Protecting Copyright Ownership via Identification of Remastered Music in Radio Broadcasts

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Index No : 15000877

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February 2020

Submitted in partial fulfillment of the requirements of the
B.Sc in Computer Science Final Year Project (SCS4124)

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Declaration

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under my supervision. The thesis has been prepared according to the format stipulated and is of acceptable standard.

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Abstract

Preface

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Chapter 1

Introduction

1.1 Background to the Research

According to the intellectual property act of Sri Lanka[1], royalties must be paid to the original artistes when a song is broadcast on a radio channel. Each radio channel is maintaining a playlist to keep track of the songs that were broadcast throughout the day. That playlist can later be used to pay royalties to the respective artistes. However, in order to streamline and regulate the royalty payment process, it is vital to have a method to monitor the radio broadcasts. Manual radio broadcast monitoring is infeasible and expensive due to increasing number of both radio channels and songs. In manual monitoring a person should be assigned to each channel who needs to keep record of each song in the radio broadcast of that assigned channel. Due to the increasing number of songs and the fallible nature of humans such a monitoring task is prone to errors and inaccuracies. Hence an automated radio broadcast monitoring approach must be considered as an viable alternative in the modern day radio broadcast monitoring.

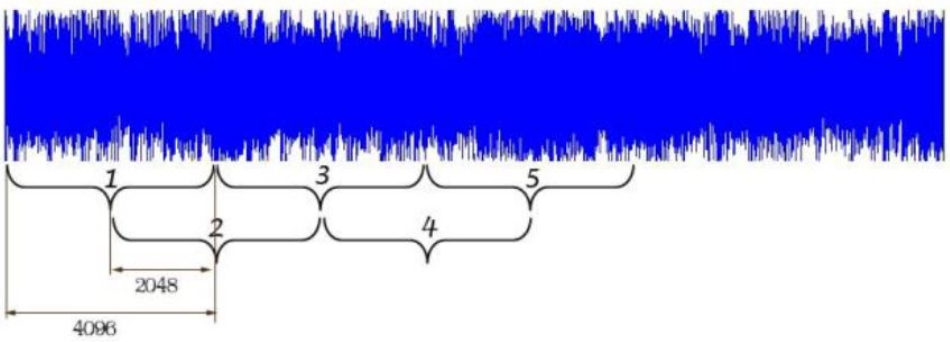

Figure 1.1: Key controlling parameters of STFT[2]

In the research "Radio Broadcast Monitoring to Ensure Copyright Ownership"[2], researchers have implemented an automated radio broadcast monitoring system (refer the Figure 1.2 for the architecture) which has achieved 97.14% overall accuracy in identifying original songs in radio broadcasts. The researchers introduced an audio fingerprint to register and identify songs. The fingerprint was introduced as a series of hash values extracted from frequency domain audio signal. Time domain signal was converted to frequency domain by using Short Time Fourier Transformation (STFT), which used 4096 bits long window and 2048 bits long overlapping area as shown in Figure 1.1. Then five peak values were extracted for each window by dividing mid frequency level into five bins and taking peak value from each bin. Extracted five peak values were used to create a hash value as depicted in Figure 1.3.

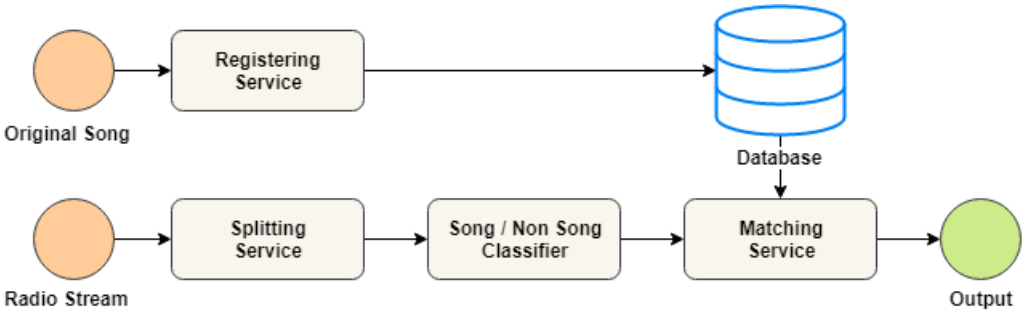

Figure 1.2: Architecture of the existing system

In contemporary radio broadcasts, channels tends to alter songs by including commercials and dialogues and by remastering the original song. Remastering can be done by adding or subtracting elements, or by changing pitch, equalization, dynamics or tempo[3]. Even though the above mentioned radio broadcast monitoring system's accuracy is not significantly affected by commercials and dialogues included in songs, the system is unable to identify a song when that song is remastered by the radio channel as changing pitch, equalization, dynamics or tempo which directly affects both time domain and frequency domain audio data.

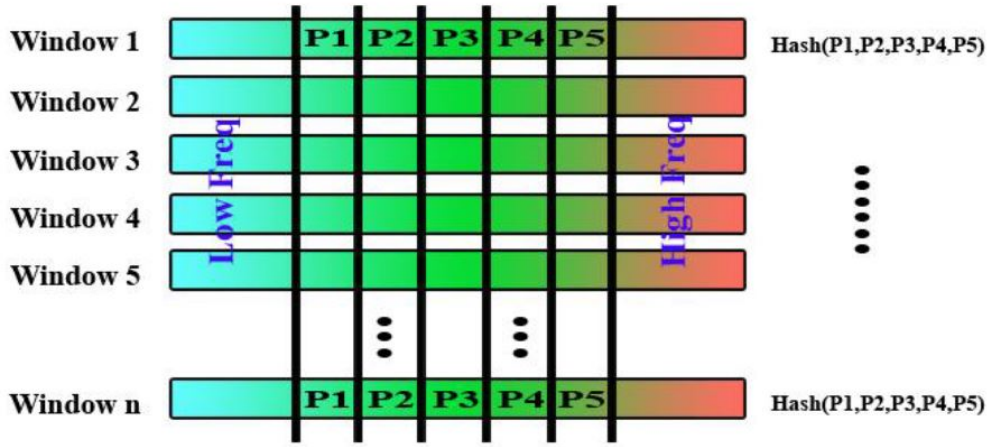

Figure 1.3: Extracting peaks and generating a hash value[2]

Timbre, tempo, timing, structure, key, harmonization and lyrics are the basic musical facets that can be identified[3].Timbre, also known as tone colour is the music facet which makes a difference of different sound productions even when they have the same pitch and loudness. Simply it is what makes a difference between a piano and a violin playing the same note at the same volume. Timbre can be changed due to the use of different sound enhancing and processing techniques or to the use of different instruments and configurations. Tempo is the speed or pace of the music which can be easily changed by playing the music in different speeds. The music facet of timing is rhythmic structure of the music which can be altered by the changes to the drum section. Structure is the arrangement of music sections, and music structure alterations can be made while remastering. Key, harmonization and lyrics are tonality, chords and words of the music which can be altered while remastering.

In order to identify remastered music in radio broadcasts, existing literature on cover song identification and music similarity measures can be used as foundation study to this research. Directly implementing a cover song identification method or a music similarity measure to identify remastered music in radio broadcasts is not possible as there is limited time to do the identification and it is not just comparing two music clips to find similarity, but comparing a radio broadcast with more than twenty thousand song database.

1.2 Research Problem and Research Questions

1.2.1 Research Questions

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Chapter 6

Conclusions

References

[1] Parliament of the democratic socialist republic of Sri Lanka, "Intellectual Property Act, No.36 of 2003."

[2] E. D. N. W. Senevirathna and K. L. Jayaratne, "Radio Broadcast Monitoring to Ensure Copyright Ownership," *International Journal on Advances in ICT for Emerging Regions (ICTer)*, vol. 11, p. 1, Aug. 2018.

[3] J. Serrà, E. Gómez, and P. Herrera, "Audio Cover Song Identification and Similarity: Background, Approaches, Evaluation, and Beyond," in *Advances in Music Information Retrieval* (J. Kacprzyk, Z. W. Raś, and A. A. Wieczorkowska, eds.), vol. 274, pp. 307–332, Berlin, Heidelberg: Springer Berlin Heidelberg, 2010.