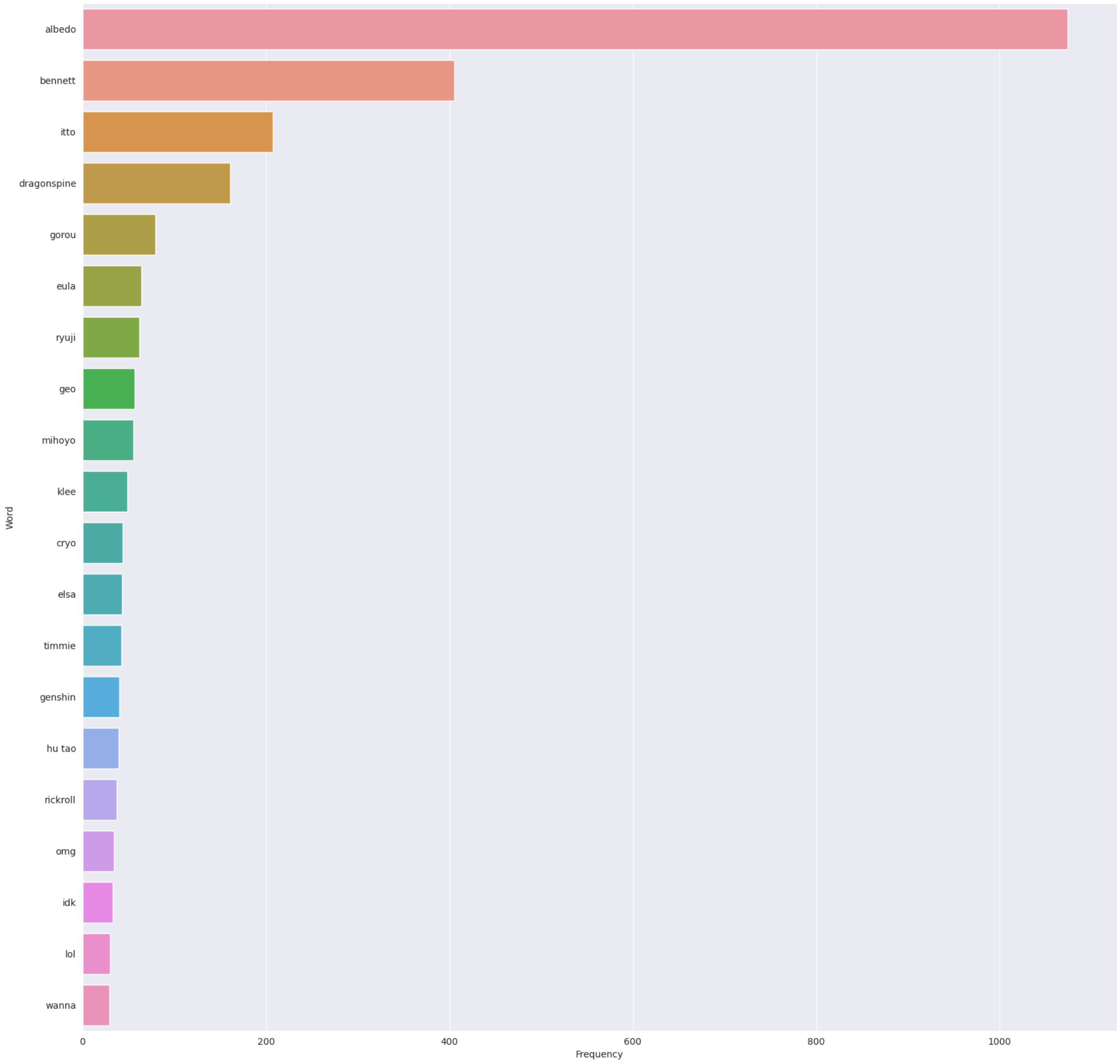
Result

Entity and linking result

Named Entity	Entity Linking	Top Related Words(by frequency)	Top Related Words(by similarity)
albedo	https://genshin-impact.fandom.com/wiki/Albedo	['albedo albedo', 'cryo delusion', 'eula devil', 'dragonspine event', 'story quest']	['1154 albedo devil', '11737 albedo secretly', 'fighting 10735 doe', 'dragonspine 4305 fake', 'idiotic theories 3647']
itto	https://genshin-impact.fandom.com/wiki/Itto	['itto itto', 'albedo eula', 'voice actor', 'playable character', 'new boss']	['hot bully 11144', 'best husbando 11678', 'sexier girl 12367', 'biggest cat fish', 'favorite fictional character']
mihoyo	https://genshin-impact.fandom.com/wiki/Mihoyo	['mihoyo albedo', 'game coincidence', 'people china', 'death flags', 'story anniversary']	['story amazing battle', '10784 just dragon', 'snowman 6844 love', 'got balls 2022', 'battle su 150']
bennett	https://genshin-impact.fandom.com/wiki/Bennett	['bennett bennett', 'team albedo', 'amber eula', 'screen time', 'pyro archon']	['4575 dear diary', '1785 bennett dragon', 'actually hate dragonspine', '6870 funny knights', 'hate dragonspine seeing']
dragonspine	https://genshin-impact.fandom.com/wiki/Dragonspine	['dragonspine dragonspine', 'albedo cyro', 'new event', 'itto part', 'dragon durin']	['getting flashbacks dragonspine', '2975 thank dragonspine', 'fast 10686 dragonspine', '2675 dragonspine nightmare', 'returning dragonspine 5153']
genshin	https://genshin-impact.fandom.com/wiki/Genshin	['genshin genshin', 'game mihoyo', 'new albedo', 'quest lines', 'cryo accident']	['3909 rifthounds whopperflowers', '2018 halloween lol', 'game free anime', '336 bestfriend plays', 'anime game 2010']
geo	https://genshin-impact.fandom.com/wiki/Geo	['geo vision', 'albedo cryo', 'itto part', 'khemia life', 'lay lines']	['itto 10351 christmas', '2396 albedo better', 'albedo gives 5132', 'dad 4647 albedos', 'love geo tank']
gorou	https://genshin-impact.fandom.com/wiki/Gorou	['gorou gorou', 'itto part', 'albedo notes', 'hangout event', 'voice actor']	['best boy 6949', 'sleeping gorou 8215', 'trailer hyped gorou', 'arguing youtube comments', 'fighting huge monster']
hu tao	https://genshin-impact.fandom.com/wiki/Hu_Tao	['hu tao', 'itto albedo', 'weapon banner', 'eula cryo', 'fates primos']	['12915 albedo rerun', 'mihoyololyall gotta dragonspine', 'lost wanting hu', 'absolu 9893 sorry', '7622 regret pulling']

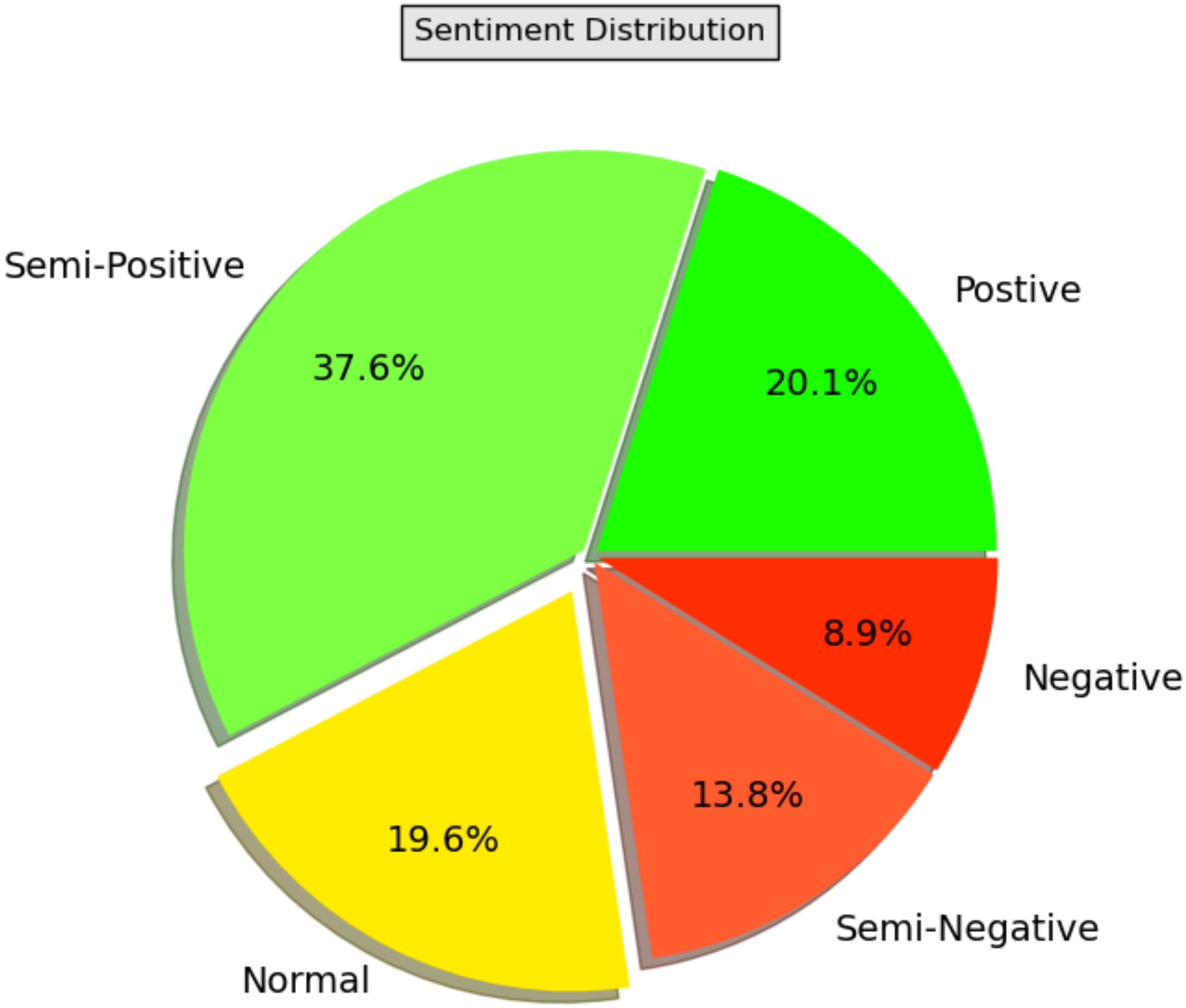
The results are saved in `.csv` format in `./output/text_mining`.

Histogram of named entity



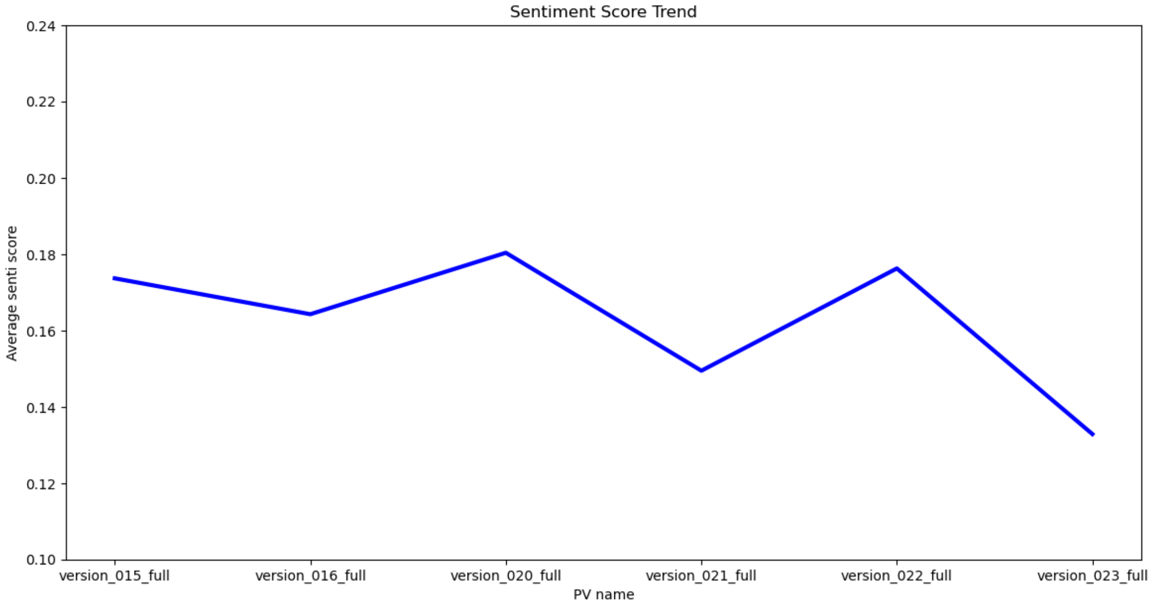
The results are saved in `.png` format in `./output/text_mining`.

Pie graph of sentiment categories



The results are saved in `.png` format in `./output/senti`.

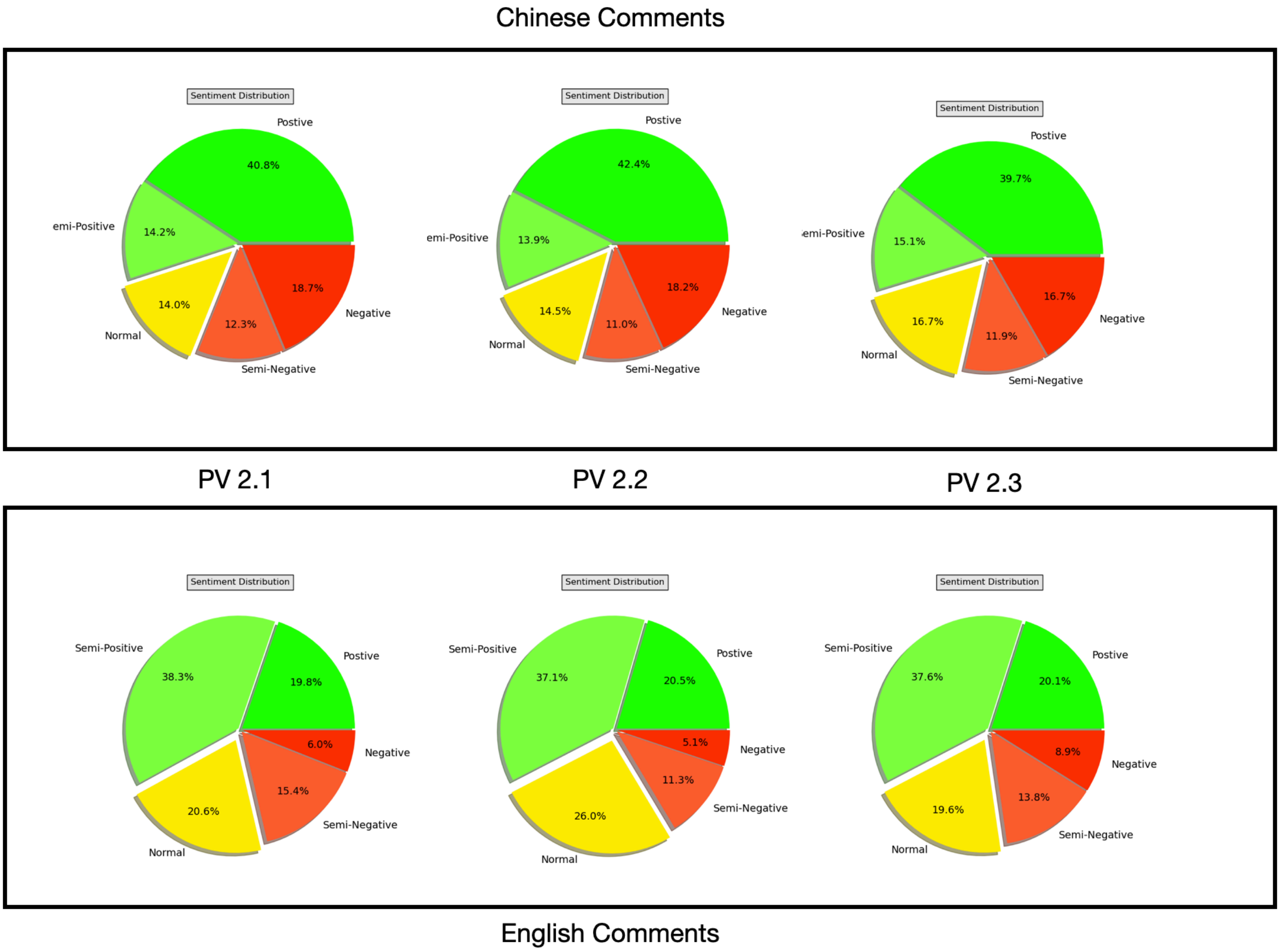
Line graph of trend



The results are saved in `.png` format in `./output/senti`.

CN ver. and comparison

The percentage of general postive and negative is similar, but in Chinese community, the proportion of very positive and very negative is much higher, which means that Chinese players express more extreme emotions.



Moreover, comparing the entity words of each version, we also found that the same words may appear earlier in the Chinese community, which means the characters in 2.3 may be mentioned by players in 2.2. This phenomenon is not showed in the English community. Quite interesting.

[1] Every 45 days, Genshin Impact will update the game version. One week before the update version, the official will release a trailer which talks about the new contents of next version. ↩