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COMPARISON OF K-NN AND SVM CLASSIFIER FOR MUSIC GENRE CLASSIFICATION

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Abstract: Recommendation of music is one of the predominant things, like streaming platforms of music. Music genres are the frames used to catalogue music files. Most of the music classification is initiated by the extraction of the audio features which calls for computing processes. This scrutiny aims the analysis and tests the performance of the classification of music genre based on the functionality of two different classifiers, such as Support Vector Machine (SVM) and K Nearest Neighbors (K-NN). The music dataset of Spotify was chosen as it had the functionality of each of its musical genres. The results correspond to the audio feature extraction, hence the classification with the extortion of functionality features can be developed more if the functionality in the dataset is managed well.

Keywords: Music Genre, K-NN, Support Vector Machine, Audio Features

INTRODUCTION

Music is a means of communication for humans. Music is playing an important role in many human activities like celebrations, healing, worship and preserving their stories. The foundational characteristics of the tones produced are pitch, timbre and loudness. Music genre classification aims to categorise audio files into specific sound categories to which they belong. To organize and search music collections, machine learning approaches are used to extract useful information from the music such as genre, mood, and style. The application is critical and requires automation to reduce manual error and time because manually classifying music requires listening to each file for the entire duration. Genre classification has become a common distinguishing factor for music. This paper involves a comparison between the two

machine learning approaches used in music genre classification i.e., K Nearest Neighbors (KNN) and Support Vector Machine (SVM), from these approaches the music can be classified from the audio signal and thus reducing the search time for music within large music databases that has been booming in the digital platform. With the help of signal processing techniques, music features can be extracted. Many functionality feature sets have been approved to represent different genres. Mel-frequency Cepstrum Coefficients (MFCC) are used as functionality features related to tone. MFCC are cepstral characteristics acquired on a twisted frequency scale equable to human auditory perception. MFCC feature extraction includes various steps such as pre-emphasis, frame blocking and windowing, DFT spectrum, Mel spectrum, Discrete Cosine Transform (DCT), and Dynamic MFCC features. KNN is a machine learning algorithm that is used for classification and regression. It is also referred to as the lazy learner algorithm. It simply employs a distance-based method to determine the K number of similar neighbors to new data and the class in which the majority of neighbors reside, resulting in that class as an output. SVM comes under supervised learning models used for the analysis of classification and regression methods. The purpose of SVM is to discover a hyperplane in N-dimensional space (N- feature number) that catalogues the data points.

RELATED RESEARCH

Audio processing is one of the hardest tasks in data science. Tzanetakis and cook researched and created a breakthrough in audio feature extraction and created the GTZAN dataset as a norm for genre classification.

[1] De Rosal Ignatius Moses Setiadi has shown for music genre classification based on metadata, the accuracy is comparable to that of audio feature extraction; however, metadata records must be complete and correct, which is quite possible on a professional music streaming platform. Aside from that, the logic of the classification based on the metadata feature is relatively faster than the extraction of audio features because it does not necessitate a lengthy conversion process.

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[2] Nilesh M.Patil have illustrated an automated system for music genre classification. Chroma features, ZCR, MFCC features, spectral roll-off, and spectral centroid are employed as the feature vectors and trained in the system using three classifiers like linear and polynomial kernel SVMs, K-Nearest Neighbor. Also, analyzed the mean accuracy, mean recall and mean precision of them.
[3] S Prabhavathy has depicted to classify musical instruments, an automatic classification system based on SVM and KNN has been proposed, in which MFCC, Sonogram, and their combinations are calculated as features. The music is classified based on the genre using a machine learning approach i.e., MFCC and Sonogram with KNN, MFCC and Sonogram with SVM their results are contrasted.

PROPOSED SYSTEM

There are different machine learning approaches for classifying music genres such as,

- Multiclass support vector machine
- K-means clustering algorithm
- Convolutional neural network
- K-Nearest neighbor

The techniques we have used here is Support Vector Machine (SVM) and K-nearest neighbor (K-NN).

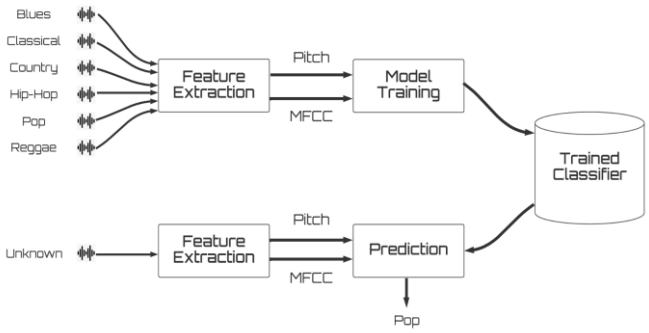

Fig 1. Block diagram of proposed system

The proposed system includes the following steps namely,
1. Data accession and selection: The GTZAN data set, which is used here, contains 1000 music records. Each dataset is 30 seconds in length. The dataset contains six classifications, each with 50 tracks.
2. Pre-processing: After the first stage, training and testing data are being distributed,80% - training data and 20% - testing data.
3. Feature extraction and selection: Extraction of the feature includes recognising audio segment signals that are used to differentiate linguistic content and cast out the wide range of stuff that deliver data like emotion, noise in the background etc.
4. Classification using each classifier: The data undergo a training process hence features are selected accordingly, and later the testing process is done.
5. Evaluation process: The testing process on each trained data is done to find the accuracy of each classifier used.

IMPLEMENTATION

The advent of large music collections has represented a test of how to recover, browse, and recommend the items contained within them. Keeping label explanations of all music resources is one approach to facilitating access to vast music classification. Labels can be manually or automatically added. However, because manual labels require a significant amount of human effort, automatic labelling is more cost-effective. To address this issue, we used the GTZAN dataset to compare KNN and SVM classifiers for genre classification. We discovered that the k-NN classifier produced more accurate results than the SVM classifier.

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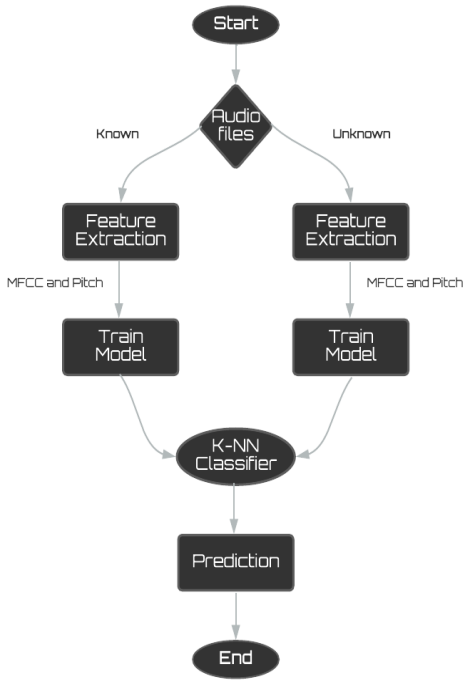

Fig 2. Block diaDiagram of Workflow

Classification of the genre is used to separate features from the music records. It includes differentiation of linguistic content and casting out the wide range of stuff that delivers data like emotion, noise in the background etc. MFCC extracted features and pitch are removed from the music record. These extracted features are used to train classifiers such as SVM and K-NN. This trained classifier predicts which genre the particular music dataset belongs to.

MFCC- MEL FREQUENCY CEPSTRAL COEFFICIENTS

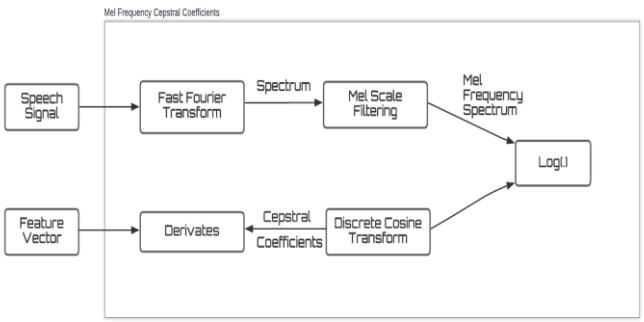

Fig 3. Block diagram of MFCC

- Signal partitioning is done into short frames to maintain signal consistency. Many frequencies are tried to be presented in a single frame.
- Power spectra are pushed into the Mel filter and the energy is assembled. With this energy, energy at the diverse frequency region is assembled.
- Mel scale equation:

  M (f) = 1125ln (1+f/700)
- The logarithm of the filter bank is calculated so that desired frequency can be heard closely.
- And the DCT is calculated to relate filter energies with one another.

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K-NEAREST NEIGHBOR ALGORITHM (K-NN)

The KNN algorithm, one of the most basic ML techniques, interprets data in such a way that when new data is fed into the machine, it automatically recognises and categorises it based on feature similarity. The K-NN algorithm can be used for both regression and classification, but it is most commonly used for classification problems. There are two properties to define KNN-

1. Lazy learning algorithm: It does not immediately learn from the training set; instead, it stores the dataset and acts on it during classification.
2. Non-parametric learning algorithm: It does not conclude about the underlying data. KNN, a nonparametric learning algorithm makes no assumptions about the hidden data.

WORKING OF K-NN

K-Nearest Neighbor is a machine learning algorithm which deduces the resemblance between the existing data and new data and put the new data into the most similar category from the available category. The K-NN algorithm stores all available data and uses similarity to classify new data points. This means that when new data is generated, it can be quickly classified into a well-suited category using the K- NN algorithm. We require a dataset to run any algorithm. As a result, we should stack the training data similarly to the test data at the initial stage of KNN. The value of K, or the nearest data points, must then be determined. Any integer can be used as K. Using Euclidean distance, calculate the distance between test data and each row of training data. Euclidean distance is calculated.

$$d(p,q) = \sqrt{\sum_{i=1}^{n}(qi - pi)^2}$$

Sort them in ascending order depending on the distance value. The top K rows of the arranged array will then be selected. It will now assign a class to the test point based on the most common class of these rows.

SUPPORT VECTOR MACHINE (SVM)

Support vector machines are a machine learning technique based on the notion of structural risk minimization. In the field of pattern recognition, it has several uses. SVM creates a linear model based on support vectors to estimate the decision function. If the training data are linearly separable, SVM finds the best hyperplane that separates the data without error. The support vectors are training patterns that are both close to the hyperplane of separation. The most challenging patterns to categorise are the support vectors, which are the training samples that define the ideal hyperplane. SVM is used for classification and regression. It can handle the linear and non-linear subjects and function accordingly. This algorithm makes the hyperplane distribute data into classes. The SVM algorithm's goal is to establish the decision boundary that divides n-dimensional space into classes and places fresh data points in the appropriate category. This boundary is a so-called hyperplane. The support vector machine chooses a vector that helps in the formation of the hyperplane. These are called support vectors. Hence the algorithm is called a Support Vector Machine (SVM).

RESULT

The performance and efficiency of the system can be measured using metrics like precision, recall, and accuracy. The number of correctly classified data instances divided by the total number of data instances is referred to as accuracy. Precision is the ratio of the number of correct results to the predicted results. More the precision value greater the efficiency of the classification. SVM handles outliers better than KNN. When the training data is much larger than the number of features (m>>n), KNN outperforms SVM. However, when there are many features and less training data, SVM outperforms KNN. SVM failed in classifying blues, and reggae and falsely classified them as metal. In the case of KNN, it underpredicts hip-hop, pop, reggae, and disco but outperforms in country and jazz. The accuracy of classification varied between the KNN and SVM machine learning techniques and genres. However, SVM proved to be more efficient, with an accuracy of 79% and a precision of 77%.

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Genre	k-NN classifier	SVM
	precision	precision
Blues	0.70	0.60
Classical	0.70	0.80
Country	0.90	0.80
Disco	0.50	0.80
Hip-Hop	0.40	0.80
Jazz	0.80	0.80
Metal	1.00	1.00
Pop	0.40	0.80
Reggae	0.40	0.60
Rock	0.65	0.76
Accuracy	0.70	0.79

Fig 4. Efficiency table

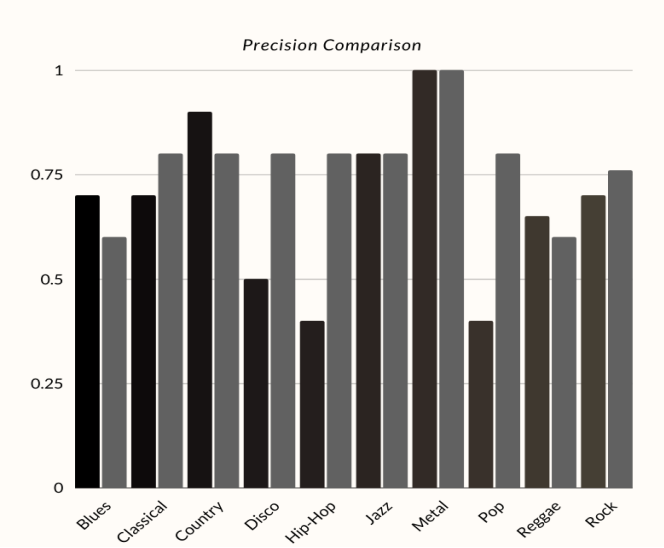

Fig 5. Genre precision graphical representation

Black-KNN
Grey-SVM

CONCLUSION

In this research, we offer an approach for automatically extracting musical elements from audio files and classifying them by genre. We have extraction and selection processes, as well as a categorization procedure. SVM is an easy-to-implement supervised learning classifier. We discovered that the SVM classifier produced more accurate results than the K-NN classifier. Overall, SVM is a more successful classifier, with a 79 per cent accuracy rate for music genre classification.

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