NCSA SPIN FELLOW

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Project Objective

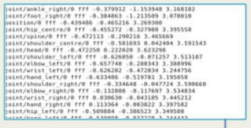
Teach a computer program simple human movements using machine learning, then utilize that data to process human movement in real time, identifying specific gestures, actions, and intentions.

Approach

To generalize the gestures, we separate movement into the 8 **Laban** Effort Actions: Float, Dab, Slash, Wring, Punch, Glide, Flick, Press

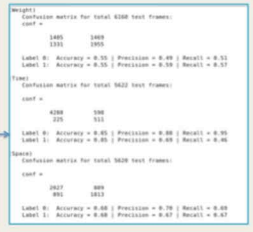
1. Capturing raw data by using Microsoft KINECT
2. Pass the raw data into a feature extraction function.
3. Use the Naïve Bayes algorithms to classify the the extracted features.
4. Validate each feature function as a classifier with clustering, improving the accuracy.

Status



Step1. Raw data set (XYZ Position)

Step2. Feature Extraction Function



Step3. Result (confusion matrix with all the features)

As the result shows, the Naive Bayes classification is poor. To improve the accuracy of classification. we need to validate each feature function to be on correct hyper plane.

Future Research:
There are two alternative way to improve the result.

1. Using different algorithm for machine learning, such as Support Vector Machine(SVM), Hidden Markov's Model(HMM) etc..
2. Validate all of feature function and interpret meaning on classification.

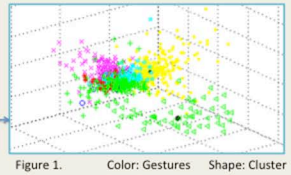


Figure 1. Color: Gestures Shape: Cluster
Black Dot: Centroid

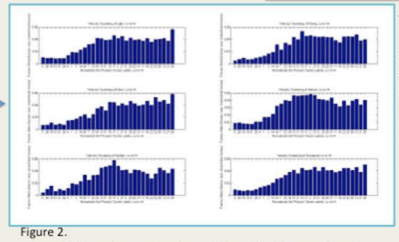


Figure 2.

Step4. Clustering method to validate the feature function.
Figure 1. is clustering based on velocity data.
Figure 2. is clustering based on Normalize Dot Product.

The figure 1, and figure 2's accuracy are not always better than accuracy of Naïve Bayes. However, at least for specify efforts, it has better than Naïve Bayes.

Efforts	Figure 1.	Figure 2.
Light	0.6839	0.5215
Strong	0.6055	0.5221
Direct	0.4680	0.4972
Indirect	0.7770	0.6267
Sudden	0.8002	0.5573
Sustained	0.5170	0.5250

Questions

- What is the importance of classifying the human Action?
- What is the possible obstacle to predict the gestures?
- What is the real life application?