

Tennis gets smart: Machine Learning Based Tennis Personal Coach



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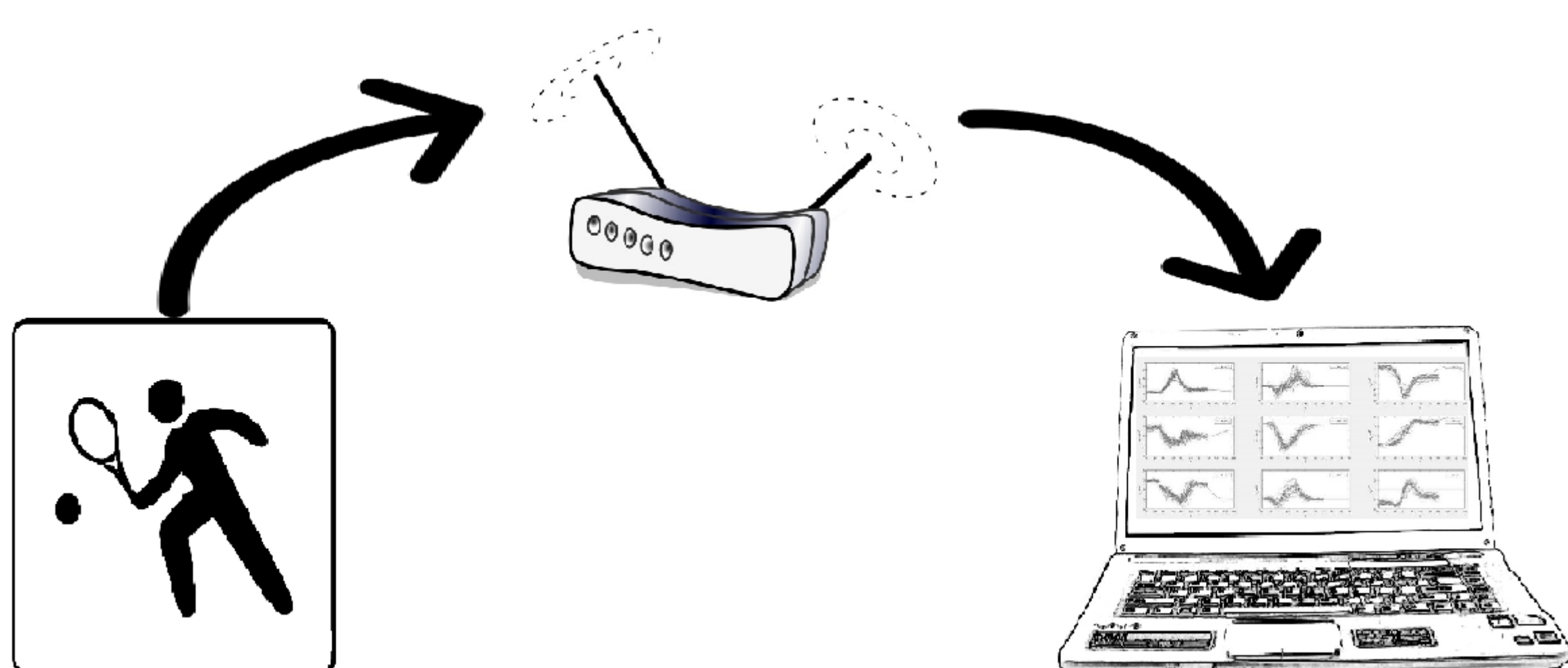
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Introduction

Tennis is a fun game to play, however quite difficult to get better at it: a Tennis club membership is usually the only option for ambitious players who want to level up their game. This comes with a big cost and time commitment.

Fortunately, a smart racket may replace the effort of a personal trainer at the club as well as the pricey bill that follows. The project is an alternative of a personal coach while training, where it guides the player via live feedback of his tennis moves in order to develop a proper technique.

Hardware Setup



Client Side

- 9-axis MPU-9150™ [Gyroscope / Compass / Accelerometer]
- Intel Edison module Broadcasts sensor data

Server Side

- Live data plotting
- On-the-fly classification of data to detect swings
- Display game statistics

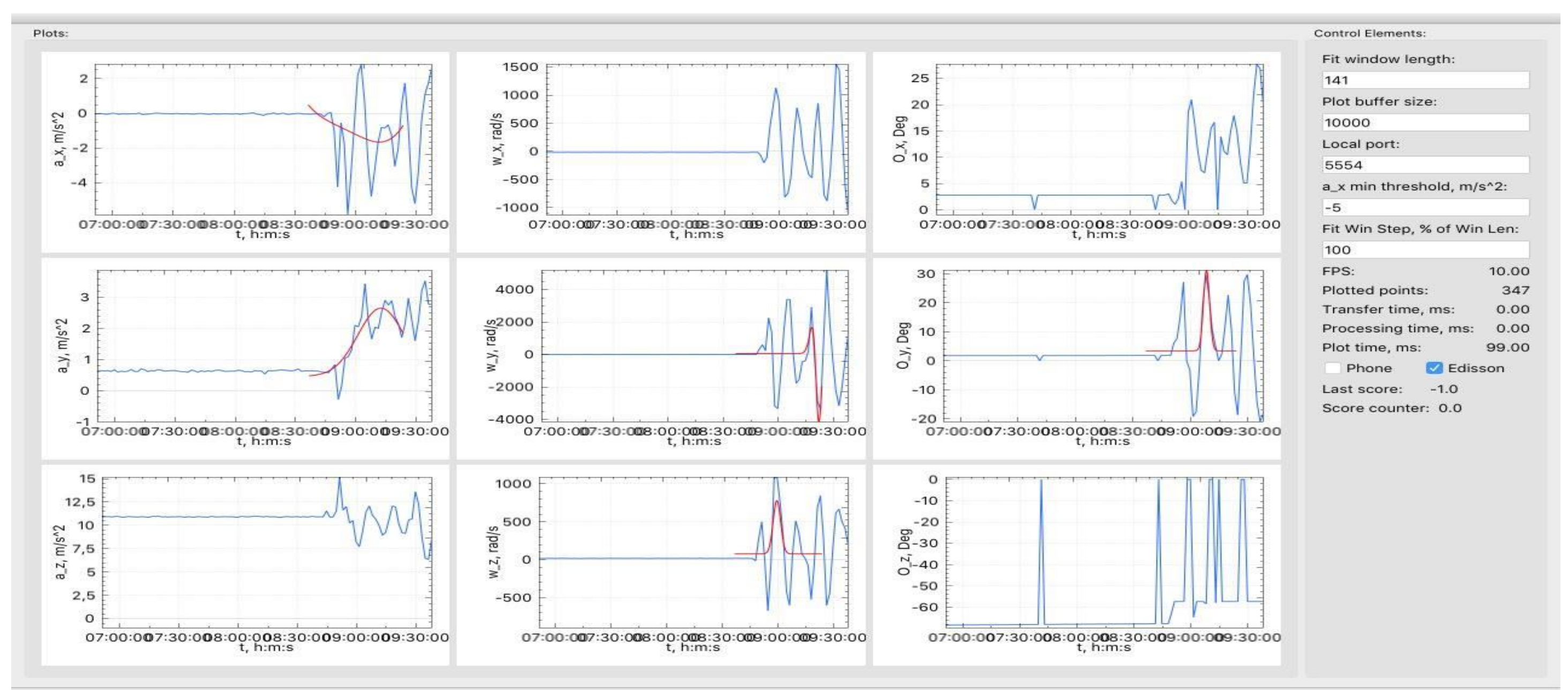
Theory & Methods

Sensor data streams were recorded while performing 93 tennis swings. 5 out of 9 sensor data channels were modeled using 1st and 2nd gaussian distributions. The models have served as a training set for a classifier using the Linear Discriminant Analysis (LDA) algorithm.

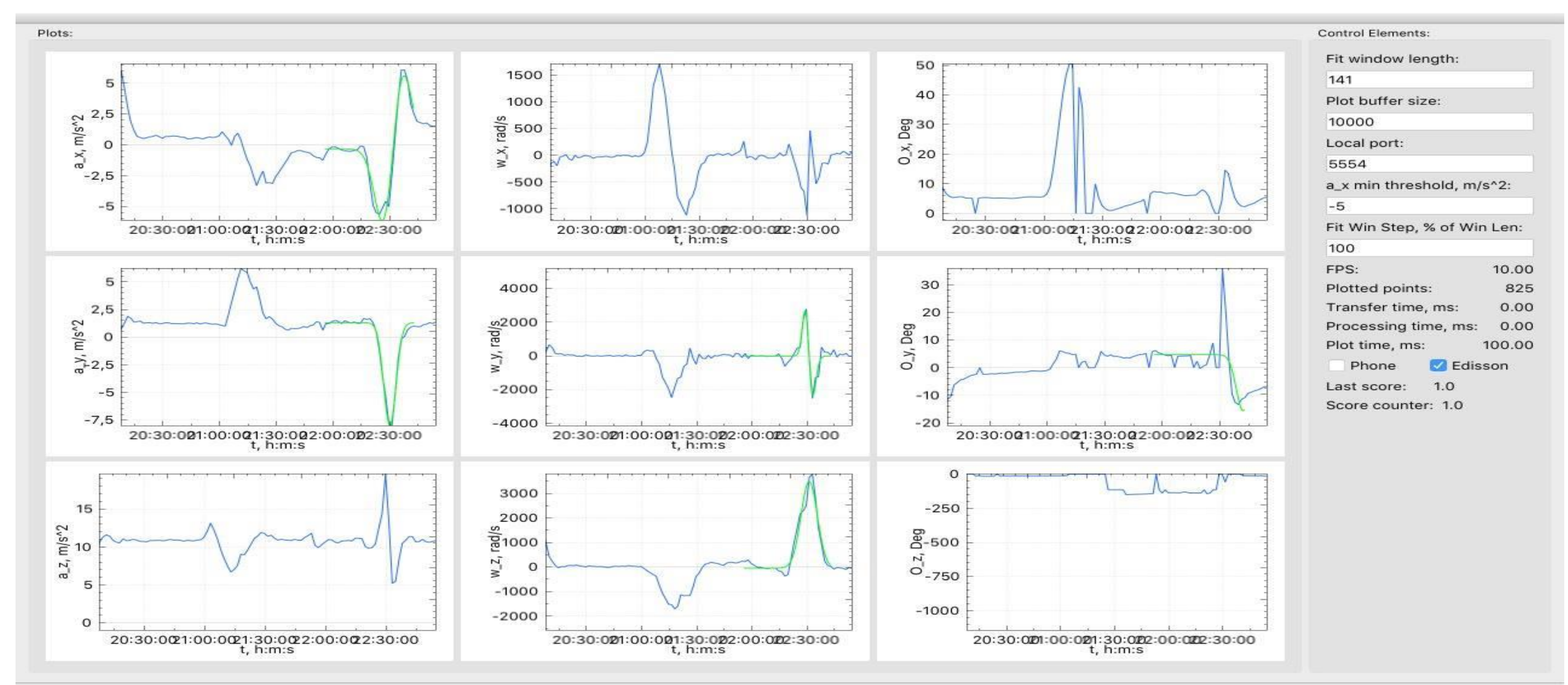
Once the classifier is defined, the player may play and track his movements through the 9 sensors' data feed plotted live. The classifier predicts on the fly whether a swing has taken place or not.

Results

Server side application receiving data, plotting them and predicting goodness of swings based on the training set already provided:



Data plotted and predicted correctly as a wrong swing move



Data plotted and predicted correctly as a correct swing move

Future Work

The challenge addressed in this project revolves around reducing the dimensionality of the classification problem: algorithm was used to easily classify 26 features of gaussian distribution models representing 5 sensor data channels. The system can be improved through the following:

- Record more data for the training set for better swing prediction accuracy.
- Train a classifier with nonlinear characteristics.
- Better signal filtering.
- Train the system automatically while playing.
- Compare swing quality in comparison to the training set.
- Provide live feedback along with game statistics and estimated calories burned through a smartwatch