

Detection Of Alterations In Audio Files Using Spectrograph Analysis

Anandha Krishnan G, Don Caeiro

Abstract: The corresponding study was carried out to detect changes in audio file using spectrograph. An audio file format is a file format for storing digital audio data on a computer system. A sound spectrograph is a laboratory instrument that displays a graphical representation of the strengths of the various component frequencies of a sound as time passes. The objectives of the study were to find the changes in spectrograph of audio after altering them, to compare altering changes with spectrograph of original files and to check for similarity and difference in mp3 and wav. Five different alterations were carried out on each audio file to analyze the differences between the original and the altered file. For altering the audio file (MP3 or WAV) by cut/copy, the file was opened in Audacity. A different audio was then pasted to the audio file. This new file was analyzed to view the differences. By adjusting the necessary parameters, the noise was reduced. The differences between the new file and the original file were analyzed. By adjusting the parameters from the dialog box, the necessary changes were made. The edited audio file was opened in the software named spek where after analyzing a graph is obtained of that particular file which is saved for further analysis. The original audio graph received was combined with the edited audio file graph to see the alterations.

Key words: Audio file, Spectrograph, Audio Forensics, Critical Listening, Noise reduction, Frequency

1. Introduction

An audio file format is a format for storing digital audio data on a computer system. An analog audio system captures sounds, and converts their physical waveforms into electrical representations of those waveforms by use of a transducer, such as a microphone. Digital audio is technology that can be used to record, store, generate, manipulate, and reproduce sound using audio signals that have been encoded in digital form. The authenticity of audio forensic evidence has traditionally focused on analog magnetic tape recordings. The methodology requires the examiner to observe the physical integrity of the recording medium, the quality of the recorded audio, and the consistency of the magnetic signatures present on the tape. A sound spectrograph is a laboratory instrument that displays a graphical representation of the strengths of the various component frequencies of a sound as time passes. Voice researchers use the spectrograph as a tool for analyzing vocal output. In current research, it is used for identifying the strength and frequencies of formants, and for real-time biofeedback in voice training and therapy.

2. Methodology

- The audio files used were of MP3 and WAV format.
- Five different alterations were carried out on each audio file to analyze the differences between the original and the altered file.
- The Five alterations were cut/copy, noise reduction, frequency/pitch variation, change in tempo and change in speed.
- The software used was AUDACITY.

- For altering the audio file (MP3 or WAV) by cut/copy, the file was opened in Audacity. The region of the audio to be cut was selected and cut by using "ALT+X". A different audio was then pasted to the audio file. This new file was analyzed to view the differences.
- The original file was opened in Audacity for noise reduction. A particular region of the audio was selected. By selecting effects and further noise reduction, a dialog box was displayed. By adjusting the necessary parameters, the noise was reduced. The differences between the new file and the original file were analyzed.
- To change pitch and frequency, the required region of the audio file was selected after loading it in Audacity. Effects were selected and change pitch and frequency option was selected. From the dialog box, the parameters were adjusted to make the changes.
- Change in tempo was selected from effects after selecting the required region of the audio. By adjusting the parameters from the dialog box, the changes were made.
- The edited audio file was opened in the software named spek where after analyzing a graph is obtained of that particular file which is saved for further analysis.
- The original audio graph received was combined with the edited audio file graph to see the alterations.

3. Findings

- The audio files were differentiated between original and duplicate copies. The wave differences could be identified between the original and duplicate copies. The noise is reduced. Noise frequency is eliminated between the pitchfrequency. Increasing the tempo decreases the time duration and vice-versa.
- The alterations were identified using spectrograph of the original files. There is a rise in the wave of

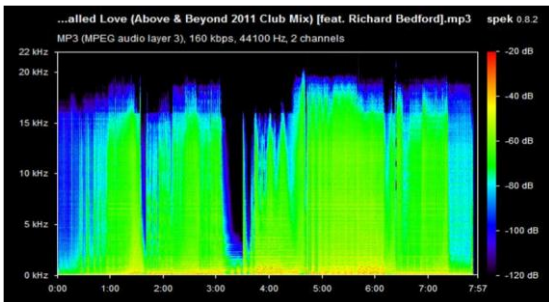
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the spectrograph when cut copy was done to the original file.

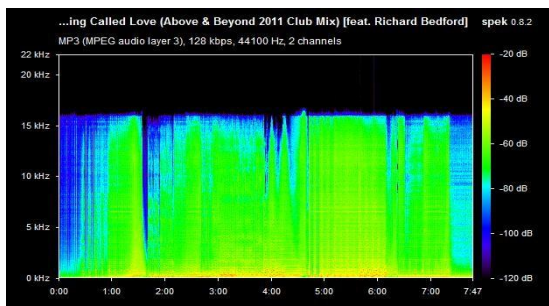
- The noise reduction was done where only the required sound was obtained and the unwanted noise was eliminated.
- The variation in the pitch frequency was observed.
- The duration of the audio is increased along with the decrease in the density of the main frequency
- Only similarities were detected between MP3 and WAV format. Both MP3 and WAV files are used in all the areas of audio, from portable players, and handheld recorders, to audio interfaces and more. Both the formats are interchangeable in all ways.
- The differences found between WAV and MP3 are that WAV files are more accurate and lossless format. They are of simple format. MP3 files are of small file format. They compress files with little perceivable difference to the overall sound quality. It is easy to convert WAV file format to MP3 file format.
- MP3 files when compressed, the audio quality is sacrificed. This audio inaccuracy means that MP3s are not suitable for pro audio work. WAV files sizes are large and thus making it impractical for portable devices and streaming.

A

Original audio

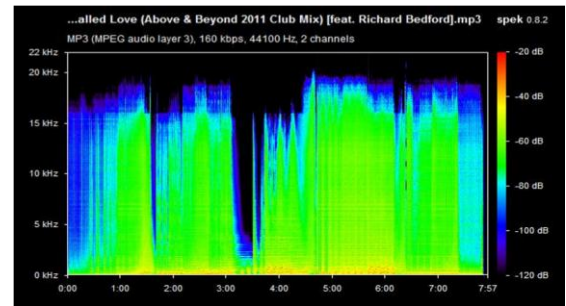


Cut- Copy

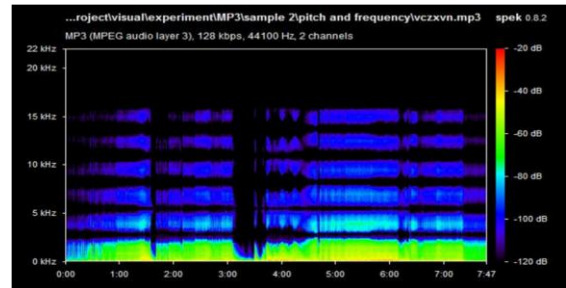


B

Original audio

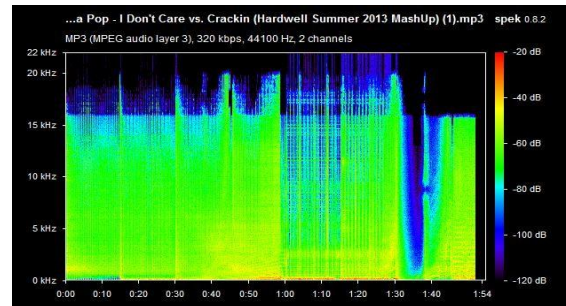


Pitch- Frequency

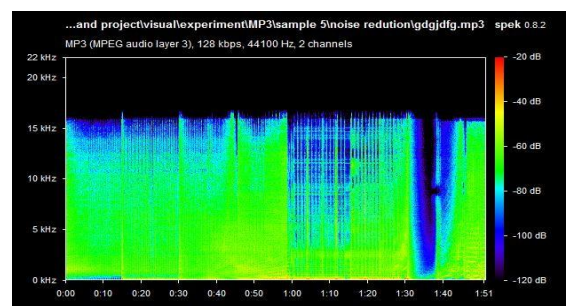


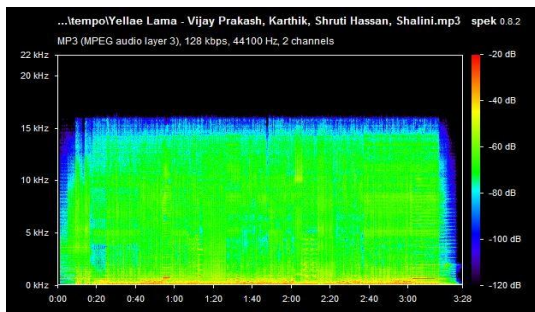
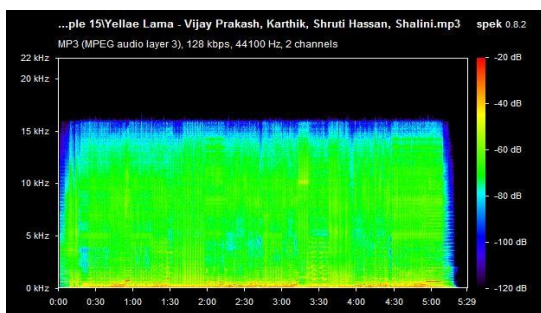
C

Original-audio



Noise Reduction



D**Original audio****Tempo****4. Conclusion**

From the study conducted it is found out that majority of the audio files were differentiated between original and duplicate copies. The wave differences could be identified between the original and duplicate copies. The alterations were identified using spectrograph of the original files. The noise is reduced. Noise frequency is eliminated between the pitchfrequency. The variation in the pitchfrequency was observed. Increasing the tempo decreases the time duration and vice-versa. Only similarities were detected between MP3 and WAV format. Both MP3 and WAV files are used in all the areas of audio, from portable players, and handheld recorders, to audio interfaces and more. Both the formats are interchangeable in all ways. The differences found between WAV and MP3 are that WAV files are more accurate and lossless format. They are of simple format. MP3 files are of small file format. They compress files with little perceivable difference to the overall sound quality. It is easy to convert WAV file format to MP3 file format. MP3 files when compressed, the audio quality is sacrificed. This audio inaccuracy means that MP3s are not suitable for pro audio work. WAV files sizes are large and thus making it impractical for portable devices and streaming. Thus from this study it is proved that changes can be detected by spectrograph and there are both differences and similarities between MP3 and WAV format.

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