# Using SVM (Support vector machine) and KNN (k-nearest neighbors algorithm) Classifier Performing Analysis on a Six Class Audio Data Set

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# CERTIFICATE

This is to certify that the project entitled "Using SVM (Support vector machine) and KNN (k-nearest neighbors algorithm) Classifier Performing Analysis on a Six Class Audio Data Set" is the result of my reserch work at the deprtment of ISE. I certify that no part of this work is either copied or submitted else where.

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# Chapter 1

# INTRODUCTION

With the growth of online music databases and easy access to music content, people nd it in-creasing hard to manage the songs that they listen to. One way to categorize and organize song sis based on the genre, which is identied by some characteristics of the music such as rhythmic structure, harmonic content and instrumentation Being able to automatically classify and provide tags to the music present in a user's library, based on genre,would be benecial for audio streaming services such as Spotify and iTunes. This study explores the application of machine learning (ML) algorithms to identify and classify the genre of a given audio le.

Musical instrument classification is very important task for musical information retrieval system. As a domain of musical instrument is becomes very wide. Musical instruments have different characteristics including their physical aspects. The task of classifying musical instruments is very complex and many problems remain unsolved. For instance, few attempts have been made on a musical content which involve more than one musical instrument playing at a time. The human ability to distinguish between musical instruments from large data has been a subject of investigation for a number of years

Automatic musical instrument recognition is a crucial sub task to solving problems in structured coding, automatic musical signal annotation, and musicians' tools and also provide useful information in other sound source recognition areas, such as speaker recognition

A grouping of several different but related sizes or types of instruments forms the family of musical instruments.musical instrument classification system, are based on a hierarchy of instrument families and family relationships are not always clear-cut. A brass instrument (trumpet) is a musical instrument which produces sound by of air in a tubular resonator in sympathy with the vibration of the player's lips. There are several factors involved in producing different pitches on a brass instruments. Slides, valves or keys are used to change vibratory length of tubing, string instruments (Viola,Cello) are musical instruments that produce sound from vibrating strings when the performer plays or sounds the strings in some manner. Aerophones (Flute,Oboe,Sax) are a family of instruments that use a vibrating column of air to produce sound

Classification of musical instruments has many problems due to Multidimensional nature of musical instruments i.e. one instrument can belong to more than one instrument family

This system is designed to solve the problems in musical instrument classification by using the SVM(Support Vector Machine), KNN (k-nearest neighbors algorithm) classifiers. Formal Concept Analysis is applied to represent the relationship between musical instruments

This system has divided into three parts I) Creation of data set II) Classification of musical instrument i) Using SVM ii) Using KNN iii) Printing the Confusion Matrix III) Analysis of result.

As we know classification of musical instruments is challenging task, so the proposed system is designed to make it easier by using classifiers. First the input is given to the system which is audio file then it processed for extracting the output which is name of musical instrument. Then it uses the SVM, KNN classifier. Each classifier is trained and tested for best result

In support vector machine, first the classes of musical instruments is created, each class contains the musical instrument with their attributes. Each class is separated by maximizing the margin between classes. SVM is trained for the musical instruments and tested across the data set. k-NN is a type of instance-based learning, or lazy learning, where the function is only approximated locally and all computation is deferred until classification.Both for classification and regression, a useful technique can be to assign weights to the contributions of the neighbors, so that the nearer neighbors contribute more to the average than the more distant ones

## 1.1 Existing approaches/methods (Literature survey)

In this section we includes some of the recent contribution in the area of Musical Instrument Classification.. Many researchers use the different classifiers to solve the problems in musical instrument classification algorithms for the development of suitable intrusion detection system. So here we are discussing some of them which is based on neural network concepts.

Sefki Kolozali, Mathieu Barthet, Gyorgy Fazekas, Mark Sandler et.al. presents preliminary work on ontology designing for musical instruments. This paper also provides the investigation of heterogeneity and limitations in existing instrument classication schemes. In this paper author implemented two instrument taxonomies

Slim ESSID, Gael RICHARD and Bertrand DAVID have proposed study on the use of hierarchical taxonomies for musical instrument recognition on solo recordings. Both a natural taxonomy (inspired by instrument families) and a taxonomy inferred automatically by means of hierarchical clustering are used to build a hierarchical classication scheme based on Support Vector Machine classiers and an efcient selection of features from a wide set of candidate descriptors. The classication results of each taxonomy are compared and analyzed

In Lidy and Rauber (2005), the authors dis-cuss the contribution of psycho-acoustic features-for recognizing music genre, especially the impor-tance of STFT taken on the Bark Scale (Zwickerand Fastl,1999). Mel-frequency cepstral coef-cients (MFCCs), spectral contrast and spectralroll-off were some of the features used by (Tzane-takis and Cook,2002). A combination of visualand acoustic features are used to train SVM andAdaBoost classiers in Nanni et al. (2016)

Keith D. Martin and Youngmoo E. Kim present musical instrument identification: A pattern-recognition approach. In this paper they applied statistical pattern-recognition technique to the classification of musical instrument tones within a taxonomic hierarchy. They uses data set which included examples from the string , woodwind, and brass families. Their experiments simulating results shows that fisher projection method resulted in successful classifiers at all levels of the taxonomy

## 1.2 PROBLEM STATEMENT

This is basically an 6 class problem where we are trying to apply SVM and kNN on the audio data set the audio data set we get is from an open source website gives access to AUDIO data set which is a collection of 600 audio tracks each 30 seconds long. There are 6 genres represented, each containing 100 tracks. All the audio files in .mp4 format. We first convert the audio from .mp4 format to .wav format so as to make it compatible to Python‘s wave module for reading audio files. For this conversion we use the open source Audacity which helps us to convert the mp4 format audio into .wav. To classify our audio clips we begin by calculating the MFCC features with that MFCC features we generate the feature vector

## 1.3 ALGORITHM STUDY

Interest in musical instrument classification is increased in few years. In this domain number of different algorithms and techniques are used. From these of some technique's we used some algorithms and techniques for this system development. These are as follows :

A. The KNN algorithm is among the simplest of all machine learning algorithms. KNN classifier is a type of instance based learning technique and predicts the class of a new test data based on the closest training examples in the feature space. KNN is a variable-bandwidth, kernel density estimator with a uniform kernel.KNN is a type of instance-based learning, or lazy learning, where the function is only approximated locally and all computation is deferred until classification.Both for classification and regression, a useful technique can be to assign weights to the contributions of the neighbors, so that the nearer neighbors contribute more to the average than the more distant ones. For example, a common weighting scheme consists in giving each neighbor a weight of 1/d, where d is the distance to the neighbor.

B. Support Vector Machine SVM is strong classification algorithm due to the simple in structure and it requires less number of features. Support vector machine is supervised learning technique for classification and regression. SVM currently considered the most efficient family of algorithm in domain of machine learning .Support vector machine is trained with data set of musical instrument. During the training of SVM feature extractor unit converts each input value to feature set and these feature sets capture basic information about each input. And these sets are used for classify the feature unit

# Chapter 2

# METHODOLOGY

Automatic music classification is an area of research that have been received a great deal of attention in now a days because it is very difficult for human and computers to categories the music. There are very rarely, precise, clear and consistent heuristics in delineating the musical qualities and characteristics of each category. It is very difficult to defining and implementing measurement of musical similarity

It is important to build computer systems to classify instruments because many of the internet search sites, for example AltaVista, Lycos, are evolving from purely textual indexing to multimedia indexing. It is estimated that there are approximately thirty million multimedia files on the internet with no effective method for searching their audio content.

The aim of this is to classify the musical instruments automatically. The given system is designed around the classifiers namely Support Vector Machine,K-Nearest Neighbors algorithm and result is evaluated for each classifiers. The goal of system is as follow:

- Musical instrument classification.
- Analysis of system using SVM, KNN classifiers.

## 2.1 SYSTEM DESIGN

System design is shown in fig. 1 which contain the input, data set formulation, formal concept analysis, application of classifiers, result analysis for each classifier

### 2.1.1 Input Unit

Input which given to the system is the audio file. first audio file is submitted to the system to identify the musical instrument i.e. output of system.

### 2.1.2 Data set formulation

Data set formulation unit designed to perform the task to check the input and store it into data set with their appropriate attributes. This unit is designed to choose correct class label for a given data input. For example if input given to the system is 'piano' then it store it with attributes 'Vibrating string' and 'Sound initiation process: Struck. Data set contained the value records of musical instruments with their attributes.

### 2.1.3 Selection of Classifier

Then the classifier is selected for the training. Training is performed using the data set which contains the musical instruments with their attributes. System process the audio file and returns the returns the appropriate name of musical instrument using java MIDI library. Selected classifier is trained from the data set. classifiers extracted the features from the data set which includes the instruments and their attributes.It uses LibKNN inbuilt library function for KNN. For the SVM, model of SVM is created from the LibSVM. Required parameter are selected to create the SVM. It uses the RBF kernel with three degree.

### 2.1.4 Application of classifiers

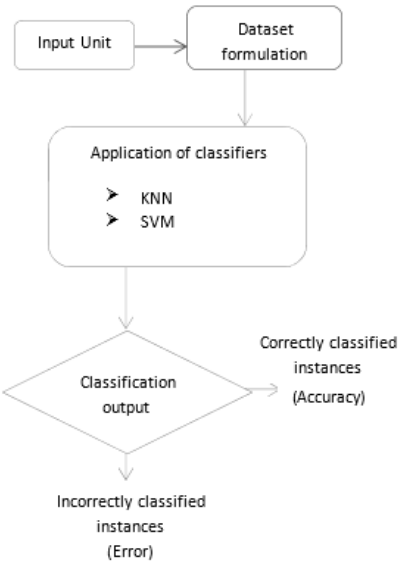
Upon the dataset formulation classifiers are applied. Each classifier is trained and tested across this dataset.

### 2.1.5 Classification output

Output of the system is the name of musical instruments for the audio file. Classification output shows the classification result of each classifier which is used to find out best classifier that improves the system performance. Classification output is in the form of correctly classified instances out of total instances, which gives the accuracy of system and incorrectly classified instances which shows error of system. After finding the classification output for Two classifier analysis is across their result

## 2.2 BLOCK DIAGRAM

Figure 1. shows the flow of execution of developed system in which we give the input to the system i.e. audio file which is processed by system and returns the name of musical instrument as output. Data set is created by system automatically. One of the classifier is selected from three classifier and they are trained and tested separately. These classifier returns the correctly classified instances and incorrectly classified instances which decides the accuracy ad error of classifiers. Each classifier shows the correct result for given input audio file and returns the name of musical instrument as output.




(72).png

**Figure 2.1:** Block Diagram

# Chapter 3

# EXPERIMENTAL RESULT

Experiment is performed by using three classifiers. SVM, KNN classifiers are trained and tested with these data set. The experimental result is calculated for each classifier on data set.

We did the experiment by using training and testing phase of classifier on dataset . We got the results in terms of precision, recall, accuracy, error. Accuracy defines the correctly classified instances

$$Accuracy = \frac{Correctly\ classified\ instances}{total\ instances}$$

(69).png

**Figure 3.1:** Formula for accuracy calculation

$$Error = \frac{Incorrectly\ classified\ instances}{total\ instances}$$

(70).png

**Figure 3.2:** Formula for Erroc calculation

**Figure 3.3**

**Figure 3.4**

**Figure 3.5**

**Figure 3.6**

**Figure 3.7**

# Chapter 4

# CONCLUSION AND FUTURE WORK

## 4.1 CONCLUSION

We are designed and implemented musical instrument classification to overcome the problem in existing classification technique using two classification techniques. First classification is based on KNN Classification ,second classification is based upon support vector machine. By observing the experimental results we found that support vector machine classification gives more accuracy and less error rate than other classifier's.

## 4.2 FUTURE WORK

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# REFERENCES