Air-Guitar Control of Interactive Rhythmic Robots

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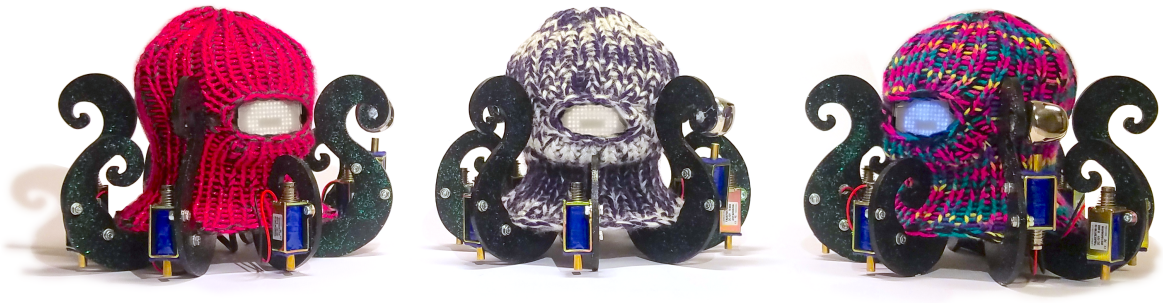

Figure 1: Dr Squiggles Interactive Tapping robots

Abstract. This paper describes an interactive art installation shown at ICLI in Trondheim in March 2020. The installation comprised three musical robots (Dr. Squiggles) that play rhythms by tapping. Visitors were invited to wear muscle-sensor armbands, through which they could control the robots by performing 'air-guitar'-like gestures.

Keywords: musical robots, Myo, muscle sensor, EMG, tapping, rhythm, HRI, CHI, HCI, interaction, air-guitar, art installation, music, sound, Dr. Squiggles, evolutionary algorithms, machine learning, tapping, octopus

Background

This installation brings together a few separate research projects within RITMO Centre for Interdisciplinary Studies in Rhythm, Time and Motion at the University of Oslo. These are as follows:

Dr. Squiggles

Dr. Squiggles (Figure 1) is a robot that plays rhythms by tapping. It normally listens to rhythms played by humans or other robots, and attempts to play along. We are using Dr. Squiggles to study fun and enjoyment in human–machine interaction. What makes some interactive systems a pleasure to use, and why do people choose certain objects as the focus of lifelong hobbies? How should the robot behave in order to maximize enjoyment and help people gain musical skills?

Expressive Guitar Performance

A number of projects at RITMO focus on various types of human music-related body movement, including that of performance on acoustic musical instruments. We have recently carried out a study of guitarists, using optical motion capture, inertial sensors, and myoelectric sensors. The aim is to understand more about the links between overt and covert bodily expressions during music performance. The next step is to use this knowledge in the creation of new expressive digital instruments.

Figure 2: A human performer interacts with three Dr. Squiggles robots. Two Myo muscle-sensors can be seen on the arms of the human performer. The robots tap on metal rods on the table.

Rhythmic Algorithms

The algorithms employed in our installation consist of adaptive sequencers that send instructions about the generated rhythms to the robots. The aforementioned myoelectric sensors are used to interactively adjust parameters of the algorithms, which is again used to perturb the rhythms. An underlying question is how we can use artificial intelligence and optimization algorithms to make the rhythms produced by the robots more interesting?

Installation

This installation explores expressive bodily control of a collective of rhythmic robots. Visitors are invited to wear muscle-sensors on their arms and perform 'air-guitar'-like gestures: strumming, moving their fretting arm and fingers, and tapping their foot. The robots each independently generate some rhythms. They synchronize with each other and with the human performer in a way that is inspired by biological rhythms. Although each robot is fully autonomous, the overall music played by the ensemble is influenced by metaphors associated with the gestures of the human performer. For example, more strumming creates more dense music. The setup is shown in Figure 2.

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