Recognition of Eudaimonic and Hedonic Qualities from Song Lyrics

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Abstract

This work addresses the research question of how to use machine learning methods in order to develop a computational model which is able to predict the hedonic and eudaemonic qualities of songs from song lyrics. We conducted a survey on 1991 users (1904F, 87M) with an average age of 28 years (SD = 9 years), where we gathered demographics, big five personality test, eudaemonic and hedonic song tendencies, overall music sophistication and data for song classification. After that we gathered song lyrics by web scraping. Song lyrics were normalized, tokenized, lemmatized and stemmed, and a TF-IDF scored was assigned to each word in a song. The collected data was transformed into meaningful data and fed to machine learning models. We used classification and regression machine learning models. The classification models that were used are kNN, logistic regression, random forest, bagging, SVC and ridge, while the regressor models that were used are random forest and XGBoost. We created two models, one hedonic and one eudaemonic. The best models were achieved with bagging classifiers for both machine learning models, while the random forest regressor gave the best results out of the regressors. Our preliminary results indicate that there exists a connection between hedonia and eudaemonia and song lyrics, and that we can classify songs into highly hedonic or highly eudaemonic, with the created models. This study also showed that there exists a difference between eudaemonic and hedonic tendencies between genders, as well as that there exists a strong connection between emotions and eudaemonia.

Keywords

eudaimonia, hedonia, song lyrics, machine learning

1. Introduction

Music surrounds us - whether we listen to it in private or hear it at a shopping mall, while walking next to a coffee shop or even in an elevator - it is becoming almost an unavoidable aspect of our lives. In a study by Roberts D.F. et al., it was shown that some young people consider music as an element that defines their identity and their course through life [1]. The respondents of this study even went as far as to compare music to oxygen and water. Elif T.G. has shown in her research that the main reasons for listening to music are enjoyment, emotional mood, peer group, and family [2]. The study has also shown that the majority of the respondents listen to music between two to nine hours per day [2]. There have been many studies conducted on emotion recognition based on different combinations of data features,

Human-Computer Interaction Slovenia 2021, November 11, 2021, Koper, Slovenia

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such as the work done by Dan Yang [3], as well as some other works which were solely based on music lyrics [4]. Eudaemonia is based on a self-determination motivational concept of pursuing intrinsic values such as personal growth, relationships and health rather than extrinsic values such as wealth, popularity and power [5]. Hedonia and eudaemonia are juxtaposed as opposing perspectives on human wellness, with hedonia involving the seeking of happiness and life satisfaction, and reducing negative affect [6].

Music is often classified by the emotion it conveys, but what happens if we dig deeper and look further than just at the specific emotion a certain song gives. We have seen that eudaemonia and hedonia have shown to be useful for user modeling and recommendations, as shown by Tkalcic et al. [7]. In their study the results show that eudaimonic user profiling effectively divides users into pleasure-seekers and meaning-seekers. Therefore we can explore this idea further by looking for hedonic and eudaemonic qualities within songs by using song lyrics instead of movies. Eudaemonia equates happiness with the human ability to pursue personal and societal meaningful values, while hedonia equates happiness with pleasure, enjoyment and comfort [8].

Searching for hedonic and eudaemonic qualities within songs by human annotation would be time consuming. This is why a method for the automatic recognition should be devised. A model which will be able to take in the song lyrics and as an output give us a hedonic and eudaemonic quality of the given song. The main purpose of this study is to devise a model for the automatic recognition of the hedonic and eudaemonic qualities of songs from their lyrics. Therefore, the goal is to create a model which will be able to differentiate between eudaemonia and hedonia in song lyrics and as a result show us how eudaemonic or hedonic a certain song is. Here we present the preliminary results of our work up to now.

2. Related Work

2.1. Hedonism

There are many definitions of hedonism, such as: ”Pursuit of or devotion to pleasure, especially to the pleasures of the senses.”, or ”Pursuit of or devotion to pleasure, especially to the pleasures of the senses.”, or ”The definition of hedonism is the relentless pursuit of pleasure”. We can see that most of these definitions resolve around pleasure, and this is because the word Hedonism comes from the Attic-Greek word hedone, meaning simply “pleasure” [6]. Hedonism is a theory which states that pleasure and pain are the only factors in a human life [9]. There are many different kinds of hedonism, such as prudential hedonism [10], but mostly hedonism is represented as a pursuit to pleasure. Just like the other hedonistic values which resolve around the pursuit of pleasure and avoidance of pain, prudential hedonism also resolves around the idea that the only pleasure is good for us in itself and only pain is bad for us in itself [11].

Hedonism is the pursuit of pleasure and a sensual self-indulgence. In philosophy it is an ethical theory that states that pleasure is the highest good and proper aim of human life. There are many hedonic theories but most of them revolve around pleasure playing the main role in one’s life.

2.2. Eudaimonia

Eudaemonia is a Greek word which is most commonly translated as 'happiness'. Eudaemonia appears in aristotelianism and is described as a life of activity governed by reason. Eudaemonia is all about states and pursuits which are associated with developing the best in yourself. Eudaemonia is also a term which is used in religion, and it is mostly referred to as conception of what it means to be a better person.

Eudaemonia revolves around human flourishing or living well. It is an orientation towards a better good [6].

Hedonia and eudaemonia relate to different experiences, as described above. People that pursue both eudaemonia and hedonia, have a better picture of well-being compared to people that pursue one or another. Hedonia is related to carefreeness, positive affects and very low negative affects, while eudaemonia is related to meaning and elevation. Most people have both, eudaemonic and hedonic needs, but for the purpose of this study, we will be doing an oversimplification regarding separating people with hedonic tendencies and people with eudaemonic tendencies [6]. People that tend to have better eudaemonic tendencies, tend to seek for a deeper meaning in most of the things in their lives, while people with hedonic tendencies tend to seek pleasure and fun in life – without a deeper meaning included.
Based on the definitions of hedonism and eudaemonia we are going to propose a definition of eudaemonia and hedonism in song lyrics.
Songs that have a deeper meaning, or that make someone question everything on a deeper level are going to be categorized as eudaemonic songs.
Songs that don't have a deeper meaning, but are rather based on different pleasures, enjoying life, and not digging deep for a different meaning are going to be categorized as hedonic songs.

A current problem, that this work will be dealing with, is the lack of methods for automatic recognition of hedonic and eudaemonic qualities in songs. There have been many studies that dealt with music recognition from song lyrics before, as shown by Malheiro et al. [4], but none of them went as far as to explore the hedonic and eudaemonic qualities of song lyrics.

Recognition of music emotion has been going around for two decades. Music emotion can be extracted from songs in many ways, such as from song lyrics, speech audio signals [12] etc. In his phd thesis, Renato P. writes about emotion-based analysis and classification of audio music using audio signals, which explores the typical approaches of emotion recognition [13]. Most of the emotion recognition approaches start with a data set, usually composed of songs and emotion ratings collected from listeners. From here on, the data is processed by computational algorithms which extract and summarize the data characteristics. In her paper, Shamila N. writes about widely used feature selection and feature extraction techniques and their effectiveness when it comes to the performance of learning algorithms [14].

As mentioned, all of the work is focused on deriving emotion characteristics from songs through different channels. But what if we could try to derive and classify songs not only based on emotions, but on other factors as well. People have different pathways to happiness, and these pathways can be described as hedonia and eudaemonia, which are both important aspects of wellbeing [15]. Eudaemonia and hedonia have been shown to be useful for user modeling and recommendations. Tkalcic et al. have shown that there exists an eudaemonic user profiling which divides users into pleasure-seekers and meaning-seekers [7]. In their study,

they performed a characterization of users in terms of eudaimonic and hedonic preferences. Although, this profiling was used in movies, we believe it can also be transfered to songs.

3. Methodology

In order to devise a model which will be able to differentiate between eudaemonia and hedonism in song lyrics and tell us how eudaemonic or hedonic a certain song is, we need to collect song lyrics and the weighted eudaemonic/hedonic scores for each song. We are going to acquire the song lyrics by web scraping, and the weighted eudaemonic/hedonic scores by a survey, where respondents will answer questions about songs, and these questions will be transformed into hedonic and eudaemonic scores. In order to explore the topic further, we are going to be collecting some additional data as well.

For the purpose of this study, which is to create a model that will be able to do automatic recognition of hedonic and eudemonic qualities in songs, we need to choose songs that are going to give us meaningful information. To avoid bias and in fact collect songs that are going to be meaningful for this study, we ran a pre study with 17 respondents. Our sample consisted of 17 students, 16F and 1M, with an average age of 25 years (SD=4 years). The respondents were given definitions of eudaemonia and hedonism and were asked to give their favorite songs for each category. At the end of this pre study, we collected 100 songs for each category, respectively.

After the songs were collected, a second pre study test took place, where the collected songs from the first pre study were put in a list and the same respondents were asked to vote for the songs which they deem to fit the given category. For eudaemonia, they were given a list of 100 songs that were collected in the first pre study, and they were asked to choose the ones they think fit the eudaemonic category. The same process was done for the hedonic category of songs. After we collected responses from the respondents, we were left with a list of songs and a certain weight assigned to them. This weight is represented by a score, derived from respondents' votes. Since respondents were able to choose or not to choose a song for each of the two categories, the final score represents a percentage of how many respondents picked the song over the overall number of respondents included in the pre study. The songs that were deemed to fit the given category by the most respondents were the songs that were later included in the main study.

In order to create a machine learning model which will be able to recognize hedonic and eudaemonic qualities of songs from song lyrics, we need to obtain the song lyrics as well. The song lyrics were obtained using python and beautiful soup, regular expressions, and requests packages. We created our own model for obtaining song lyrics from the web. This model consists of a function which scrapes a website, taking the lyrics of a given song and saves the lyrics of that song to a dictionary.

The main study consisted of collecting data with a 7-part survey. The survey was collected using an 1ka platform, while the respondents were reached via social media platforms. Each part of the survey collected meaningful data which was used for further data analysis. The first five parts of the survey are used in order to model a relationship between respondents' personality traits, music sophistication and their eudaemonic and hedonic qualities, while the last two parts of the survey are used for modeling a machine learning algorithm.

We collected the following groups of data through the questionnaire:

- demographics
- music genre preferences
- Big-five personality
- Eudaimonic and Hedonic Music orientation
- Music Sophistication Index
- Song preferences
- Eudaimonic and Hedonic perceptions of songs

We cleaned the song lyrics by performing stopwords removal, tokenization, stemming and lemmatization and extracted TF-IDF features. For predicting eudaimonia and hedonia characteristics we evaluated several classifiers and regressors.

4. Results

4.1. Correlational Analysis

We first performed a correlational analysis among the groups of variables collected. Fig 1 shows the results.

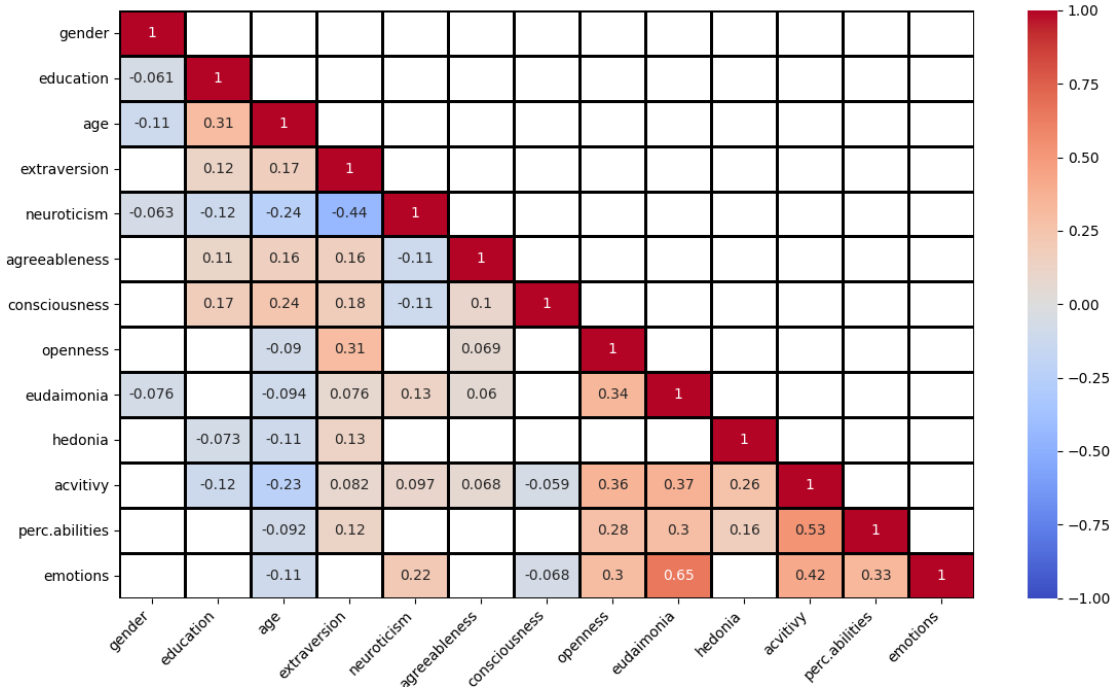

Figure 1: Correlational Analysis Results

4.2. Prediction

We performed two kinds of prediction: regression and classification. In classification we performed median splitting. The target variables to predict were eudaimonic and hedonic characteristics of songs. For regression, the baseline was the average value of the target variable in the train set while for classification it was the most popular class in the train set.

We are using a nested cross validation, with an outer loop splitting the data set into 5 folds, repeating it 4 times. The nested 5-fold cross validation works in a way that it splits the data set into 5 folds, and each time one fold is the test set, while the remainder of the data is the train set. Data are randomly split into 5 folds, and in each iteration we have a test set and a validation set. The model works in a way that it trains each proposed parameter set on the train data, evaluates it on the validation data and keeps track of the accuracy for classification models, and RMSE, MSE and MAE for regression. After looking at the average score for each set of the parameters, it chooses the best ones and trains a model based on that set of parameters.

We are also applying PCA on our data set. We are using a 70% for the number of components parameter.

The prediction results are reported in Tabs. 4.2 through 4.2.

MODEL	ACCURACY	STD
Random Forest	0.515	0.099
KNN	0.523	0.052
SVC	0.515	0.062
Logistic Regression	0.531	0.057
Ridge	0.531	0.045
Bagging	0.538	0.054
Baseline	0.423	0.069

Table 1
Eudaemonic machine learning model accuracy and standard deviation results for classifiers and the baseline

5. Discussion and Conclusion

The results presented here are still preliminary as we just started this line of research.

Comparing the results from our models and the baseline model results we can see that best classifiers from our eudaemonic and hedonic models perform better than the baseline. The best accuracy from the eudaemonic model is 0.54, with a standard deviation of 0.054, compared to the baseline model of 0.42, with a standard deviation of 0.069. This accuracy score comes from a Bagging classifier.

When it comes to the regressors, neither the hedonic nor eudaemonic regression model gives us satisfying results compared to the baseline model. The RMSE of the eudaemonic model is equal to 0.132, compared to the baseline of 0.132 we see no improvement in the performance. On another note, we see that the hedonic model performs slightly better than the baseline model with the RMSE score of 0.076 compared to the baseline model of 0.078.

MODEL	ACCURACY	STD
Random Forest	0.485	0.093
KNN	0.523	0.099
SVC	0.500	0.047
Logistic Regression	0.423	0.081
Ridge	0.485	0.105
Bagging	0.546	0.057
Baseline	0.408	0.031

Table 2
Hedonic machine learning model accuracy and standard deviation results for classifiers and the baseline

	SCORE	SCORE STD	BASELINE	BASELINE STD
MAE	0.115	0.011	0.115	0.010
MSE	0.018	0.003	0.018	0.002
RMSE	0.132	0.012	0.132	0.010

Table 3
Eudaemonic machine learning model MAE, MSE and RMSE results for regressors and the baseline

	SCORE	SCORE STD	BASELINE	BASELINE STD
MAE	0.064	0.010	0.064	0.007
MSE	0.006	0.002	0.006	0.002
RMSE	0.076	0.012	0.078	0.008

Table 4
Hedonic machine learning model MAE, MSE and RMSE results for regressors and the baseline

Some of the limitations that this study has come across are the number of female respondents and the number of male respondents. The difference is drastically huge with having 1904 female respondents and 87 male respondents. Since we have seen that there exists a difference between eudaemonic and hedonic tendencies between genders, this raises the question whether the eudaemonic and hedonic scores of songs would have changed if we had more of a balanced gender test group. Another limitation could possible be the way the study was conducted. This specific study was conducted by a survey on an online source, therefore the respondents were only able to see a certain part of lyrics (mainly the introduction and the chorus). It would be interesting to conduct this study in person where we can make sure that the respondent has understood the song lyrics more, therefore we might change the outcome results of hedonic and eudaemonic scores for each song. Another consideration for the future work is to add more songs in the study. While building models we came accross an issue of splitting the data into testing, validating and training sets with K-fold cross validation because of the small amount of songs included in the study.

Songs can be classified into hedonic and eudaemonic by human annotiation, but now we see that it can also be done by machine learning models. In this work we addressed a research question of how to use machine learning methods in order to develop a computational model

which will be able to predict the hedonic and eudaemonic qualities of songs from song lyrics. After collecting survey results from 1991 users (1904F, 87M) with an average age of 28 years (SD = 9 years), where we gathered demographics, big five personality test, eudaemonic and hedonic song tendencies, overall music sophistication and data for song classification, we successfully created a model which classifies songs into highly eudaemonic and highly hedonic, based on the features we extracted from song lyrics. Out of the two classification models, the hedonic model does not perform as well as the eudaemonic one, even though both models perform better than the baseline. On the other hand, the regression model created was not able to perform better than the baseline. The created classification models are able to classify songs with a higher accuracy than a baseline model, which opens new possibilities of modeling song user recommendation based on hedonia and eudaemonia with the application of given limitations to this study.

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