Mini Project Report on

TITLE

Submitted in partial fulfilment of the requirement for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE & ENGINEERING

Submitted by:

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CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in the project report entitled **"UI/Android app to mimic String Movement"** in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in Computer Science and Engineering of the Graphic Era (Deemed to be University), Dehradun shall be carried out by the under the mentorship of **Dr. Jay Bhatnagar, Professor**, Department of Computer Science and Engineering, Graphic Era (Deemed to be University), Dehradun.

Name: Anjali Dhyani University Roll no :2017464

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Chapter 1

Introduction

Music is the best source of expressing our emotions from being a nomad to travel in tribes and now being a civilized man in every age of human's history they have used music to express joy, grief, anger, victory etc.

Then why not to use in era of 20th century? Here, in this world we are having everything in human reach without at any cost or cost of one Wi-Fi-recharge. A middle class thinks twice or thrice before buying a west-instrument such as Drum which may cost 12-15K and there are many who won't even think. We can clearly see how an art is becoming a platform to discriminate among classes, to discriminate a man financially. To keep away art from this chaotic conversation. Let present you Visual **Drum -**

1.1 Introduction

In the realm of music, the drum is a timeless instrument that has captivated audiences for centuries. Its rhythmic beats have the power to move our bodies and stir our souls. But what if the drum could transcend its auditory nature and evolve into a mesmerizing visual spectacle? Welcome to the world of Visual Drum, a groundbreaking fusion of rhythm and visual expression.

Visual Drum takes the traditional concept of drumming and elevates it to new heights by integrating innovative technology and captivating visuals. Imagine a drummer surrounded by an array of sensors and lights, each meticulously synchronized with the beats they create. With every strike of the drumstick, a burst of vibrant colors illuminates the stage, creating a mesmerizing interplay of sound and light.

This transformative experience is made possible through the seamless integration of advanced motion capture and image detection using Webcam of your device. As the drummer moves and strikes the drums, their motions are captured and translated into a dazzling display of visual effects that dance across the stage. Each beat becomes a brushstroke of light, transforming the performance into a true audio-visual symphony.

Beyond its visual spectacle, Visual Drum offers a new dimension of creative expression for musicians. It allows drummers to harness their innate rhythm and extend it into a realm of visual storytelling. Each performance becomes a narrative, conveyed not only through the beats but also through the mesmerizing visuals that accompany them. Audiences are transported into a world where music transcends its auditory boundaries, immersing them in a sensory feast that ignites their imagination.

Visual Drum has the power to revolutionize the way we experience music, breaking down the barriers between the performer and the audience. It blurs the lines between traditional drumming, visual art, and technology, creating an entirely new medium of artistic expression. Whether in concert halls, theaters, or multimedia installations, Visual Drum opens up a world of possibilities for musicians, visual artists, and audiences alike.

So, step into a realm where rhythm and visual expression intertwine, and prepare to be captivated by the enchanting symphony of sound and light that is Visual Drum. Experience the convergence of ancient rhythms and cutting-edge technology, and embark on a transformative journey that transcends boundaries and expands the horizons of artistic expression.

1.2 Visual Drum: A Harmonious Fusion of Rhythm and Visual Expression

The interface of Visual Drum is designed to seamlessly blend the physicality of drumming with the digital realm of visuals. It serves as the bridge between the drummer's movements and the visual effects that are generated in real-time.

At the core of the interface is Webcam of your device or laptop in my case that capture the drummer's actions. These sensors are strategically placed on the drum set to detect strikes, hits, and movements. They gather precise data about the drummer's technique and generate on demand string movement describing its amplitude.

Music not only a emotional tool but a therapeutical appliance which can interact with our neurons thereby healing us internally

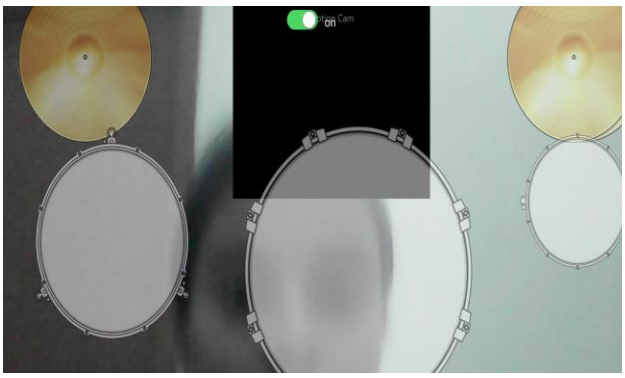


Figure 1.2

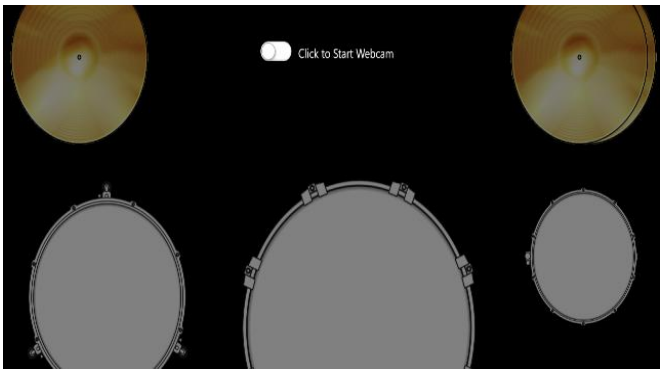


Figure 1.1

Once we turn on our webcam, it will start capturing the movements and detecting the object behind each hit or each stroke. For getting wave's amplitude or frequency we must look on the screen. There are for drums in a drum set which are:

1. Crash

2. Ride

3. Splash (2)

4.Bass

On basis of how stroke is hit, amplitude of each drum is decided which leads to interfering with notes of music resulting in giving a sense of joy to the audience if played in an orderly manner.

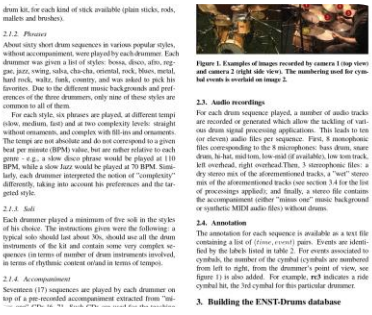
Chapter 2

Literature Survey

Combat stress reaction is common among soldiers and can develop to a post-traumatic stress disorder (PTSD). This distressing condition embraces symptoms such as feelings of loneliness and isolation from society, intrusive memories, outbursts of anger and generalized feelings of helplessness. Drumming has been receiving considerable attention in music therapy. Only few references relate to such activity among those who suffer from PTSD, and even fewer relate to combat induced post-traumatic syndrome, none of them empirical. The current study presents music therapy group work with six soldiers diagnosed as suffering from combat or terror related PTSD. Data were collected from digital cameras which filmed the sessions, open-ended in-depth interviews, and a self-report of the therapist. Some reduction in PTSD symptoms was observed following drumming, especially increased sense of openness, togetherness, belonging, sharing, closeness, connectedness and intimacy, as well as achieving a non-intimidating access to traumatic memories, facilitating an outlet for rage and regaining a sense of self-control.

Some of the work done by researchers to advance it commercially was published in HAL,

A well-known sci-fi research institute in France which commits in following ways:



drum kit, for each kind of stick available (plain sticks, rods, mallets and brushes).

2.1.2. Phrases

About sixty short drum sequences in various popular styles, without accompaniment, were played by each drummer. Each drummer was given a list of styles: bossa, disco, afro, reggae, jazz, swing, salsa, cha-cha, oriental, rock, blues, metal, hard rock, waltz, funk, country, and was asked to pick his favorites. Due to the different music backgrounds and preferences of the three drummers, only nine of these styles are common to all of them.

For each style, six phrases are played, at different tempi (slow, medium, fast) and at two complexity levels: straight without ornaments, and complex with fill-ins and ornaments. The tempi are not absolute and do not correspond to a given beat per minute (BPM) value, but are rather relative to each genre – e.g., a slow disco phrase would be played at 110 BPM, while a slow Jazz would be played at 70 BPM. Similarly, each drummer interpreted the notion of "complexity" differently, taking into account his preferences and the targeted style.

2.1.3. Soli

Each drummer played a minimum of five soli in the styles of his choice. The instructions given were the following: a typical solo should last about 30s, should use all the drum instruments of the kit and contain some very complex sequences (in terms of number of drum instruments involved, in terms of rhythmic content or/and in terms of tempo).

2.1.4. Accompaniment

Seventeen (17) sequences are played by each drummer on top of a pre-recorded accompaniment extracted from "mi-

Figure 1. Examples of images recorded by camera 1 (top view) and camera 2 (right side view). The numbering used for cymbal events is overlaid on image 2.

2.3. Audio recordings

For each drum sequence played, a number of audio tracks are recorded or generated which allow the tackling of various drum signal processing applications. This leads to ten (or eleven) audio files per sequence. First, 8 monophonic files corresponding to the 8 microphones: bass drum, snare drum, hi-hat, mid-tom, low-oral (if available), low tom track, left overhead, right overhead.Then, 3 stereophonic files: a dry stereo mix of the aforementioned tracks, a "wet" stereo mix of the aforementioned tracks (see section 3.4 for the list of processings applied); and finally, a stereo file contains the accompaniment (either "minus one" music background or synthetic MIDI audio files) without drums.

2.4. Annotation

The annotation for each sequence is available as a text file containing a list of (*time*, *event*) pairs. Events are identified by the labels listed in table 2. For events associated to cymbals, the number of the cymbal (cymbals are numbered from left to right, from the drummer's point of view, see figure 1) is also added. For example, **rc3** indicates a ride cymbal hit, the 3rd cymbal for this particular drummer.

3. Building the ENST-Drums database

Figure 2.1

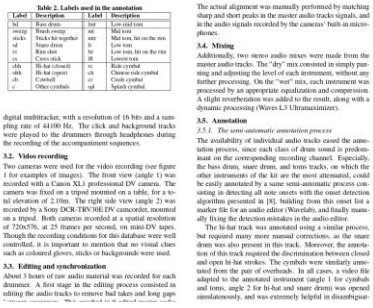


Table 2. Labels used in the annotation

Label	Description	Label	Description
hd	Bass drum	lmt	Low-mid tom
sweep	Brush sweep	mt	Mid tom
sticks	Sticks hit together	mtr	Mid tom, hit on the rim
sd	Snare drum	ltr	Low tom
rs	Rim shot	ltr	Low tom, hit on the rim
cs	Cross stick	ft	Lowest tom
chh	Hi-hat (closed)	rc	Ride cymbal
ohh	Hi-hat (open)	crh	Chinese ride cymbal
ch	Crashall	cr	Crash cymbal
c	Other cymbals	spl	Splash cymbal

digital multitracker, with a resolution of 16 bits and a sampling rate of 44100 Hz. The click and background tracks were played to the drummers through headphones during the recording of the accompaniment sequences.

3.2. Video recording

Two cameras were used for the video recording (see figure 1 for examples of images). The front view (angle 1) was recorded with a Canon XL1 professional DV camera. The camera was fixed on a tripod mounted on a table, for a total elevation of 2.10m. The right side view (angle 2) was recorded by a Sony DCR-TRV30E DV camcorder, mounted on a tripod. Both cameras recorded at a spatial resolution of 720x576, at 25 frames per second, on mini-DV tapes. Though the recording conditions for this database were well controlled, it is important to mention that no visual clues such as coloured gloves, sticks or backgrounds were used.

3.3. Editing and synchronization

About 3 hours of raw audio material was recorded for each drummer. A first stage in the editing process consisted in editing the audio tracks to remove bad takes and long gaps

The actual alignment was manually performed by matching sharp and short peaks in the master audio tracks signals, and in the audio signals recorded by the cameras' built-in microphones.

3.4. Mixing

Additionally, two stereo audio mixes were made from the master audio tracks. The "dry" mix consisted in simply panning and adjusting the level of each instrument, without any further processing. On the "wet" mix, each instrument was processed by an appropriate equalization and compression. A slight reverberation was added to the result, along with a dynamic processing (Waves L3 Ultramaximizer).

3.5. Annotation

3.5.1. The semi-automatic annotation process

The availability of individual audio tracks eased the annotation process, since each class of drum sound is predominant on the corresponding recording channel. Especially, the bass drum, snare drum, and toms tracks, on which the other instruments of the kit are the most attenuated, could be easily annotated by a same semi-automatic process consisting in detecting all note onsets with the onset detection algorithm presented in [8], building from this onset list a marker file for an audio editor (Wavelab), and finally manually fixing the detection mistakes in the audio editor.

The hi-hat track was annotated using a similar process, but required many more manual corrections, as the snare drum was also present in this track. Moreover, the annotation of this track required the discrimination between closed and open hi-hat strokes. The cymbals were similarly annotated from the pair of overheads. In all cases, a video file adapted to the annotated instrument (angle 1 for cymbals and toms, angle 2 for hi-hat and snare drum) was opened simultaneously, and was extremely helpful in disambiguat-

Figure 2.2

ENST-Drums: an extensive audio-visual database for drum signals processing

Olivier Gillet, Gael Richard

► **To cite this version:**

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https://telecom-paris.hal.science/hal-03103777

Submitted on 9 Jun 2021

Figure 2.3

Audio recordings

For each drum sequence played, several audio tracks are recorded or generated which allow the tackling of various drum signal processing applications. This leads to ten (or eleven) audio files per sequence. First, 8 monophonic files corresponding to the 8 microphones: bass drum, snare drum, hi-hat, mid tom, low-mid (if available), low tom track, left overhead, right overhead. Then, 3 stereophonic files: a dry stereo mix of the aforementioned tracks, stereomix of the aforementioned tracks and finally, a stereo file contains the accompaniment (either ”minus one” music backgroundor synthetic MIDI audio files) without drums.

Annotation

The annotation for each sequence is available as a text file containing a list of (*time, event*) pairs. Events are identified by the labels listed in table 2. For events associated to cymbals, the number of the cymbal (cymbals are numberedfrom left to right, from the drummer’s point of view, **Figure 2.4**) is also added. For example, **rc3** indicates a ride cymbal hit, the 3rd cymbal for this drummer.

Building the ENST-Drums database

Audio recording

8 microphones were used to record the performances: A Beyerdynamic M-88 for the bass drum, a Shure SM57 for the snare drum, a Schlep’s CMC body with a cardioid capsule for the hi-hat, two Shure SM58 for the mid and low- mid toms, a Sennheiser 441 for the low tom and two Audio-Technical AT4040 for the overheads. The microphones wereamplified by 4 Behringer Ultra gain Pro Mic2200 dual pre- amplifiers. The signals were recorded on a Tascam MX2424

Figure 2.4

We can clearly see how therapist useful databases have been there in thesis, but no application till date has been implemented to built a commercially useful app.

This project is going to deal with diagnosis as well as your hobby classes in being pocket friendly.

Chapter 3

Methodology

3.1 How to use:

- Turn on webcam and allow browser to access your integrated camera.
- Wave your hands in air to overlay the drum in accordance with interface.
- When it hits the drum or cymbal area, after being detected it will generate the gear sound respectively.

3.2 Technology used:

Developing a virtual drum using HTML, JavaScript, and webcam-based object detection involves several steps. Here's a high-level overview of the methodology you can follow:

1. Set up the HTML structure: Create an HTML document with appropriate containers for the drum elements, such as divs, where the virtual drum will be displayed.

2. Access the webcam: Use JavaScript to access the webcam feed. This will allow you to capture video frames from the user's webcam.

3. Display the webcam feed: Use the HTML5 <video> tag to display the webcam feed in a designated area on the webpage.

4. Object detection: Implement an object detection algorithm in JavaScript to detect hand detection strokes in the webcam feed.

5. Define drum regions: Identify the specific regions on the webcam feed where the drums are located. You can define these regions as rectangular bounding boxes or circular areas, depending on the drum layout.

6. Track hand movement: Using the object detection results, track the movement of the drumstick within the defined drum regions. You can use the position and trajectory of the detected object to infer hand strokes.

7. Trigger drum sounds: Associate each drum region with a specific sound or sample. When a drumstick stroke is detected within a particular region, trigger the corresponding sound using JavaScript's audio capabilities or an HTML5 <audio> element.

8. Visual feedback: Provide visual feedback to the user by highlighting or animating the drum regions upon detecting a hand stroke.

9. Event handling: Now according to the music recorded in 10 seconds, a wave is generated of a particular amplitude and frequency that can be use by therapist for their clients for major treatments.

10. Testing and refinement: Test the virtual drum application extensively, gathering user feedback and making refinements to improve its accuracy, responsiveness, and user experience.

Chapter 4

Result and Discussion

Apps such as Yousician or GuitarTuna have been having more than 100M+ downloads on PlayStore each which can be recognized as a tremendous success for an app.

Calling Virtual Drum an app which may gain profits in multiple folds commercially or an app impacting Health Sector significantly or the virtual drum may offer a convenient and accessible way for users to enjoy drumming without the need for physical drums. It provides a fun and interactive experience for drum enthusiasts, beginners, or anyone interested in exploring rhythmic expressions.

It will not bind players to be limited to their old music School instead provide accessibility in their own reach.

Current result of GuitarTuna user may vary vividly. But by adding feature of String Movement, we can also reach to the users who are interested in Health Sector or embrace finding hidden sounds of nature.

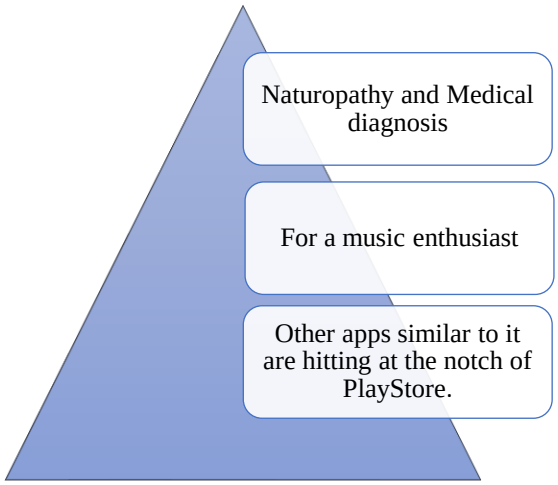

Figure 4.1

Chapter 5

Conclusion and Future Work

5.1 Time to draw conclusion:

I am very much satisfied seeing my hard work which was once my thought in one part of my left brain have been visualized through my retina and is actively present on my browser. It's well said no man is perfect and none of their accomplishment. So, a man with open door always yells high that yes "There is room for improvement."

Therefore, for future work, several enhancements and expansions can be considered to further improve the virtual drum application:

1. Gesture recognition: Incorporate gesture recognition capabilities to detect and interpret various drumming techniques, such as rim shots, ghost notes, or cymbal swells. This would provide a more expressive drumming experience.
2. Online collaboration: Implement features that enable users to collaborate with others in real-time, allowing multiple users to play together and create music remotely.
3. Advanced object detection: Explore more sophisticated object detection algorithms or machine learning models to improve the accuracy and reliability of drumstick stroke detection. This could involve training custom models on a diverse dataset of drumstick movements.
4. Beyond limits: Virtual drum should not be limited to drum indeed it must incorporate widely used instrument of this era.
5. Access to knowledge: Not all of us are equipped with science behind art and knowledge of art. An AI mentor can do it well. Basic chords, keys or, notes, should be taught to beginners so that they can start their journey and know it beforehand. It's the best way to know whether their interest would bring success to them or not.
6. Mobile device compatibility: Optimize the application for mobile devices, enabling users to play the virtual drum on smartphones or tablets, making it more accessible and portable.
7. Health Sector: Till now no 100M $ app has been come across to be useful to mankind through enhancement in music. So, I would certainly be more proud if any suggestion were endorsed in this section.

5.2 References:

[1] Olivier Gillet, Gael Richard. ENST-Drums: an extensive audio-visual database for drum signalsprocessing. International Society for Music Information Retrieval Conference (ISMIR), Oct 2006, Victoria, Canada.

[2] Department of Criminology, Bar-Ilan University, Ramat-Gan 52900, Israel, Music Department,Bar-Ilan University, Ramat-Gan, IsraelSha'arei Mishpat College of Law, Hod HaSharon, Israel.Drumming through trauma: Music therapy with post-traumatic soldiers, 25 September 2007, Israel.