

## Improving Machine Learning for Hearing-Impaired People's Dance Instruction: An Emphasis on Sri Lankan Traditional Dancing Style

**Nāgānanda International  
Journal of Humanities & Social  
Sciences**

Vol: 6, No. 3, 2023 pp. 14-23

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<http://www.niibs.lk>

Issue Published Online: 01 Dec., 2023

ISSN No: ISSN 2961-5801-F (online)

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### **Abstract:**

For many people, dance is a natural way to express themselves, but it can present special difficulties for those who have hearing loss. Though a lot of study has been done to help the hard of hearing enjoy music, not much has been done to help them become self-sufficient dancers. This study explores the subtleties of teaching dance to people with hearing impairments, highlighting the significance of comprehending certain dance forms and their complex motions. This study presents a novel strategy to deal with these issues by utilizing machine learning technology. Using a machine learning model, the study focuses on three essential moves in Sri Lankan traditional dancing, making training easier for dancers with hearing impairments. The goal of the project is to empower and promote inclusivity by teaching people with hearing impairments a culturally rich dancing style.

**Keywords: Deaf People, Machine Learning, Dancing Style, Sri Lanka**

**Received** : 01 July 2023

**Revised** : 25 August 2023

**Accepted** : 10 September 2023

**Published** : 01 December 2023

### **TO CITE THIS ARTICLE:**

P.M.D.S. Amarasooriya,  
Improving Machine Learning for  
Hearing Impaired People's Dance  
Instruction : An Emphasis on  
Sri Lankan Traditional Dancing  
Style, Nāgānanda International  
Journal of Humanities and Social  
Science.1:1, Pp.14-23

## **Introduction**

Sound is a doorway to discovery in human experience, enabling us to understand and interact with the environment we live in. People who suffer from mixed hearing loss that is, hearing loss involving both conductive and sensorineural components find it extremely difficult to navigate the auditory environment. When sound waves are not able to reach the inner ear due to obstructions in the outer or middle ear, conductive hearing loss occurs, resulting in a significant detachment from the auditory world (Cunningham & Tucci, 2017). This deprivation of senses is most felt in dance, where the perfect fusion of music, lyrics, and rhythm is the fundamental element of expression. Even though deaf people can feel the bass or beat of a song to a certain extent, they have trouble understanding subtle musical elements, which makes it difficult for them to keep up with the beat of a dance. Hearing-impaired people are excluded from dancing because they cannot hear cues, even though they have an inbuilt desire to do so and enjoy the joy it offers.

Even though they are available, current hearing aid apps do not provide the educational foundation required to empower those with hearing impairments in the art of dancing. Our research aims to close this gap by offering thorough dancing instruction to individuals with hearing impairments. Our goals include helping children to learn dance genres on their own, developing new skills, and closely observing their movements, correcting them as necessary, and tracking dance sequences. Our project seeks to close the gap by utilizing technology and educational techniques to give hearing-impaired people the opportunity to express themselves freely through dance, promoting inclusivity and improving their quality of life.

One major obstacle to the full participation of people with hearing impairments in this expressive art form is the difficulty they have learning to dance. Though they have an innate desire to dance, their progress is hampered by the lack of an appropriate, needs-based strategy. Conventional learning environments, including private lessons or dancing teachers, are unable to adequately meet the special needs of the deaf community. Although there are a few dancing applications available, they are insufficient to meet the unique learning requirements of people who are deaf. This study proposes a solution to this urgent problem: a specifically

tailored dance application that enables the hard of hearing to learn dance on their own, promoting self-reliance and the discovery of new skills.

The shortcomings of equipment designed to improve hearing-impaired people's perception of music serve as more evidence of how inadequate current options are. Without the assistance of a third party, the most important component of dance instruction realizing the complex relationship between musical beats and physical movements remains elusive even with modern tools. To support this claim, a thorough survey was carried out, which produced more than fifty qualitative and quantitative answers. It is clear from the survey results that people with hearing impairments would greatly want an app that would enable them to learn dance on their own without the need for outside help. This study highlights the urgent need for an inventive, approachable, and user-friendly dance program catered to the learning needs of the hearing-impaired community in addition to pointing out a significant vacuum in current resources.

The research aims to teach hearing-impaired individuals to learn a dancing style independently and develop new talents. The application focuses on tracking the deaf dancer's movements and correcting incorrect ones. The application uses a visual picture to track and correct movements in real-time, allowing the dancer to adjust their movements accordingly. The goal is to teach the dancer to learn a new style without the need for third-party assistance. The application aims to improve the quality of life for deaf dancers.

## **Literature Review**

The World Health Organization divides hearing impairment into three categories: profound hearing loss, moderate hearing loss, and mild hearing loss. Even though hearing loss presents difficulties, people with auditory impairments want to live similar lifestyles to others who do not have hearing impairments. Prior studies, such as Chao et al. (2018), have accomplished significant progress in closing this gap. To provide hearing-impaired people with a tactile way to perceive music, Chao and colleagues invented a wearable gadget that replays musical beats through vibrations. Although this invention was a major step forward, it was

primarily concerned with improving the auditory experience of music and gave little thought to how to make dance instruction more accessible to the hard of hearing. While the wearable technology allowed deaf people to understand the subtleties of music, its potential for teaching dance was not fully investigated. The community of hearing-impaired people was able to learn dance with the help of the device and an instructor. It is important to remember, though, that the focus of this research was on improving the auditory experience rather than teaching the deaf community dance techniques. By emphasizing the creation of an all-encompassing dance education program customized to the special requirements of hearing-impaired people, this study seeks to close this particular gap by encouraging inclusivity and enabling them to fully participate in the art of dance.

In their study, Chao et al. (2018) undertook an investigation aimed at developing a wearable device capable of reproducing musical rhythms. This device was designed to assist individuals with hearing impairments in experiencing music through tactile sensations. However, it should be noted that a limitation of this research is the absence of a system to instruct deaf individuals in the art of dancing. This technology was designed to enhance the auditory experience for those with hearing impairments, specifically focusing on the musical aspect. By utilizing this equipment, hearing-impaired individuals are able to perceive and appreciate sound in a more profound manner. Additionally, in conjunction with the guidance of a dancing instructor, deaf individuals have successfully acquired the skill of dancing. This research study aims to provide the auditory experience to deaf individuals who have acquired the skill of dancing. The research study did not have a primary objective of instructing dance to those within the deaf community.

In a recent study conducted by Wolfe-Webb (2021), the focus was on the training methods employed to enhance the performance of individuals with hearing impairments in the context of mainstream film production. In their study, (Alkhalifa et al. ,2018) undertook research with the aim of creating a system that might assist individuals with hearing impairments in perceiving their environment through the utilization of Google (Glass.Enriquez et al,2020) conducted a study exploring the potential of virtual reality (VR) applications in enhancing the music

experience for individuals with hearing impairments. However, their research did not address the topic of teaching dance to the deaf community.

In a study conducted by (Kaltsatou et al, 2013), researchers in Greece sought to impart Greek traditional dancing skills to individuals with hearing impairments. The objective of the study was to investigate whether the participants' dancing abilities showed any improvement because of the training. The present study spanned a duration of eight months, during which the researchers observed a discernible enhancement in the participants' proficiency in the domain of dancing.

## **Methodology**

This part is dedicated to discussing the research methodologies employed in the present study. Questionnaires and personal experiences yield diverse amounts of information that can be collected.

The researcher has opted to employ the qualitative research methodology as it aligns better with the nature of this study, which involves the collection of qualitative data. Given the subjective nature of user experience, which can vary among individuals, the researcher utilized a Google form questionnaire to get the necessary data for this investigation.

In order to gather data on dancing movements, the researcher has established a collaborative partnership with a professional dancing instructor. The dancing movements are gathered and inputted into a machine learning model in order to extract the essential points and angles necessary for estimating the pose of such action. The estimation of these postures has been conducted through the utilization of Python scripts within the Jupyter Notebook environment. The researcher has employed the Meadiapipe library and OpenCV library to visualize the landmarks and skeleton associated with these poses. In order to achieve the goal of ongoing monitoring of dancers with hearing impairments, this study aims to estimate the dancer's pose and subsequently compare it to the correct pose. If any discrepancies are identified, the dancer's pose will be corrected as needed.

In this research study, the researcher has opted to utilize qualitative data in order to obtain pertinent information pertaining to the research topic. The researcher has undertaken a survey in order to collect pertinent data. The researcher

has gathered the opinions of more than fifty persons. The researcher has opted to utilize the interpretive Phenomenological Analysis (IPA) approach for the study of the gathered data. The utilization of the Interpretive Phenomenological Analysis (IPA) methodology facilitates the researcher's comprehension of the subjective personal experiences and viewpoints expressed by the sample.

The study was conducted with a cohort of 50 adults who have hearing impairments, who provided their own experiences and opinions. The focus of this survey was the prior dance experience of individuals with hearing impairments.

## **Result and Discussion**

During our research endeavor, we have identified two significant findings that have arisen from the survey administered to a sample size of 51 participants. The primary objective of our study was to provide instruction in a particular form of dance to individuals with hearing impairments. Additionally, we sought to promote autonomous exploration of other dance genres, with the intention of cultivating the development of new skills. Furthermore, our aim encompassed the ongoing monitoring of the movements shown by dancers with hearing impairments, making appropriate adjustments to their motions, and painstakingly documenting the sequence of their choreography.

Upon examination of the demographic data, it was noted that a substantial proportion of the participants belonged to the age bracket of 25 to 30 years, suggesting a prevailing inclination towards dancing within this cohort. Moreover, it is worth noting that out of the total sample size of 51 participants, a significant majority of 96.1% were individuals with hearing impairments. This observation underscores the specific demography that our research aims to investigate. Regarding previous dancing experiences, it was found that 58% of individuals with hearing impairments engaged in autonomous dancing, while 28% participated in dancing activities alongside friends, and 14% sought the assistance of a professional dancing instructor. It is worth mentioning that a significant majority of participants, namely 84.3%, expressed dissatisfaction with the results of their prior dance learning methods. This finding emphasizes the necessity for novel and

efficient ways to dance instruction that are specifically designed to cater to the unique needs of those with hearing impairments.

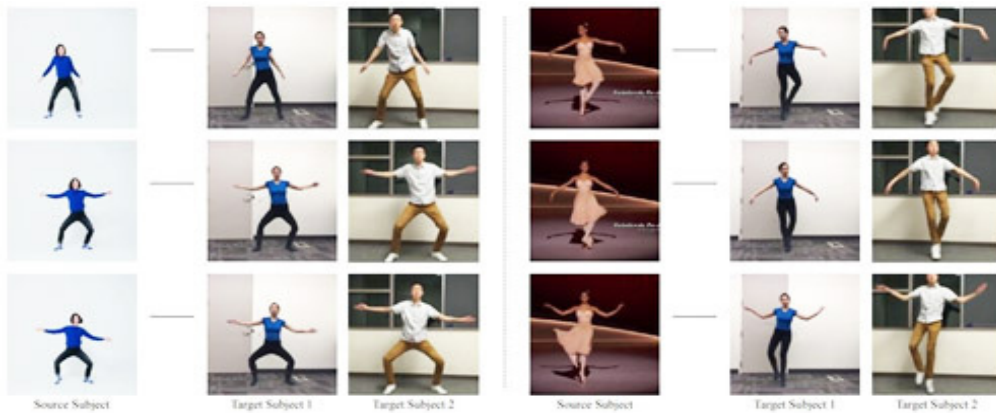
The discoveries shed light on the difficulties encountered by individuals with hearing impairments in their endeavor to engage in dance, underscoring the importance of tailored and inclusive approaches to dance education. The data emphasizes the pressing nature of our study goals, emphasizing the significance of enabling individuals with hearing impairments to independently engage in the domain of dance. This would not only improve their general quality of life but also enable them to fully realize their creative capabilities.

The results pertaining to the participants' prior encounters with dance applications and their inclinations towards a novel dancing training application provide insights into their learning preferences. Significantly, every participant affirmed that they had not used any software or program for the purpose of acquiring dance skills previous to the survey. This observation indicates a noteworthy deficiency in the provision or reach of dance instructional resources specifically designed for those with hearing impairments.

It is noteworthy that a considerable majority, accounting for 78.4% of the participants, exhibited a pronounced inclination towards utilizing a mobile application for the purpose of acquiring dancing skills. The strong inclination expressed here underscores the sincere enthusiasm and drive among individuals with hearing impairments to participate in dance education via digital platforms. Furthermore, it is worth noting that 21.6% of the participants expressed a likelihood of being interested in these applications, underscoring the considerable scope for a meticulously crafted dancing instruction application among individuals belonging to this specific demographic.

Based on the aforementioned data, it is apparent that the individuals with hearing impairments who participated in the survey had not yet availed themselves of dance education opportunities offered through applications. This observation suggests a deficiency in their access to appropriate resources. The substantial proportion of participants who expressed a strong desire to utilize a mobile application for dance instruction serves to underscore the want for a customized,

accessible, and all-encompassing dancing training platform. The provided data provides support for the notion that individuals with hearing impairments have restricted access to dance applications. This emphasizes the importance and timeliness of creating a novel and inclusive digital platform that addresses their unique educational requirements.



**Figure 01 : Capturing of moment**

The research study demonstrates the implementation of a continuous monitoring system for the purpose of tracking and correcting any erroneous movements exhibited by deaf dancers. In this research study, the researcher posits a hypothesis that individuals with hearing impairments have not previously utilized an application for independent dance learning. The findings of this study indicate that participants have not before utilized a self-guided dance learning program. To tackle this issue, researchers have devised an application that monitors the movements of deaf dancers and rectifies any erroneous dance movements. This is accomplished by employing a machine learning model and utilizing TensorFlow Keras to train the model on customized data.

This study is subject to some limitations that necessitate additional research. The research study had a relatively small sample size compared to the larger sample, which may potentially restrict the generalizability of the findings. Furthermore, the researcher was constrained by a limited time frame to carry out the research investigation. In order to enhance the efficacy of future research

endeavors, it is recommended that subsequent studies employ a more extensive data collection and a prolonged time length to facilitate the training of individuals with hearing impairments and to effectively track their progress and advancements.

## **Conclusion**

The primary objective of this research study was to develop a dance training program specifically designed for those with hearing impairments. The primary objective of this study was to document and analyze the dance movements in order to determine their alignment with the prescribed dance motions. The machine learning model that was developed successfully achieved the goal of continuously monitoring a dancer with hearing impairment. It accurately estimated the dancer's pose and compared it to the correct pose. Additionally, the model corrected the dancer's pose and provided instructions to the dancer, who is deaf, in order to rectify any incorrect poses. This study has filled a gap in the existing research, as identified by the researcher. The proposed system aims to teach a specific dancing style to those with hearing impairments, while also introducing novel characteristics that have not been explored by previous researchers.

The implementation involves the continuous monitoring of the movements in a dancing motion performed by an individual with hearing impairment. This work has the potential to inform future research endeavors pertaining to movement capturing techniques and potential areas for development.

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