One-Man Orchestra: Conducting Smartphone Orchestra

http://musicconductorfyp.blogspot.hk/

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Figure 1: Our one-man orchestra platform allows a single human conductor to control music performance of a set of smartphone devices using bimanual conducting gestures. The system consists of two Leap motion controllers and a varying number of smartphone devices.

1. Introduction

This work presents a new platform for performing one-man orchestra (Figure 1). The conductor is the only human involved, who uses traditional bimanual conducting gestures to interactively direct the performance of smartphones instead of human performers in a real-world orchestra. Each smartphone acts as a virtual performer who plays a certain music instrument like piano and violin. Our work not only allows ordinary people to experience music conducting but also provides a training platform so that students can practice music conducting with a unique listening experience.

2. Related Work

Various paradigms for music creation and performance using new technologies have been proposed. For example, Levin at al. [2001] have performed a large-scale concert whose sounds are wholly produced through the carefully choreographed ringing of the audience’s own mobile phones. Laptop orchestra and mobile phone orchestra have been explored by the researchers from Stanford [Wang et al. 2009] and Princeton [Oh et al. 2010], respectively. Although laptops and smartphones are used as their main music instruments, they still have to be performed by human musicians, who are unified by human conductors. Kapur et al. [2011] introduce the Machine Orchestra, where robotic musical instruments together with laptops are used and controlled by human performers.

The latest motion sensing technologies such as Microsoft Kinect and Leap Motion support real-time performance capture of users and allow effective human-computer interaction via gestural interfaces, thus enabling new ways of virtual conducting. The early efforts have focused on virtual conducting using a single computer\(^1\), which is not sufficient to closely mimic the performance of an orchestra, consisting of an ensemble of instruments arranged in different sections. The Computer Orchestra proposed by Diesbach et al. [2013] allows one human conductor to control 24 laptops using a Kinect sensor. Each laptop is mapped to a motion detection zone for activation and manipulation. Very recently the design studio WhiteVOID [2014] presents an interactive installation that consists of a Leap motion sensor, a touchscreen and 13 upright speakers with digital displays on them. The system calculates a player’s speed based on the pendulum interval of her movement and adjusts the tempo correspondingly. Our work gets inspirations from [Diesbach et al. 2013; WhiteVOID 2014] but aims to support a more complete set of traditional conducting gestures, which are currently missing in the existing systems.

3. Methodology

Our one-man orchestra consists of one human conductor, two Leap motion controllers, and a varying number of smartphones.

Unlike [Diesbach et al. 2013; WhiteVOID 2014], which mainly support unimanual gestures only, we aim for bimanual gestures, which are vital for real-world conducting. Although a Leap motion controller has a super-wide 150° field of view, it is still insufficient to capture dramatic movement of two hands of the conductor. We thus decided to use two Leap motion controllers, which are placed at a specific distance away from each other to mitigate the interference between them. Since the Leap Motion SDK does not allow to connect multiple Leap controllers to a single PC, we connect one Leap to one PC and then combine the data through TCP/IP.

\(^1\) https://www.youtube.com/watch?v=WW8dYoohGYKg
https://www.youtube.com/watch?v=TjF8JN5aVfc
As shown in Figure 1, the conductor may use her left hand for a pointing gesture to select a smartphone of interest and then control the volume by moving her left hand up or down. The conductor typically holds a baton with her right hand for the main gestures. For example she may use the size and speed of the conducting movements to control the dynamics and tempo, respectively.

Again through TCP/IP, the mid-air gestures captured by the Leap controllers are then sent to our smartphone devices, Android devices in our implementation. We design a simple app to mimic different music instruments that respond to the gestures issued by the conductor. Since the smartphones have their own sound sources, placing them at various locations gives a unique listening experience. Our platform supports dynamic addition of smartphones, which will be automatically synchronized with the existing ones.

References


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