

A Review on Music Genre Classification Methods

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ABSTRACT

Music has become an important part in our life. We have an always evolving music industry, producing various songs each day. This study delves into the realm of music genre classification using machine learning techniques, acknowledging the pivotal role music plays in providing relief, entertainment, and emotional expression. The proliferation of music streaming services necessitates accurate classification models, leading to an exploration of various methodologies. The literature survey reviews notable research, highlighting the efficacy of Convolutional Neural Networks (CNNs), deep learning techniques, and Transfer Learning in achieving high classification accuracy.

Keywords: Convolutional Neural Networks, Music Streaming Services, Transfer Learning, Deep Learning

I. INTRODUCTION

These days it is very evident that music has become a mode of relief to almost everyone. Music is used as a therapy, while some use it for entertaining, and some use it to express their feelings and so it can go on. With the fast moving and evolving world, we have an evolving music industry where there are millions of songs and many numbers of categories present. Compared to the last decade we have a lot more songs created and produced on a yearly basis. With such a huge amount of music being produced and stored, we would face the need to categorize and classify them

into genres. One way to doing so is manually adding tags to all the music files being produced. But it would require a lot of effort and time, and with the increasing number of songs produced, it would become a tedious process. Adding tags to the music files and retrieving it might be one way of doing genre classification, but one would not call it efficient and effective.

Music can be categorized into many different genres such as hip hop, pop, jazz and so on. The other way of doing the classification is using the Mel Frequency Theory. The music can be categorized into these genres based on its Mel frequencies. The clip of audio can be converted to the desired format, which can be used to

feed to the classification models. These classification model's help us accurately classify the music into different genres.

With the growth in the music streaming and the number of songs of available, it is important to have an accurate classification model. Music genre classification is a crucial task in music information retrieval, having applications in music recommendation systems, music generation, and automated playlist creation. With the evolving technology, there are many techniques that are being used to classify music based on their genres, which makes it easier for people to search for songs or group them together into an album they are interested in. We have various music streaming apps like spotify, apple music or wynk, which all need an accurate music classification algorithm or model.

The main objective of this study is to draw some similarities among different papers as well as highlight the key takeaways that are required for classifying music into different genres using machine learning algorithms. We have many different methodologies which can be used to classify music into genres. Some of the frequently used methodologies could be time-frequency analysis, Wavelet package decomposition, feature extraction based on sub-band signal correlations, machine learning and deep neural networks. This study focuses more on the classification methods based on machine learning and deep learning techniques. The overall review of this paper discusses the classification of music based on their genres using Machine learning techniques.

II. LITERATURE SURVEY

L. K. Puppala, P. S. Rajendran, S. S. R. Muvva, & S. R. Chinige have discussed A Novel Music Genre Classification Using Convolutional Neural Network. In their work, they have discussed the prospect of using a convolution neural network for music genre classification. Their planned framework categorizes music into varied genres after extracting the feature

vector. They have concluded their study has an accuracy level of about 97% for training and 74% for testing, which will significantly boost and encourage the classification of music genres. [2]

Shajin Prince, Justin Jojoy Thomas, Sharon Jostana J, Kakarla Preethi Priya and J Joshua Daniel have come up a summary of the deep learning research and application work done with regard to musical genre classification.[4]

Wency Suo discussed about how deep learning is an efficient tool to classify music genres since the accuracy of the network is higher than that of the human baseline model. The human baseline correctly classified 43.3% of the samples. The CNN achieved an accuracy of 98% in 37 sec on the train set and 68.7% in 36 sec on the test set. Wency Suo transformed the audio sample to image via combining Short Time Fourier Transform (STFT) and the Melfrequency spectrum which were later passed to the deep learning model as images. [11]

Samuel Wycliffe J, Ponnaiah Karthik R M, Praveen Kanth K, Prasanna J came up with a novel deep learning model that combines multiple deep learning algorithms such as CNN and LSTM. They considered various traditional features to be included and came up with a new variety rich feature set.

Jun-Han Shi and Chih-Hsun Chou analysed time-frequency method in the genre classification of music songs. Due to the benefits of multi-resolution analysis, the proposed methods first adopted the wavelet package decomposition (WPD) to obtain candidate features from the spectrograms of music songs. Then the singular value decomposition (SVD) was used to extract the desired features because of its dimension reduction ability. [13]

III. METHODOLOGY

With the increasing in digitalization of music, we need a better classification system for browsing, recommendation and retrieval of music based on the genre. With these requirements, we have multiple

articles pertaining to multiple methods. The most basic step in Music Genre Classification is divided into two, extracting audio features and classification. The most common method used in extraction of the audio is the Mel spectrum, which is used to simulate human perception. It is formulated that the human hearing is selective to frequency, so it only pays attention to certain frequency components [4]. The features extracted are converted from the original music file to mel-spectrograms. Mel Frequency Cepstral constant (MFCC), the function vector is applied to every song. In some cases, Short-Term Fourier Transform (STFT) is also extracted along with mel-spectrogram and MFCC. Extraction of audio features is also possible with auto-encoders and digital signal processing techniques. There are various datasets available containing music belonging to various genres. Few such datasets are Million Song Dataset (MSD), GTZAN dataset. Most widely used dataset is the GTZAN dataset, which has 10 genres; blues, classical, country, disco, hip-hop, jazz, metal pop, reggae, rock. Each of these 10 genres have 100 music files, each lasting 30 seconds. Music classification can be considered as a difficult task. The classification can be enhanced using various techniques. Convolutional Neural Networks (CNN) has been used to find solution for complex audio problems; sentiment analysis, feature extraction, genre classification and prediction. The CNN is basically made of convolutional layer, pooling layer, and fully connected layer. The CNN classification techniques include the K- Nearest Neighbor Algorithm, SVM, decision tree, random forest and other algorithms. The CNN is proved to have been effective and efficient in time series data. The CNN model proved to have project accuracy around 75%. Machine Learning algorithms like Naive Bayes, Support Vector Machine are one of the effective ways in classification.

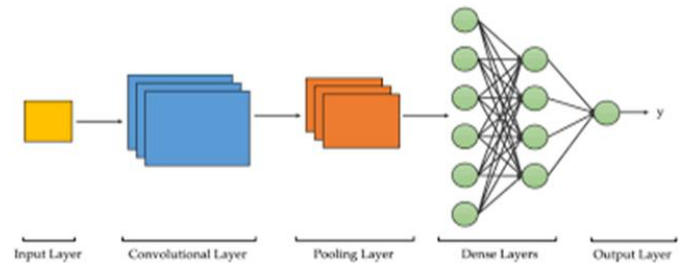


Fig 1 Layers in CNN

IV. KEY TAKEAWAYS

On analyzing nearly ten research papers, the following are the key takeaways.

1. A combined network classification algorithm (CNN-LSTM) has been built, extracting the features of support vector machine (SVM), convolutional neural network (CNN) and cyclic neural network (RNN) which has been proven to have higher classification accuracy when compared to traditional classification algorithms [10].
2. Deep Learning Techniques: CNNs have achieved significant accuracy in MGC. Studies have explored various CNN architectures, including 1D CNNs, 2D CNNs, and hybrid architectures, with varying levels of success. Some examples include:
 - a. 1D CNNs: These models work directly on the audio signal sequence, capturing temporal patterns.
 - b. 2D CNNs: Spectrograms are used as input, representing the frequency and time variations in audio. 2D CNNs can learn spatial-temporal features.
 - c. Hybrid Architectures: Combining 1D and 2D CNNs can leverage both temporal and spectral features for improved accuracy.
3. One other mode of classification that has proved to have higher accuracy of 0.8836, is using Transfer Learning. The dataset is divided into source dataset and target dataset, in order

to use data more efficiently. Combination of transfer learning and active learning has resulted in higher accuracy in massive databases containing noises.

4. The objective of feature selection and feature co-relation is to improve the recognition rates or to reduce the feature vector dimensionality in music genre recognition task. In these models, probabilistic neural network is used in classification.
5. One different approach to music genre classification is emotion-based music generation model. A specific individual's emotion will be recognized with the help of CNN and it is used to estimate what the individual is currently feeling and generating recommendations related. Face acquisition will be handled using live camera, which is used to collect non-verbal clues such as facial expressions and the classification algorithms are based on ML-CNN.

V. CONCLUSION

Music Genre Classification using machine learning and deep learning is a rapidly evolving field with immense potential. By addressing the challenges and exploring promising avenues like feature selection and emotion-based approaches, we can unlock even greater accuracy and personalization in music organization, recommendation, and generation, ultimately shaping the future of our musical experiences.

VI. CHALLENGES AND FUTURE SCOPE

- Data Scarcity and Diversity: Large, diverse datasets are crucial for training robust CNN models. Collecting and annotating such datasets is challenging.
- Feature Engineering: Exploring alternative and novel feature representations beyond MFCCs could lead to further improvements in accuracy.

- Interpretability: CNNs are often considered "black boxes," making it difficult to understand their decision-making process. Explainable AI methods are needed to understand which features contribute to genre classification.
- Real-world Applications: Integrating MGC models into practical applications like music recommendation systems and personalized music playlists requires careful consideration of efficiency and scalability.

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