DRAFT: Can a humanoid-robot be used as a model of simple movement to analyse the movement variability accross participants and across movements?

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ABSTRACT

This paper provides ...

CCS Concepts

•Computer systems organization → External interfaces for robotics;

Keywords

Humanoid dance robot, movement variability, Wearable sensors, Inertial sensors

1. INTRODUCTION

The use of humanoid-robots has been increasing for training and demonstration of dance movements. For instance, Fung *et al.* made movement comparison of two low-cost humanoid robots for implementation and demonstration of simple Thai dance activities [1]. Xia *et al.* implemented automatic humanoid-robot dancing with NAO which is driven by the beats and emotions of the music [6]. Similarly, NAO acted as a tutor to guide children to teach dance with the *concept-based learning* in which the robot guides the child thorough different stages of dance [4, 3]. In the same vein of dancing with robots, *Keepon*, a non-humanoid-robot, showed a positive effect on the children's rhythmic behavior. For example, some children tried to make the robot synchronise its movements to the music, some other children exaggeratedly danced to the music when the robot was not synchronised; while other children imitate robot's movements to the point of ignoring the musical rhythm, and one important behavior was that the synchrony of the children with the music was more prevalent than the robot movement [2]. Tsuchida *et al.* explored the dancing feeling with an actual dancer in four scenarios (dancing with a dancer, dancing alone, dancing with a self-propelled robot and dancing with a projected video) of which they managed to make people feel like they were dancing with a dancer when dancing with a self-propelled robot and dancing with a projected video [5]. However, none of the previous works have been analysed the movement of the participants whom interact with the robot. For this report, we are therefore asking if the use of NAO can be useful to analyse the variability across movements and across participants performing simple movements.

The report is divide in three sections: 2.

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2. METHODS

2.1 Research Questions

Can the use of a humanoid Robot help us to understand the measurement of movement variability accross participants and accross movevements? How the variability of a movement can be related to the dexterity of the performance of such movement?

2.2 Hyphotheses

We belive that the outcome that this preliminary experiment can help us to understand the variability of simple movements which for future outcomes the variablity of the movements can be linked with the leve dexterity of users and more importantly provide feedback to move better.

2.3 Participants

Twelve participants.

2.4 Procedure

Participants were asked to follow two simple movements which were performed by a NAO robot. Two inertial sensors were attached to the right hand of the robot and two intertial sensors were attached to the right hand of the participant. We use muse inertial sensors [ADD REF] which provide tri-axial data for the accelerometer, gyroscope and magnetometer as well as quaternions.

3. PRELIMINARY RESULTS AND OUTGOING DATA ANALYSIS

Please see Figure 1

4. FUTURE WORK

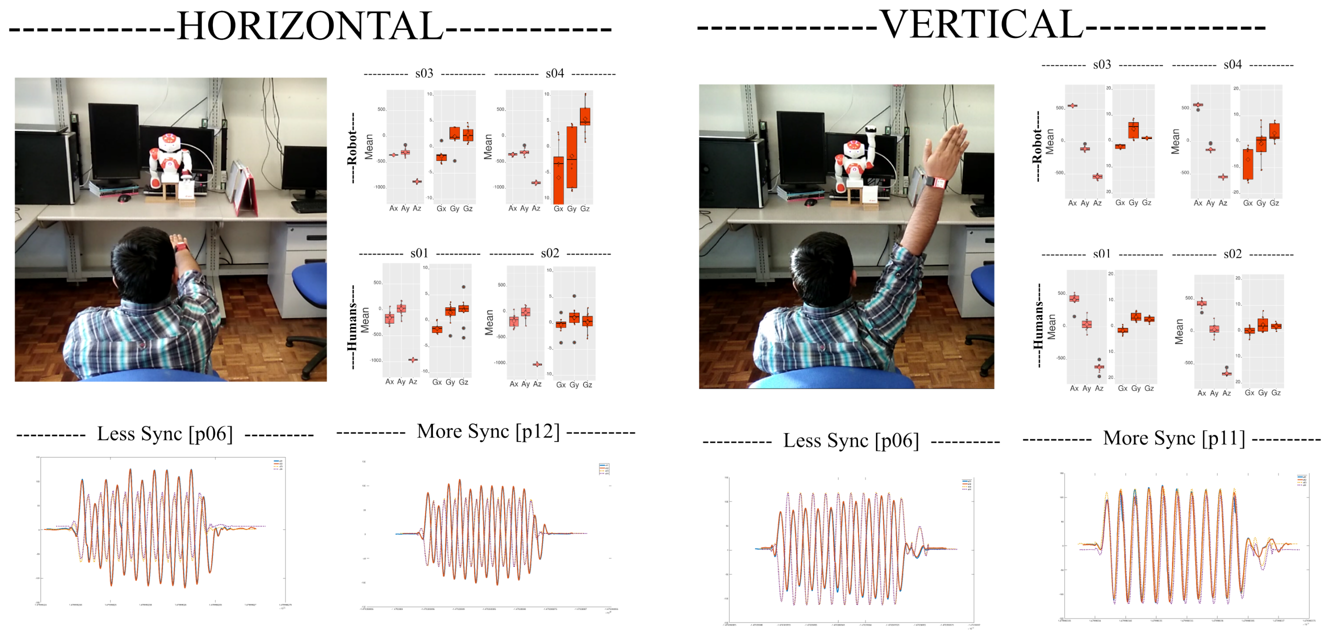

Figure 1: Ten repetitions of vertical and horizontal movement were performed by twelve participants following a humanoid robot. Error bars present the mean values for ACC and GYR sensors for participants and the robot of which the sensors 01 and 02 were attached to participants and the sensors 03 and 04 were attached to the robot. (x) Time-series for s01-s04 for less and more sync horizontal movement with respect to the robot. (z) Time-series for s01-s04 for less and more sync vertical movement with respect to the robot.

Collect data from more participants whom will perform complex movements in groups. Take advantage of the Deep Neural Networks to automatically clasify the quality of the movements according to how well the participants are in sync with the movements.

5. ACKNOWLEDGMENTS

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