Gesture Control for Remote Rugby Score Board

Erik Crispin, Lillian Kolb and Kayla Malherbe | Persephone-Green

INTRO

The Gesture-Controlled Interface facilitates real-time remote control of a Rugby score board. The wearable device, designed for referees, utilises hand gesture recognition powered by a machine learning (ML) model running on a connected PC.

SYSTEM OVERVIEW

The system's mobile node (B-L4S5I-IOT01A Discovery) integrates an accelerometer and a gyroscope, providing comprehensive 3D motion and orientation tracking. This mobile node communicates with the base node (NRF52840dk) via connection-oriented Bluetooth. The base node then interfaces with the PC node using a Universal Asynchronous Receiver/Transmitter (UART) connection.

Data from the mobile device is transmitted to the PC, where a data window undergoes mathematical evaluation to extract key features from the two sensors such as maximum and minimum values, entropy, standard deviation, and other relevant coefficients. The evaluated data is then classified by a trained Random Forest ML algorithm. The resulting classifications are sent back to the base node via UART and subsequently transmitted to the LED scoreboard (actuator) using advertising Bluetooth.

FINDINGS

Bluetooth limitations

The speed of transmission constrained the system's ability to respond quickly to movements. The solution was to implement connection-oriented Bluetooth, which streamlined packets and significantly improved transmission speed.

Additionally, the effective range of Bluetooth presents a limitation, with increased distance leading to slower transmission rates and a higher likelihood of packet loss.

ML Training Requirements

Effectively training ML models for real-world applications requires extensive training. With over 10,000 data points, 94% accuracy can be achieved within controlled conditions; however, ensuring robust performance in diverse real-world scenarios demands comprehensive datasets including a variety of situations, user behaviour and environmental factors.