POS-004

Applying Machine Learning technique to Evaluate the Developmental Degree of Musical Expression in Early Childhood

Mina Sano
Osaka-Shoin-Women's University, Japan

Abstract

The author proposes to develop methodology to employ AI-based evaluation process on musical expression of body movement. Little researches using machine learning has been employed to the domain of early childhood education due to difficulty of applying quantitative approach on highly skilled profile.

This study aims to validate appropriate feature quantities calculated from 3D motion capture to facilitate quantitative models. Utilizing ANOVA, statistically effective data sets were chosen to coordinate to educate series of machine learning classifiers to fit to observations. In total, five classifiers were attempted to predict output of 3 levels of developmental degrees of musical expression with input of 13 kinetic feature quantities. Children who participated in the practice of musical expression program were 3-year-old, 4-year-old, and 5-year-old (n=76) whose activities were motion captured and simultaneously video recorded. The author evaluated developmental degrees into 3 levels based on the videos. For training process of machine learning, such 76 data sets were applied to classifiers to fit to observations. Among trained classifiers, decision tree (Boosted Trees and Random forest) and neural networks (Multi-Layer Perceptron "MLP" and Radial Basis Function "RBF") showed fair fitting. After algorithms trained, classifiers were applied to feature quantities captured from different children in 2018 (n=128). As this attempt successfully achieved fair accuracy level, the author increased data sets and adopted additional classifiers to enhance prediction confidence. Training data sets of 76 children in 2016 were again applied to the new data sets acquired in 2019 (n=87) to conduct classification and discrimination. According to the derived outcome in 2019, the classification accuracy of C & RT (Classification & Regression Trees) was the highest at 42.53% (High: 13, Medium: 5, Low: 19), and the classification accuracy of Boosted Trees as decision tree was 39.08%. As a result, based on classification accuracy from confusion matrix and sensitivity analysis, C & RT as decision tree showed superior prediction. The highest contributing factor of sensitivity analysis was the moving average acceleration of pelvis. Next, the ones having the greatest influence were the moving distance of right foot and the moving distance of right hand.

The author presented a quantitative framework to handle full-body movement of children and empirically applied its musical expression nature to computer based classifiers of predicting developmental degrees. The framework will provide objective aspect of evaluation process of musical expression and will help to achieve assurance of certain level of educators' skill.

Key words: machine learning, motion capture data, classifiers, Classification & Regression Trees, predicting developmental degrees of musical expression