K Nearest Neighbor Algorithm for Feature Reinforcement and Music Genre Prediction in Mobile Applications: Comparison to Decision

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ABSTRACT

Aim: The research work aims to improve the accuracy of the classification of music into different genres using a K Nearest Neighbor algorithm with machine learning algorithms. **Materials and Methods:** The categorizing is performed by adopting a simple size of (N=10) in K Nearest Neighbor algorithm and sample size (N=10) in decision tree algorithm and G power (80%). **Results and Discussions:** The categorizing is performed by adopting a simple size of (N=10) in K Nearest Neighbor algorithm and sample size (N=10) in Novel Decision Tree algorithm and The G power was analyzed as (80%) with the independent sample T-Test ($p = 0.01$) value ($p=0.903$) with a 95% confidence level. Significance of Music Classification results can be used to support sociological and psychological research into how humans construct the notion of musical similarity and form musical groupings. The outcome of this study shows the KNN algorithm with (81.56%) performing better than the Decision tree algorithm with (71.99%). There exists a statistically insignificant difference between the two groups ($p=0.903$; $p>0.05$). **Conclusion:** Classification of music genre in advance using the K Nearest Neighbor algorithm appears to generate better accuracy than the decision tree algorithm.

Keywords: Music Genre, Novel K Nearest Neighbor, Decision Tree, Machine Learning, Dataset, GTZAN.

INTRODUCTION

Machine learning has become very popular in recent years. Depending on the type of application and the data set we used is GTZAN, certain types of machine learning techniques are more appropriate than others for different applications(Michalski, Carbonell, and Mitchell 1983)The main types of learning algorithms in machine learning. The main types of learning algorithms include supervised learning ,unsupervisedlearning,semi supervised learning and reinforced learning (Zhang 2010). Music is used for relaxation and entertainment. Music genre is a key feature of any song that can guide users to their preferred category Music Genre ("Musical Genre Classification of Audio Signals" n.d.). Since the application of apps such as Spotify, YouTube and many more, accessing various novel songs of our beloved artists has become a less tedious task (Liu et al. 2021).

Classification of music genres using different machine learning algorithms for over past years and several surveys and classification, prediction have

been published in the last couple of years over 1,600 articles from Google Scholar, 761 journals IEEE Xplore digital library, 975 research articles from ScienceDirect. Among all the articles and journals, the most cited paper is (Chen and Steven 2021). The model produced by the (Chen and Steven 2021) is very accurate and much more efficient compared to the other models. The classifier uses different algorithms to classify the music into different genres. Audio processing is one of the most complex tasks in data science as compared to image processing and other classification techniques.

(Bhavikatti et al. 2021; Karobari et al. 2021; Shanmugam et al. 2021; Sawant et al. 2021; Muthukrishnan 2021; Preethi et al. 2021; Karthigadevi et al. 2021; Bhanu Teja et al. 2021; Veerasimman et al. 2021; Baskar et al. 2021)

The goal of this research is to develop a machine learning model that can classify music samples into distinct genres in a more systematic manner. Its goal is to guess the genre based on an audio signal as input. The goal of automating music classification is to make song selection more efficient and less time-consuming. Music genre classification is one such application, which seeks to classify audio files into certain sound groups to which they belong.In every song is made by the artist who first composes the lyrics, then directs the song, chooses the instruments involved, the tempo, the drops and peaks and much more(“Musical Genre Classification of Audio Signals” n.d.; Silver, Lee, and Childress 2016). In order to classify genres to music with complex analogies just by the provision of a simple audio file requires more than just a simple function (L’Hoeste and Vila 2013). Another recent tendency is to consume music via streaming, raising the popularity of on-line radio stations that play similar novel songs based on a genre preference (Nakai, Koide-Majima, and Nishimoto 2022). In addition, browsing and searching by genre on the web and smart playlists generation choosing specific tunes among gigabytes of songs on personal portable audio players are important tasks that facilitate music mining.(Hao 2019). With the huge availability of digital music in online there is a need to organize the large music collections.

MATERIALS AND METHODS

The research work was performed in the Image Processing Lab, Department of Computer Science and Engineering, Saveetha School of Engineering, Saveetha Institute of Medical And Technical Sciences. Basically it is considered with two groups of classifiers namely K Nearest Neighbor algorithm and Decision Tree algorithms, which is used to classify music into different genres. The GTZAN dataset is used for Group 1 it is the K Nearest Neighbor algorithm with the sample size of 10 and Group 2 is the Decision Tree with sample size of 10 .

It was used to compare for a more accuracy score for choosing the best algorithm to classify music into different genres correctly. Sample size has been calculated and it is identified as standard deviation for K Nearest Neighbor algorithm = 1.09191 and Decision Tree = 0.98002 the G power is analyzed as (80%). The dataset used in the model for classification process has been collected from the Kaggle website. The dataset can be found as the GTZAN dataset created by the owner (George Tzanetakis). The

dataset contains different music files more than 1000 files of various genres.

K Nearest Neighbor algorithm

Novel K Nearest Neighbor algorithm is a simple algorithm that stores all the available cases and classifies the new data or case based on a similarity measure. It is mostly used to classifies a data point based on how its neighbours are classified. Novel K Nearest Neighbor algorithm works by finding the distances between a query and all the examples in the data, selecting the specified number examples (K) closest to the query, then votes for the most frequent label (in the case of classification) or averages the labels (in the case of regression).

Pseudocode for K Nearest Neighbor

Input
Step 1. The CSV file contains required attributes to predict music genre.
Step 2. Add the distance to the ordered collection
Step 3. Sort the ordered collections in ascending order.
Step 4. Pick up the K entries from the sorted collections.
Step 5. Get the labels for the entries.
Step 6. Get the mean of the K-labels for prediction

Decision Tree

Novel Decision Tree is a Supervised learning technique that can be used for both classification and Regression problems, but mostly it is preferred for solving Classification problems. It is a tree-structured classifier, where internal nodes represent the features of a dataset, branches represent the decision rules and each leaf node represents the outcome.Decision Trees are a type of Supervised Machine Learning where the data is continuously split according to a certain parameter. The tree can be explained by two entities, namely decision nodes and leaves.In a Decision tree, there are two nodes, which are the Decision Node and Leaf Node. Decision nodes are used to make any decision and have multiple branches, whereas Leaf nodes are the output of those decisions and do not contain any further branches.

Pseudocode of Decision Tree

Input: CSV file containing required attributes.
Step 1. Start at the root node.
Step 2. Convert ordered variable X, convert it to an unordered variable X by grouping values in nodes into small numbers of intervals.
Step 3. Perform a test of independence of each X variable vs Y on data.
Step 4. Choose variable X* associated with X that has the smallest significance probability.
Step 5. Find a split set that minimizes the sum of Ginni indexes and uses it to split nodes into two nodes.
Step 6. If a stopping criterion is reached, exit.

The hardware configuration was an Intel Core i5 processor with a RAM size of 8GB. The system type used was a 64bit OS, X64 based processor with a 1TB HDD. The software configuration was an operating system that used Windows 10 and the tool used for implementation was a

jupyter notebook with python programming language.

Statistical Analysis

In SPSS, the datasets are prepared using N=10 as the sample size for K Nearest Neighbor and Decision Tree and the G power analyzed to be (80%). GroupID is given as a Groups, Accuracy, and Loss is given as the testing variable. GroupID is given as group 1 for K Nearest Neighbor and group 2 for Decision Tree. The independent value is the audio files of music and wav files of music. The dependent variables are accuracy and precision. Group Statistics is applied for the Statistical Package for the Social Sciences (SPSS) dataset.

RESULTS

For this research we used GTZAN dataset to train models.The GTZAN dataset trained more than 1000 music files and audio files on specific labels are being tested every time. The categorizing is performed by adopting a simple size of (N=10) in K Nearest Neighbor algorithm and sample size (N=10) in Novel Decision Tree algorithm and the G power was analyzed as (80%) , the significant value is p=(0.903).

Table 1, represents the data collected by running the GTZAN dataset with the machine learning algorithms Novel K Nearest Neighbor algorithm and Novel Decision Tree of accuracy are 82.56% and 71.99%. The Data Size represents the number of records or tracks represented in each sample size of Data.

Table 2, represents a comparison of the accuracy of the Novel K Nearest Neighbor algorithm and the Decision Tree algorithm. The Novel K Nearest Neighbor algorithm had the highest mean accuracy (81.29%) and the Novel Decision Tree had the lowest accuracy (70.63%).

Table 3, represents the Independent Sample Test of Accuracy and Loss (Calculate P-value = 0.005 and Significant value = 0.903, Mean Difference = 10.6100. The K Nearest Neighbor and Decision Tree are significantly different from each other. There exists a statistically insignificant difference between the two groups ($p=0.903$; $p>0.05$).The processing is done for converting the raw data into understandable data. The independent sample test of 10 samples was performed, Compared to other algorithm performance, the Novel K Nearest Neighbor algorithm performed better than the Novel Decision Tree in Table 3.

Figure 1, represents the results are used as input into the statistical analysis tool and the graph is plotted using the values.A number of packages such as keras, numpy, pandas were used to build the model. Experiment is done on the google colab platform. This research work provides the details of an application which performs Music Genre Classification using Machine Learning techniques (Lidy and Rauber, n.d.).

DISCUSSION

The categorizing is performed by adopting a simple size of (N=10) in K Nearest Neighbor algorithm and sample size (N=10) in decision tree algorithm and G power (80%) , the significant value is (p=0.903).

The novel dataset has been widely used in many studies with the aim of music genre classification. It was collected and proposed by Tzanetakis. Audio seems to be a better source of features for genre classification, as it obtains a higher performance over visual features. The

aggregation of all features is able to combine the ability of each feature vector and obtain the best results in all classes ("Musical Genre Classification of Audio Signals" n.d.).

In this research work we used two different Machine Learning Algorithms to classify different kinds of genre in music. Every experiment was run 10 times with the GTZAN dataset and mean and standard deviation of the results are reported in Table 2. The best performance in terms of all values is observed for the K Nearest Neighbor algorithm to predict the music genre with an accuracy level of 82.56%, Whereas the Decision tree recorded an accuracy level of 71.99% which is quite lower than the K Nearest Neighbor algorithm. here exists a statistically insignificant difference between the two groups ($p=0.903$; $p>0.05$). It was expected that the fine tuning setting, which additionally allows the Decision Tree to be trainable, would enhance the Decision Tree when compared to the K Nearest Neighbor.

To support this work, To aid users, genre classification will continue to be utilized to visually and conceptually organize objects or information.Genre classification, in addition to effectively finding and retrieving information, develops conceptual relationships between distinct items, which can be utilized to improve browsing functionality and developed further into customized retrieval or marketing tools.Genres reveal the goals of document creation and use, allowing for targeted information retrieval based on criteria other than topical relevance. For this project, the dataset that we will be working with is GTZAN Genre Classification dataset which consists of 1,000 audio tracks, each 30 seconds long. It contains 10 genres, each represented by 100 tracks. A visual representation for each audio file (Bağcı 2005). One way to classify data is through nearest neghibours because NN's usually take in some sort of image representation. In current research, the feature extraction is made out from .wav audio files are pitch related features. In future work, the system incorporate different sets of features like intensity, rhythm which could improve accuracy (Samson 2001).

To oppose this work, unfortunately, both people and computers find it challenging to consistently identify musical genres. This highlights two of the most significant issues with genre classification.The first is deciding which musical qualities to include for classification, and the second is figuring out how to create a taxonomy for recording classification.

CONCLUSION

The Datasets used to train the models are novel datasets.In this work, the task of music genre classification is studied using the Audioset data. The current study focused on Music Genre classification using two Machine Learning Algorithms, K Nearest Neighbor over Decision Tree. It can be slightly improved based on high trained datasets. The outcome of the K Nearest Neighbor (82.56%) has better accuracy than the Decision Tree (71.99%). The extension of this work would be to consider bigger data sets and also tracks in different formats. Also, with time the style represented by each genre will continue to change.

DECLARATIONS

Conflict of Interests

No conflict of interest

Authors Contribution

Author KB was involved in data collection, data analysis, manuscript writing. Author PP was involved in the Action process, Data verification and validation, and Critical review of manuscript.

Acknowledgments

The authors would like to express their gratitude towards Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences (Formerly known as Saveetha University) for providing the necessary infrastructure to carry out this research work successfully.

Funding: We thank the following organization for providing financial support that enabled us to complete the study.

1. SNEW.AI Technologies, Chennai.
2. Saveetha University.
3. Saveetha Institute of Medical and Technical Sciences.
4. Saveetha School of Engineering.

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TABLES AND FIGURES

Table 1 Data collection from the N=10 samples of the dataset for K Nearest Neighbor Regression with gain accuracy (82.56%) and Decision Tree to gain accuracy (71.99%).

Sample (N)	**Data Size**	**Accuracy(%)**	
		K Nearest Neighbor	**Decision Tree**
1	756	82.56	71.99
2	725	82.1	71.96
3	702	81.99	71.63
4	698	81.96	70.89
5	696	81.87	70.85
6	693	81.63	70.21
7	689	81.01	70.12
8	689	80.85	69.89
9	688	79.8	69.53
10	665	79.15	69.32

Table 2. Comparison of Mean, Standard Deviation and Standard Error Mean of K Nearest Neighbor and Decision Tree. The K Nearest Neighbor had the highest Mean accuracy (81.29 %). The Decision Tree had the lowest Mean accuracy (70.63 %). The K Nearest Neighbor had the Standard Deviation of 1.09191 and Standard Error Mean of .34529. We compare that with the Decision Tree where it had the Standard Deviation of 0.98002 and Standard Mean Error of 0.30991

	Group	**N**	**Mean**	**Std. Deviation**	**Std.Error Mean**
Accuracy	**K Nearest Neighbor**	10	81.29	1.09191	0.34529
	Decision Tree	10	70.63	0.98002	0.30991

Table 3. Independent Samples T-test Result is applied for dataset applied for the dataset fixing confidence interval as 95% and level of significance, which shows K Nearest Neighbor outperforms the Decision Tree. There exists a statistically insignificant difference between the two groups (p=0.903; p>0.05).

	Levene's Test for Equality of variances	**T-test for Equality of Means**	**95% confidence interval of the**

									Difference	
		F	Sig	t	df	Sig (2-tailed)	Mean Difference	Std.Error Difference	Lower	Upper
Accuracy	Equal Variances assumed	0.15	0.903	22.872	18	0.028	10.61200	0.46397	9.63723	11.58677
	Equal Variances not assumed			22.872	17.794	0.028	10.61200	0.46397	9.63642	11.58758

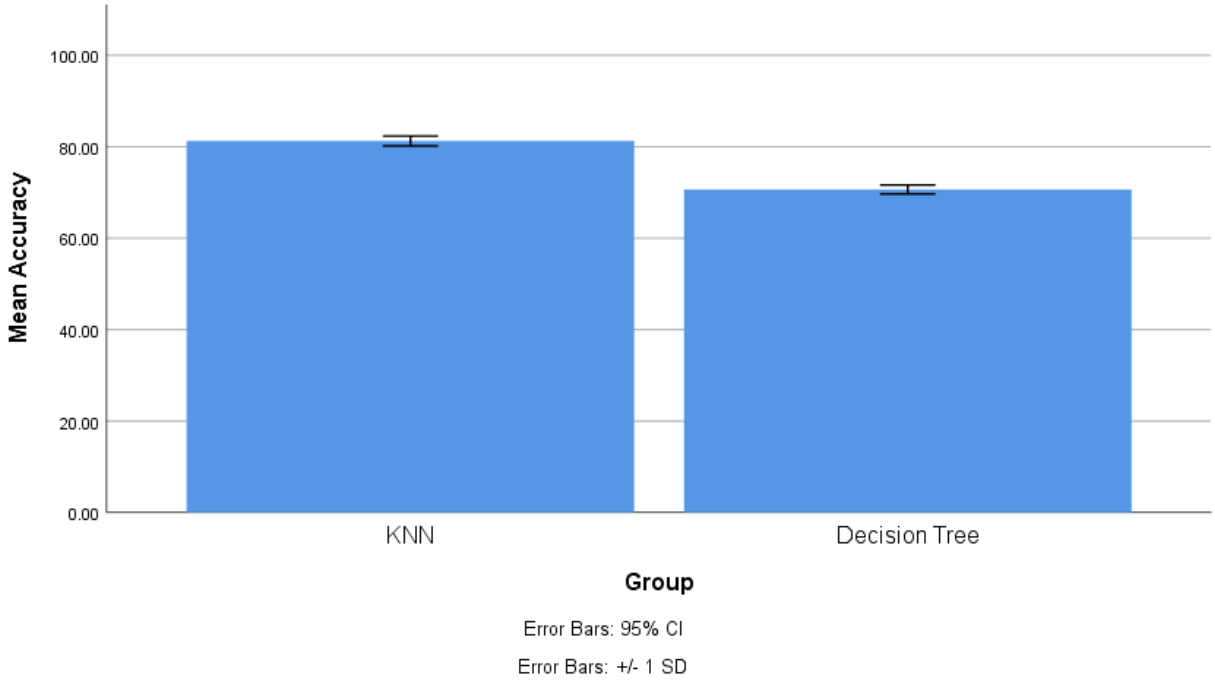

Fig. 1. Comparison of K Nearest Neighbor over Decision Tree in terms of mean accuracy of 81.29 and 70.63. It explores that the mean accuracy is slightly better than Decision Tree and the standard deviation is moderately improved compared to Decision Tree. Graphical representation of the bar graph is plotted using group id as X-axis K Nearest Neighbor vs Decision Tree, Y-axis displaying the error bars with a mean accuracy detection +/- 1 SD.