Sentiment Analysis of Lyrics on Recycled and Recent Songs using Natural Language Processing Technology

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Abstract:
This study is to examine and categorize the lyrics of popular songs both the recycled and the new ones, in Indonesian and English, using technology of Natural Language Processing or NLP, Sentiment Analysis on particular. The research uses quantitative method in collecting numerical data to be analyzed with statistical techniques. A literature study is also taken to reveal the originality and popularity of songs covering the time they were used and written. The device used in processing numerical data is an iPad with certain specification considered its ability to access internet, downloading and saving data as well as making and editing documents. It was found that the lyrics of recycled songs are classified into "very good" and those currently written are classified into "not good".

Keywords:
Lyrics, Sentiment Analysis, Natural Language Processing, popular songs

INTRODUCTION

Social media has become a main resource for people to get information, friends, popularity and even earnings (Mahirtransaksi.com, 2023) and music plays as a main part to make those purposes more interesting and creditable. Unfortunately, the quality of the songs used to boost contents is mostly ignored. In 2018 Napier has studied the significant change of lyrics on popular music towards a more negative tone resulting in anger, disgust, fear, sadness and conscientiousness. If the words were worse before the pandemic era, let alone afterward. The virality purpose of music has decreased the quality of the tone making musicians trapped in an unhealthy environment that forced them to continually creating contents to going viral regardless the value of the message which has to be the main goal of any creativities. Realizing that today's society is more technological and that people become familiar with negative words of songs daily, it is necessary to reveal content's categorization to raise people's awareness of what they experience daily in which the technology of Natural Language Processing or NLP can be effectively used to describe it.
The studies that exploring Natural Language Processing (NLP) and sentiment analysis have been conducted before. Biancofiore et al., 2022 discussed the use of NLP in sentiment analyzing based on the aspect of music using data taken from Spotify, to determine the intention of users in various aspects of music. The use of NLP to analyze musical lyric decency of Malaysia's top hit songs was also conducted by Farhan in 2021 but this project only focusing on English and Melayu language. Napier and Shamir in 2018 examining the degradation of lyrics found in 100 Billboard songs covering all the years from 1951 through 2016, showed that anger, disgust, fear, sadness and conscientiousness replacing the expression of joy, confidence and openness of the pop song lyrics; saying joy, confidence, and openness expressed in pop song lyrics have declined; means that the words people hear every day in social medias offers negative impacts to the society. However, none of the papers focused on the categorization of new and recycled songs in Indonesia and English.

The research on identifying the emotional polarity of song lyrics through NLP by Oudenne & Chasins in 2010 stating that song lyrics could give an important meta-information like genre, emotion and the theme; but it is hard to get such information since no single algorithm can produce an accurate classification. Herrada in 2008 gave some examples of NLP technology used to get metadata like entity extraction, sentiment analysis and topic classification. Yabin et al. in 2007 discussing the lyrics analyzes based on the standard natural language processing in which the NLP was used to analysis the lyrics similarities.

Theoretical Study

Each word means something and every utterance impacts the hearers. The lyrics we hear from songs is undoubtable will affect our thought and emotion. Foley stated that the world is the source of perceptions and will be represented in mind as concepts or mental representation.

Brain makes memories, which change the way we'll subsequently think. The principal activities of brains are making changes in themselves. Because the whole idea of self-modifying processes is new to our experience, we cannot yet trust our commonsense judgements about such matters (Minsky as stated by Foley 1997).

Lyrics is words uttered in written and or spoken language. It is a way to express innate emotion and thought that has stanzas and lines like poetry does; assuming to be similar, only different in the way they are delivered. The words or lyrics used in popular music are easily found online through social medias like Facebook, You Tube and Twitter nowadays.
There are two scopes of popular songs in this study, one is the melodies and lyrics currently released and have been known well by a society including the old songs that had been recycled, while the other is the form of music that has certain rhythm and style which is also called as pop music. The term "popular music" used in this study tends to be the first category and it covers up various styles of music in which pop music is included in.
Sentiment analysis is also known as opinion mining, a process of collecting, processing and analyzing texts to identify its sentiment or opinion. Imam Fahrur Rozi et al., in 2012 said that it becomes an important topic research recently focusing on analyzing text documents. Its main purpose is to extracting and understanding the information of a text in order to making decision in all aspects such as sales, branding management and product developing. It is believed that sentiment analysis develops a fast-giving great contribution to all aspects.
Sentiment Analyzes and Natural Language Processing (NLP) are two kinds of technologies often used coincide in processing natural language. In sentiment analyses, NLP can be used to process and analysis text automatically, so it fastened the analysis process of large documents. On the other hand, the sentiment analysis algorithm contributes in the development of NLP to better recognize and understand human languages. Therefore, the integration of sentiment analysis and NLP forming the efficiency and accuracy in processing natural language, also giving positive impact in several applications, such as spam detection, opinion analysis, and virtual assistant development.
Natural Language Processing is a branch of computer science focusing on cultivating human's natural language. NLP aims to develop algorithm and computation models who can understand, produce and translate human language effectively. NLP is useful in a variety of application such as searching machine, chatbot, language translating, sentiment analysis, and voice recognizing. It is a growing field and an important element in processing natural language. The use of NLP has been increased in various applications, mainly in the era of digital where texts are available in tremendous capacity.
According to Lisangan (2013), NLP is a design to let computer instructing orders written in humans language standard. It involves language processing in many levels, from words introduction, the structure, and the context and meaning understanding. Some Techniques used in NLP are:
Tokenization, separating sentences into words or token.
Parsing, analyzing sentence's structure in identifying subject, predicate, object and clause.
Language modeling, making statistic model or leaning machine to predict words in a text.
Machine learning, using algorithm machine learning to train NLP model in natural language data.
Natural processing, processing texts to identify entities, like names, locations, dates, also doing sentiment analysis or topic classification.

Naïve Bayes Classifier is the simplest sample of probabilistic classification. The result of Pr(C\d) from probabilistic classifier is the possibility that document d is included in class C. Each document contains terminologies given based on the total events of certain documents. With the supervised training, Bayes could study the supervision pattern of a group of experimented and categorized documents to compare

all contents, to make a list of words and the words that happened; so that the list of the appeared words can be used to classify new document according to the highest posterior probability as explained by Ting et al in 2011.

METHODS

Sample of songs are chosen among the those mostly played songs in the social media, both representing Indonesian and English. The selected ones are then processed through technology and statistic technique. The method of data collecting is quantitative research, producing a numerical data to be analyzed using statistic technique; the research method based on positivism philosophy, used to study certain population or sample wherein the collecting data processed through research instrument, quantitative data analysis or statistic to draw and examine the hypothesis. The device used is a hardware with specification:
Model: Ipad mini 6
Version: IpadOS 15.7.1
Data storage: 64-245 GB
Ram Memori: 4 GB
Processor: Firestorm + 1.8 GHz, Quad core, Icestorm
Processor velocity: 3.1 Ghz
Core processor: Dual Core
Version OS: 15
Operating System: iOS

The development method used is SDLC in Waterfall approach. SDLC is Systems Development Life Cycle is a cycle used in making or developing information system to accomplish problem effectively. In other words, it is a stage or work aims to produce a high-quality system according to costumer wishes. It is a form to describe stages and steps in its process.
Waterfall in the earliest SDLC approach used for in developing software. The process of Waterfall Method is started from planning, analyzing, design and the implementation on the system. This model approaching orderly and systematically; it is called waterfall because the next step performed after the first had been completely done. It runs gradually from the first step, the developing system which is the planning stage, up to the last part of developing system which is the maintenance stage. To be able to depict the process, a design system is developed.
The existing flow-map shows how the system running that many music creators still use. It started from making a song, then the creator learn on the lyrics weather it has been used or not, for basically every song's lyric has similarities to each other. After formulating lyrics, the creator can move into the next step, looking to find labeling or sponsoring checking to find sponsor of his or her song. In the diagram, *Suitable*, the creator is checking whether or not it is matching with the result of previous survey. Then, the creator is coming to the *Recording* stage in the diagram, following by the input the song into a system wherein *Publish* takes place. After that, the song will be in the *Review Song* on the diagram, to make sure that the lyrics are as expected. The next step is the *Store Review*, based on the rating of the song. This marks the end of the existing system.

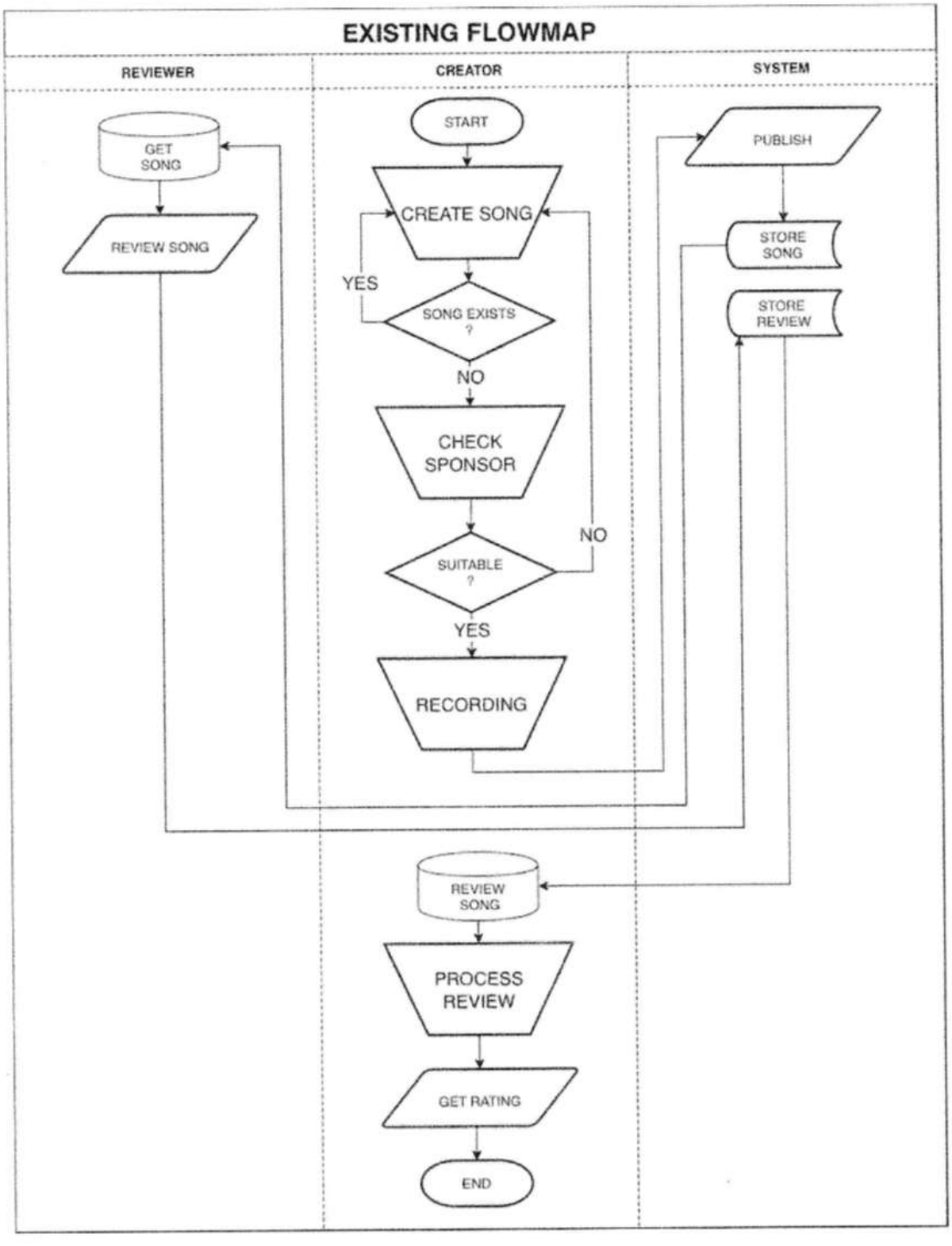

Figure 1. Existing flow-map

The diagram context shows a large circle representing all the process of a system. In the picture below, there are two connecting entities of sentiment analysis process, the Reviewer and the Creator. Of the two sides, there are several data involved in the Sentiment Analysis System of Popular Song: Song Data, Review Data, and Rating Data. The song data covers the information of the analyzed songs; the rating data covers the opinions and evaluation from reviewers; review data reflects the value or rank given by

the reviewer. At this point, the Sentiment Analysis System is the main controller that facilitating the interaction between Reviewer and Creator in order to analyze the sentiment of popular songs.

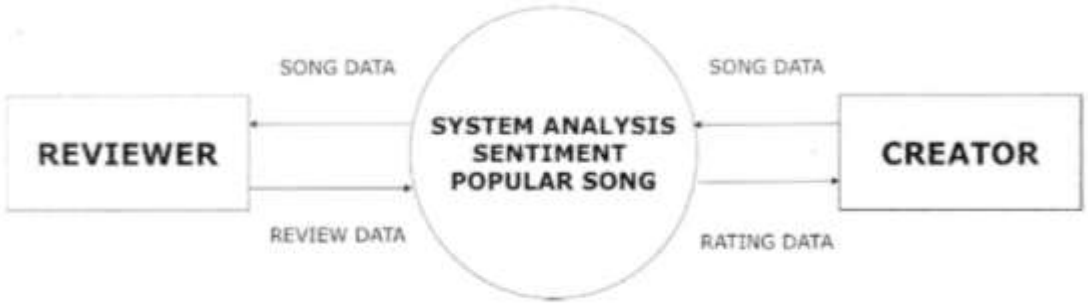

Figure 2. Context Diagram

Data flow diagram (DFD) is a description of either an existing system or a new system developed logically without considering the physical environment of where the data flows. Below picture shows three groups of main process: Classification Process, Sentiment Analysis Process and Reviewing Process. There are also entities involved in those three parts: Creator, Song, Reviewer, Review, and Rating. The data included in the process are song data, review data and rating data. The process is started with Classification Process to grouping and identifying the to be analyzed songs. Then, the Sentiment Analysis Process is used to analyze the sentiment or emotion in the review given by the Reviewer. The last process, Reviewing Process, involving the Reviewer regarding to the discussion or appreciation of the songs.

Of all the process, the Creator takes the responsibility as the writer of the song; Song, as the object of analysis; Reviewer to review the songs; Review as the result of the reviewing; and Rating which is the value given by the Reviewer. The data like Song Data, Review Data and Rating Data are used as input for all the process to get the result.

Flow-map is the combination of map and flow chart, showing the movement of things from one stage to another, like the total packet in a network, the amounts of things to buy and sell, or the amount of immigrant. In the new system, Parallel Process is taken to involve several stages, including Scraping Data, Cleaning Data, Labelling Data, Training Model Data Rating, and Access Model Data Rating. After passing all the steps, the data then come to the Classify Song so the creator may gain the rating result.

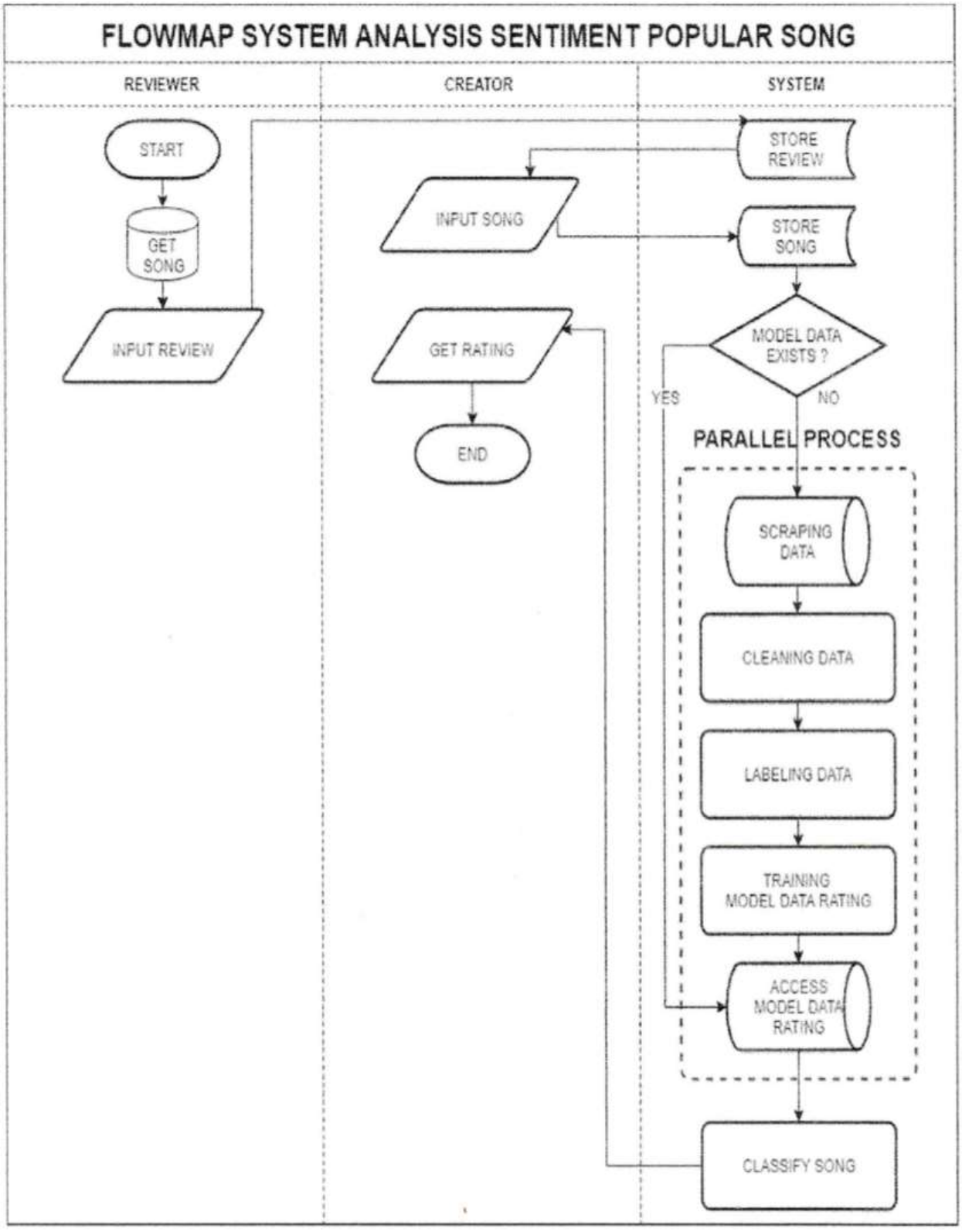

Figure 3. New Flow-map System

RESULTS AND DISCUSSION

The five popular songs taken from social medias processed in this study are: "Sial" by Mahalini Raharja released in 2023, an Indonesian popular song; "Terpesona" by Samuel Takalide, viral in 2021 across North Sulawesi; "Stand By Me" by B.N. King, first published in 1961 which is popular all over the world;

"It Is Well" by Rice, written in 1873 which is popular among Christian worldwide and has been translated into Indonesian; and "Dispossable Lies" by Superman is dead, released in 1961 but popular in Indonesia and worldwide nowadays.

When the code py train.py was being run, the result showed that the process of model training was successfully held with the accuracy of 83.0. The number indicates a level of success in modeling the lyrics classification. The higher the number, the better the model ability in classifying.

```
C:\Users\Administrator\Downloads\Compressed\my_project>py train.py
Creating model data!
Getting word features and documents..
Generating datasets..
Training model data..
Accuracy: 83.0
Saving model data..
Model data created!
Time: 2238.557473421097 s

C:\Users\Administrator\Downloads\Compressed\my_project>
```

Figure 4. Running train.py

In the "saving model data.. model data created!" showed that trained data model was successfully stored. It means that the model gained from the training process can be reused in the future, and no need for retraining. This data storage model is important in making sure the availability of the trained model. The time showed as "time: 2238.557473421097 s" indicating the time needed for the training process. The number represented the training duration in second. The higher the number, the longer the time used to train the model. In this case, the process of training took about 2238.557473421097 second. The reliable accuracy, the successful storage mode, and the reasonable timing of training showed that the given order of py train.py is accomplished that can be used to classify song lyrics with the accuracy of 83.0.

```
C:\Users\Administrator\Downloads\Compressed\my_project>py main.py
Masukan Jumlah Lagu: 1
Masukan Lagu 1: mahalini-sial
Masukan Lirik 1: sampai saat ini tak terpikir olehku aku pernah beri rasa pada orang sepertimu seandainya sejak awal tak ku yak
inkan diriku tutur kata yang sempurna, tak sebaik yang kukira andai kutahu semua akan sia-sia takkan ku terima cinta sesaatmu bagaimana dengan aku terlanjur me
ncintaimu yang datang beri harapan lalu pergi dan maghilang tak terfikirkan olehmu hatiku hancur karenamu tanpa sedikit alasan pergi tanpa berpamitan takkan ku
terima cinta sesaatmu seandainya sejak awal tak ku yakinkan diriku tutur kata yang sempurna tak sebaik yang kukira andai kutahu semua akan sia-sia takkan ku te
rima cinta sesaatmu bagaimana dengan aku terlanjur mencintaimu yang datang beri harapan lalu pergi dan menghilang tak terfikirkann olehmu hatiku hancur karena
mu tanpa sedikit alasan pergi tanpa berpamitan takkan kuterima cinta sesaatmu sial-sialnya ku bertemu dengan cinta semu tertipu tutur dan caramu seolah cintaik
u puas kau curangi aku
Hasil 1: SANGAT BAGUS
SANGAT BAGUS (%): 73.12456687081181
KURANG BAGUS (%): 26.87543392918814

C:\Users\Administrator\Downloads\Compressed\my_project>
```

Figure 5. Song 1

The picture above is a sample of a program using Python in analyzing song lyrics. After running command py main.py in the project directory, user was asked to input the number of songs to be analyzed, in this case, one song. Then, user was asked to input the title of the song and the lyrics. The song was "Sial" by Mahalini; the result showed the assessment indicating how good the lyrics are. In this case, the result is "VERY GOOD" with the percentage of 73.12% and "NOT GOOD" with the percentage of 26.88%. All process took duration of 2238.557473421097 second. It is important to note that the result is relative and could be different depends on the method of analysis used in the training model.

```
C:\Users\Administrator\Downloads\Compressed\my_project>py main.py
Masukan Jumlah Lagu: 2
Masukan Lagu 1: Samuel Takalide - Terpesona
Masukan Lirik 1: Terpesona, aku terpesona memandang memandang wajahmu yang manis. Terpesona, aku terpesona menatap menatap waja
h mu yang manis. Terpesona, aku terpesona memandang memandang wajah mu yang manis, terpesona aku terpesona menatap menatap waja
h mu yang manis. Bagaikan mutiara bola matamu bola bola matamu, bagaikan kain sutra lesungnya lesungnya pipimu. Cantiknya kamu,
 eloknya kamu, semua yang ada padamu, membuat aku jadi gelisah, sampai sampai aku terjaga dari dari mimpiku. Terpesona, aku ter
pesona memandang memandang wajahmu yang manis, terpesona aku terpesona menatap menatap wajahmu yang manis
Hasil 1: KURANG BAGUS
SANGAT BAGUS (%): 24.095775925043696
KURANG BAGUS (%): 75.90422407495643
KURANG BAGUS (%): 75.90422407495643
Masukan Lagu 2: Ben E King - Stand By Me
Masukan Lirik 2: When the night has come  and the land is dark and the moon is the only light well see, no i wont be afraid oh
i wont be afraid just as long as you stand stand by me. So darlin, darlin stand by me oh stand by me oh stand by me stand by me
, stand by me. If the sky that we look upon, should tumble and fall or the mountain should crumble to the sea. I wont cry, i wo
nt cry, no i wont shed a tear just as long as you stand , stand by me. And darlin, darlin stand by me, stand by me, oh stand by
 me, stand now, stand by me, stand by me. Darlin darlin stand by me, oh stand by me, oh stand now stand by me stand by me. What
ever you're in trouble wont you stand by me oh stand by me, wont you stand now, oh stand, stand by me.
Hasil 2: SANGAT BAGUS
SANGAT BAGUS (%): 96.81262439611535
KURANG BAGUS (%): 3.18737560388426

C:\Users\Administrator\Downloads\Compressed\my_project>
```

Figure 6. Songs in Case 2

In the above coding sample, the code py main.py was used in the project directory located at C:\Users\Administrator\Downloads\Compressed\my_project. After this step, the program will ask the user to input a number of songs to be analyzed, in this case, two songs. Users were asked to input the title and lyrics of every song. In this case, the first song was "Chris Rice" and the second was "Superman is Dead – Disposable Lies". After the input of the tittle and lyrics, the program will analyze the lyrics. The result showed that the first song was categorized as "VERY GOOD" gained 99.99%, while the second was also "VERY GOOD" with the percentage of 54.54%. When the result was revealed, the program also offered the percentage of "NOT GOOD" category. This shows how far the lyrics could be said good or not good. It is important to underline that the result is relative and could be different depends on the model analysis used and the date used in the training model. All the process of analysis took 2238.557473421097 second.

```
C:\Users\Administrator\Downloads\Compressed\my_project>
C:\Users\Administrator\Downloads\Compressed\my_project>py main.py
Masukan Jumlah Lagu: 2
Masukan Lagu 1: Chris Rice
Masukan Lirik 1: when peace like a river attendeth my way, when sorrows like sea billows roll, whatever my lot you have thought
me to say it is well, it is well with my soul. it is well, with my soul, it is well, it is well with my soul. Though Satan shou
ld buffet though trials should come, lets this blest assurance control, that Christ has regarded my helpless estate and has she
d his own blod for my soul. it is well, with my soul, it is well, it is well, with my soul
Hasil 1: SANGAT BAGUS
SANGAT BAGUS (%): 99.99395216837529
KURANG BAGUS (%): 0.006047831623846712
Masukan Lagu 2: Superman is Dead - Disposable Lies
Masukan Lirik 2: however much you want to show that, you keep me inside and what you really care, have a close look deep into y
our flame, time is running out, nothing to hide away. I know were both all right it is time to go, start running around do it f
aster that i write, leave it all behind, all the things weve burnt cruising down the memory. it is time to go, start running ar
round do it faster that i write since i dont know what the last heavens got it all. pickinng up the way back to get home it is
the hardest thing that we think all night anything could be the adventure its all growing an d beyond the tragedy. since i dont
 know what the last, since i dont know what the lies, hell i dont know what the nice, heavens go it all
Hasil 2: SANGAT BAGUS
SANGAT BAGUS (%): 54.53907740647402
KURANG BAGUS (%): 45.4609225935257

C:\Users\Administrator\Downloads\Compressed\my_project>
```

Figure 7. Songs in Case 3

In the above coding sample, the py main.py in the project directory at C:\Users\Administrator\Downloads\Compressed\my_project was used. After running that step, the program will ask the user to input the title of the songs to be analyzed, in this case, two songs. User is asked to input the title and the lyrics of the song. In this case, the first song was "Samuel Takalide – Terpesona" and the second song was "Ben E King – Stand by Me". After the input of title and lyrics, program will analyze the lyrics. The result showed that the first song categorized as "NOT GOOD" with the percentage of 75.90% and the second song grouped to "VERY GOOD" with the percentage of 96.81%.

CONCLUSION

It can be concluded that the implementation of the system lyrics analysis worked successfully. The training model using "py train.py" producing accuracy of 83.0, showing the ability of the model in classifying song lyrics into "VERY GOOD" and "NOT GOOD" with various percentages, could be effectively used for evaluating the quality of song lyrics. The result also showed that the ones classified into "Very Good" are mostly the recycled songs that popular decades before and found in two of the sample songs; and the two other Indonesian songs categorized into "Not Good" and are recently written, with the addition of one English old song. The different category among the old English songs was determined by their use, for secular and or spiritual purpose.

Even though the implementation of the system is successful, still there is room to develop it in the future. It can be widespread into dataset training with various kind of lyric, including different genres that can accumulate the model ability in classifying songs. Even though the accuracy has reached 83.0, some techniques or methods can be implemented to increase the model accuracy. The categorization

also can be widened instead of only those two mentioned previously. The combination of additional features of analysis can also be added to melody and rhythm that contributes to a more comprehensive analyzing system of the quality of song lyrics.

REFERENCES

1. Allaudin Hafidz, D., Shely Amalia, F. (2021). Informasi, S., & Informasi, T.; *Pengembangan Sistem Informasi Edukasi*
2. *dan Pemasaran Hasil Pertanian di Rulang Bawang*; In Cyberarea.id (Vol. 1, Issue 2)

3. Alvioletta, V., Setyawan, M., Yusril Helmi, & Saputra, M. H. K. (2020). Penerapan Metode Analytical Hierarchy
4. Process (AHP) pada penilaian kepuasan pelanggan berdasarkan pelayanan divisi; https://books.google.co.id/books/about/Penerapan_Metode_Analitycal_Hierarchy_Pr.html?id=uor9DwAAQBAJ&redir_esc=y

5. Biancofiore, G. M., Di Noia, T., Di Sciascio, E., Narducci, F., & Pastore, P. (2022). *Aspect Based Sentiment Analysis*
6. *in Music: a case study with Spotify*; Proceedings of the ACM Symposium on Applied Computing; 696-703: https://dl.acm.org/doi/pdf/10.1145/3477314.3507092

7. Farhan, F. (2021). *Using Natural Language Processing to Analyse the Musical lyric Decency of Malaysia's Top Hit Songs*.

8. Foley, William, A (1997). *Anthropological Linguistics: An Introduction*; Blackwell Publishers.

9. Herrada, O. C. (2008). *Music Recommendation and Discovery in the Long Tail "Oscar TAIL" Oscar Celma Herrada*.

10. Imam Fahrur Rozi, Sholeh Hadi Pramoni, & Erfan Achmad Dahlan (2012). *Implementasi Opinion Mining (Analisis*
11. *Sentimen) untuk Ekstraksi Data Opini Publik pada Perguruan Tinggi*; Jurnal EECCIS, 6 (1), 37-43.

12. Kathleen Napier, Lior Shamir (2018). Quantitative Sentiment Analysis of Lyrics in Popular Music. *Journal of*
13. *Popular Music Studies* 4 December 2018; 30 (4): 161-176. Doi: https://doi.org/10.1525/jpms.2018.300411
14. https://s100.copyright.com/AppDispatchServlet#formTop

15. Komang Dian Permatajaya (2016). *A Semantic Study of Song Lyrics of Foster The People; Journal of Art and Humanities*;
16. https://ojs.unud.ac.id/index.php/sastra/article/view/17215

17. Lisangan, E. A. (2013). *Natural Language Processing Dalam Memperoleh Informasi Akademik Mahasiswa Universitas Atma*
18. *Jaya Makassar*.

19. Oktafianto, M. M. (2016). *Analisis dan Perancangan Sistem Informasi Menggunakan Model Terstruktur dan UML* (p. 59 of
20. 116); Andi; https://books.google.co.id/books?id=2SU3DgAAQBAJ&printsec=frontcover&hl=id&source=gb#v=onepage&q&f=false

21. Oudenne, Ashley M., Chasins, Sarah E. (2010). Identifying the Emotional Polarity of Song Lyrics Through
22. Natural Language Processing; https://www.readkong.com/page/identifying-the-emotional-polarity-of-song-lyrics-through-7179252

23. Reyhaanah Asya (2023). *Yuk Cari Tahu Penghasilan Seorang Kreator Konten di Media Sosial*

24. https://www.inilah.com/yuk-cari-tahu-penghasilan-seorang-kreator-konten-di-media-sosial

25. Riyanto (2005). *Migrasi Microsoft Sql Server Dengan Postgre Sql*; PT Elex Media Komputindo Kelompok Gramedia,
26. Anggota IKAPI; https://elibrary.bsi.ac.id/readbook/212000/migrasi-microsoft-sql-server-dengan-postgresql

27. Sari, L., & Sari Siregar, G. Yanti Kemala (2021). *Perancangan Aplikasi Pendataan Data Kepegawaian Negeri Sipil Pada*
28. *Dinas Komunikasi dan Informatika Kota Metro*; Jurnal Mahasiswa Ilmu Komputer, 2 (1), 115-135; https://doi.org/10.24127/.v2il.1235

29. Searle, John R. (1970). *Speech Acts: An Essay in the Philosophy of Language*; Cambridge at the University Press.

30. Ting, S. L., Ip, W. H., Tsang, A. H. C. (2022). *Is Naïve Bayes A Good Classifier for Document Classification?*;
31. International Journal of Software Engineering and Its Applications, 5 (3), 37-46.

32. Wikipedia, https://en.wikipedia.org/wiki/Stand_by_Me_(Ben_E._King_song)

33. Yabin, Z., Zhiyuan. L., Maosong, S. (2007). *Information Mining of Song Lyrics Based on Natural Language Processing*
34. *Techniques*.