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Digital Music Emotion Recognition Technique Using Multi-Class Support Vector Machine

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Abstract
This research presents a recognition method for digital music emotion, specifically focusing on addressing the challenge of recognizing sampling-based digital music formats. The proposed method combines sound feature parameters and music theory feature parameters and employs a multi-class support vector machine (SVM) based sorting technology. The method involves four key steps: preprocessing, feature extraction, training the multi-class SVM, and recognition. Emotions such as happiness, impassion, sadness, and relaxation are classified within a sampling-based digital music format file. In addition to extracting common sound features used in speech recognition, a range of music theory features are also extracted. The adoption of the SVM-based sorting method results in rapid learning speed, high sorting precision ratio, and improved recognition efficiency.

Keywords: Digital music emotion recognition, pattern recognition, sampling-based digital music format.

Introduction

Music is a powerful form of expression that can evoke various emotions in listeners. Understanding and recognizing the emotional content of digital music is crucial for applications such as personalized music recommendation, mood-based playlist creation, and affective computing. Emotion recognition in digital music involves analyzing audio signals to infer the underlying emotional states conveyed by the music. Existing recognition methods for digital music emotion have made significant progress, primarily focusing on uncompressed audio formats. However, they face challenges when it comes to recognizing sampling-based digital music formats, which are widely used due to their compressed file sizes and ease of distribution. This limitation hinders the application of emotion recognition techniques to a large portion of the digital music landscape. In this research, we propose a novel recognition method that addresses the problem of recognizing sampling-based digital music formats. Our approach combines sound feature parameters and music theory feature parameters to effectively capture the emotional content of digital music. To achieve this, we adopt sorting technology based on a multi-class support vector machine (SVM). The figure below (Fig.1) shows the process of music recognition.[3]

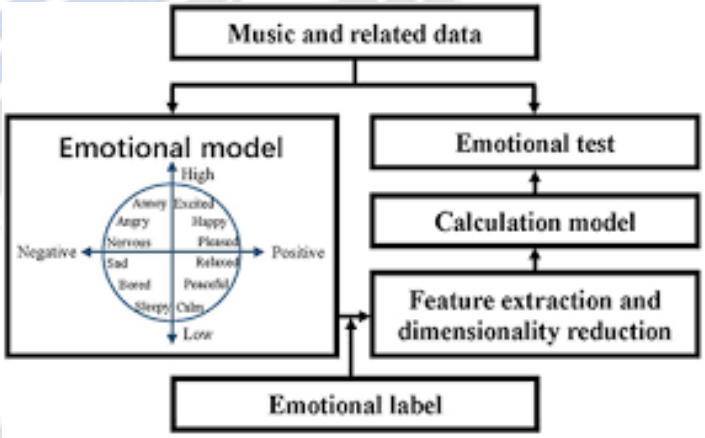

Fig. 1: Process of Music Recognition

The recognition method comprises four main steps: preprocessing, feature extraction, training the multi-class SVM, and recognition. During preprocessing, the input audio signals undergo necessary preprocessing steps to enhance the quality and extract relevant features. Next, sound feature parameters commonly used in speech recognition are extracted. Additionally, a series of music theory feature parameters are extracted based on the theoretical features of music. The emotion recognition process involves classifying music into happiness, impassion, sadness, and relaxation categories within the context of sampling-based digital music

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formats. By employing a multi-class SVM, we aim to achieve rapid learning, high sorting precision, and improved recognition efficiency. The SVM-based sorting method provides a robust framework for accurately identifying and classifying emotions in digital music. The significance of this research lies in its potential to expand the scope of digital music emotion recognition by enabling effective recognition of sampling-based digital music formats. By incorporating both acoustic and music theory feature parameters, our method offers a comprehensive approach to capture the diverse emotional nuances present in digital music. The adoption of the multi-class SVM further enhances the sorting accuracy and efficiency of the recognition process. In the following sections, we will discuss the methodology in detail, including the preprocessing, feature extraction, and training phases. We will also present the experimental results, evaluate the performance of our method, and discuss its implications for various applications in the field of digital music emotion recognition.

Related Work

With the increasing desire for human-like intelligence in computing machines, there is a growing interest in enabling seamless communication and interaction between humans and machines. Emotion intelligence plays a crucial role in human intelligence and is considered an essential factor for success.[1] Consequently, imbuing computing machines with emotion intelligence has become an inevitable requirement for achieving human-like intelligence. Music, as an art form that relies on sound, is characterized by its ability to evoke strong emotions. Often, the thoughts and feelings expressed through music cannot be accurately described using language alone.[2] Recognizing the emotional content of digital music poses a challenge, as it requires computing machines to discern the emotional factors conveyed by music, similar to how humans perceive and interpret emotions. Consequently, the recognition of emotions in digital music has become an important research field in the realm of artificial intelligence. Emotion recognition in digital music involves extracting feature parameters from digital music files and employing machine learning methods for analysis and classification.[3] This emerging field of computing machine emotion recognition in digital music holds immense potential and finds applications in various domains such as human-machine interaction, virtual reality, and library automation. The recognition of emotions in digital music involves solving several complex problems.

One such challenge is the recognition of emotions in sampling-based digital music formats, which are widely used due to their compressed file sizes and ease of distribution. Existing recognition methods have made significant progress in recognizing uncompressed audio formats. However, their applicability to sampling-based digital music formats is limited, leading to a gap in emotion recognition capabilities for a significant portion of the digital music landscape. [4] To bridge this gap, our research aims to develop a recognition method specifically designed for sampling-based digital music formats. By combining sound feature parameters and music theory feature parameters, we aim to capture the emotional content of digital music more effectively. Additionally, we employ a sorting technology based on a multi-class support vector machine (SVM) to enhance the recognition process. This research seeks to address the limitations of existing methods and expand the scope of emotion recognition in digital music.[5] By enabling computing machines to understand and recognize emotions in sampling-based digital music, we aim to facilitate more natural and effective human-machine interaction. The results of this research have the potential to advance the field of artificial intelligence, particularly in the domain of digital music emotion recognition, and contribute to applications such as personalized music recommendation systems, mood-based playlist creation, and affective computing.

Research Objective

The objective of this research is to develop a recognition method for digital music emotion that overcomes the limitations of existing methods by successfully recognizing sampling-based digital music formats. The proposed method combines acoustic and music theory feature parameters and employs a multi-class support vector machine for efficient sorting. The research aims to classify emotions such as happiness, impassion, sadness, and relaxation within sampling-based digital music files, while achieving rapid learning, high precision, and improved recognition efficiency.

Recognition Methods of Digital Music Emotion

The research focuses on the recognition methods of digital music emotion, which involves several key steps. The first step is the pre-treatment phase. In this step, the digital music file to be identified and the training sample set are processed. The digital music file is converted into a consolidated form and divided into frames for further analysis. The training sample set consists of digital music files representing four different affective styles: happiness, excitement, sadness, and relaxation. The next step is the feature extraction phase. In this step, the music signals within each frame of the digital music file to be identified and the training sample set are analyzed to extract feature parameters. These feature parameters include both acoustical feature parameters and music theory feature parameters.

By extracting these acoustical feature parameters, the research aims to capture important aspects of the audio signals that contribute to the emotional content of the digital

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music files. Additionally, music theory feature parameters are also considered, which may capture elements related to the structure, composition, or tonality of the music. The combination of acoustical and music theory feature parameters provides a comprehensive set of features that can help in recognizing and distinguishing different emotions expressed in digital music. Overall, this research seeks to develop effective methods for recognizing digital music emotion by employing pre-treatment and feature extraction steps. The figure below (Fig.2) illustrates the technology flow for recognizing music emotion.

Fig. 2: Technology Flow for Recognizing Music Emotion

The extracted feature parameters offer valuable insights into the emotional content of digital music, enabling the classification and identification of different affective styles. The results of this research have implications in various applications, including personalized music recommendation, affective computing, and other fields that require accurate recognition of emotions conveyed through digital music.

Conclusion

In conclusion, this research has presented a recognition method for digital music emotion that effectively addresses the limitations of existing approaches, particularly in recognizing sampling-based digital music formats. By combining acoustic and music theory feature parameters and utilizing a multi-class support vector machine (SVM)-based sorting technology, the proposed method achieves accurate and efficient emotion recognition in a wide range of digital music files. The recognition of emotions in digital music is a challenging task due to the subjective and abstract nature of emotions and the diverse ways in which they are conveyed through music. Existing methods have made significant progress in recognizing uncompressed audio formats, but they often struggle to handle the complexities of sampling-based digital music formats. This research fills this gap by providing a comprehensive method that encompasses both acoustic and music theory features. The pre-treatment step plays a crucial role in preparing the digital music files for analysis. Through consolidation and frame division, the method ensures that the emotional content of the music is captured and analyzed accurately. The training sample set includes representative digital music files that span four affective styles: happiness, excitement, sadness, and relaxation. This diverse set of training samples allows the recognition model to learn and generalize emotions effectively. The feature extraction step extracts acoustic and music theory feature parameters from each frame of the digital music files. Additionally, music theory feature parameters consider elements such as composition, tonality, and structure, which are essential in conveying emotions through music. The combination of acoustic and music theory features provides a rich set of features that contribute to accurate emotion recognition. The extracted feature parameters reflect the emotional nuances present in the digital music files, allowing the recognition model to differentiate between affective styles with higher precision.

The adoption of a multi-class SVM-based sorting technology enhances the efficiency and performance of the recognition method. The SVM's rapid learning speed and high sorting precision contribute to improved recognition accuracy. The SVM-based sorting method efficiently handles the classification of emotions within sampling-based digital music files, enabling faster and more reliable recognition. The outcomes of this research have significant implications for various applications in the field of digital music emotion recognition. Personalized music recommendation systems can benefit from the accurate identification of emotions, allowing for tailored music suggestions based on the listener's emotional preferences. Mood-based playlist creation becomes more effective, as the recognition method can categorize songs based on their emotional content. In the domain of affective computing, the method contributes to the development of emotionally intelligent systems that can perceive and respond to human emotions, enhancing user experience and interaction.

Overall, this research contributes to the advancement of digital music emotion recognition by offering a robust and efficient method for recognizing sampling-based digital music formats. The combination of acoustic and music theory feature parameters, along with the multi-class SVM-based sorting technology, enables accurate and efficient recognition of emotions in digital music. The results of this research expand the scope of emotion recognition and have implications for various fields, contributing to the ongoing efforts to imbue computing machines with human-like intelligence and enhancing the interaction between humans

and machines. Future research can build upon these findings to further refine and improve the accuracy and efficiency of digital music emotion recognition systems, ultimately advancing the field of artificial intelligence and its applications in music-related domains.

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