KMITL ENGINEERING PROJECT DAY 2020

Department of Computer Engineering
(Music Engineering and Multimedia)

Music - Color Application for Stage Lighting

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Abstract

The relationship between sound and color can be associated with emotion. Visualizing to people through music and color can be done by using light as a representative. After studying lots of research lights us to use variables to control the value that has been used in the new invented program. By using tempo of the musical notes appearing in the range of high and low frequencies as a control value of color and loudness as a brightness level of light. This project aims to be adapted for lighting design. The result will show the output color and input songs in video in different color models to compare. For those who are interested in this study to be an example for developing more.

Introduction

1. Objectives

The main objective of this project is to find the connection between sound and color, and having the emotion as a mediator. The components that were used for the concert lighting design and appropriateness of each color model will be discussed in this research.

2. Literature reviews

- Associating loudness of song with lightness.
- Associating frequency range and speed of song with hue
- Computing Tempogram of input audio.

3. Scope of Thesis

Correlate with the color values in the CIE Lab and HSV color model. Run and write a program in MATLAB without linking to any software or hardware.

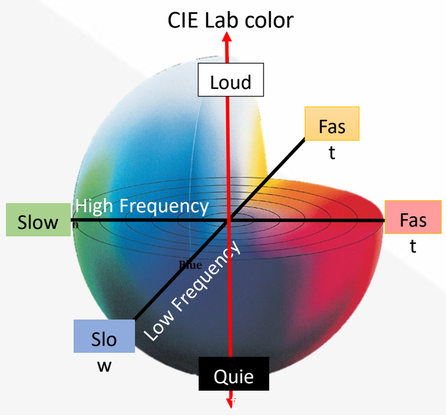
Methodology

1. Relating color to music elements

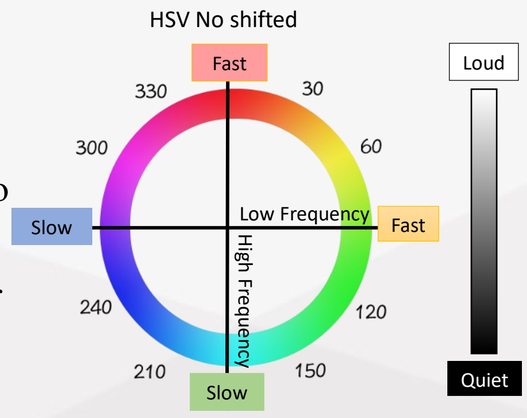
To determine the value of the color, we have divided the color into two axes, Red-Green and Yellow-Blue. The red-green axis to represent speed on high-frequency range and the yellow-blue axis represent speed on low frequency range. And we use RMS of the song to control the brightness of the lights.

2. Computing RMS and Tempogram

Computing signal RMS and Tempogram of low (below 200 Hz) and high (above 200 Hz) frequency. Tempogram is a representation of tempo and harmonic rhythm in time domain. Computing by doing Short-time Fourier transform of Novelty function, which is the function of changes in audio energy.

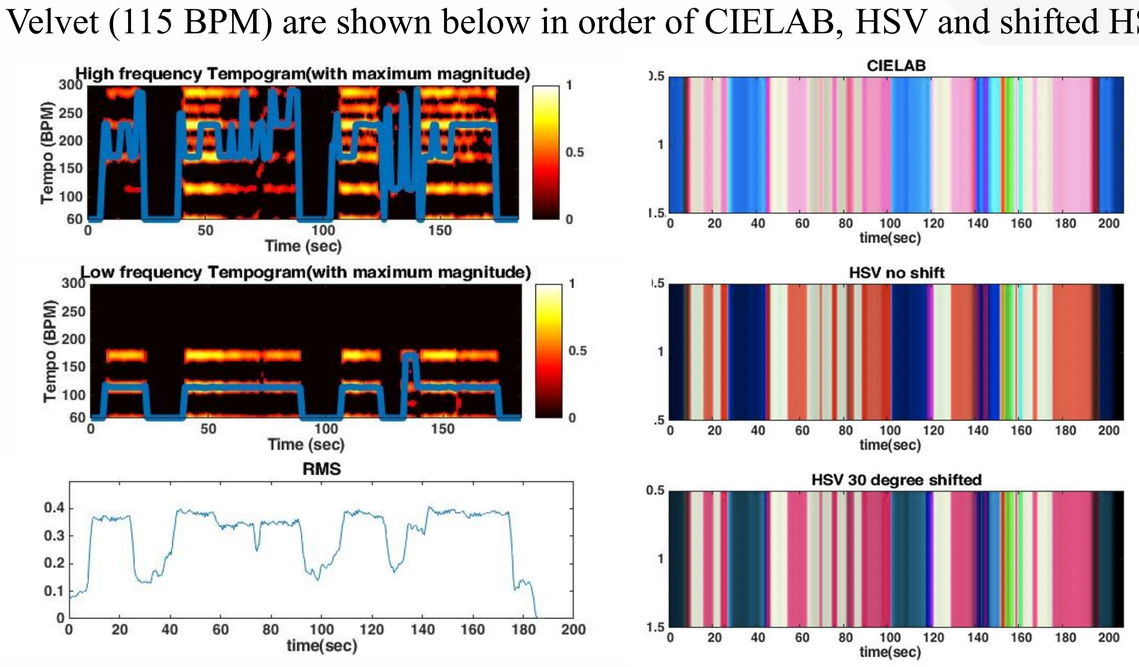


HSV No shifted



Results

The result of the transformation of full song "피카부 (Peek-A-Boo)" by Red Velvet (115 BPM) are shown below in order of CIELAB, HSV and shifted HSV



- As seen in the result, song that has a lower tempo tend to have color representation leaning toward blueish color, and song with higher tempo tend to have color representation leaning toward reddish color.

- Color representation of HSV and shifted HSV model appear to have value darker than CIELAB since the the L value from CIELAB model which represent lightness did not linearly scale on brightness.

- Even in changes of hue value only by 30 degree can affect the perception of color. For example, the color that appear orange changes to pinkish red. Therefore, the shifted HSV color model matches the association from literature review more than normal HSV color model

Conclusion

This is one of many way to associate music with lighting. Based on research, we have found our own way of correlating color with music speed to use for concert lights. Which we haven't actually connected to the hardware problem is devices we have do not support this function.

For those who want to further study this subject, we recommend that you do the survey for this method with the general public to see the accuracy of the color association method used. Including suitable for each color model in use or perform an experiment with actual hardware.

References

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