Lab: Introductory Embedded Machine Learning with Arduino Nano 33 BLE Sense

This lab prompt is designed for 100-200 level courses as an introductory exploration of embedded machine learning. After completing the preceding studios, follow the steps outlined below to design a boxing training app that will classify punches on two levels: punch or no punch, and if there is a punch, which style. A completed version of all steps in the lab are provided for guidance. The provided lab classifies punches into straight, hook, or uppercut.

For your lab, use different punches/motions than the example design lab.

1. Install the Arduino IDE and create a program. Reference Studio: 1.Arduino Nano Accelerometer for help on setting up the system.
2. Collect accelerometer data on the Arduino Nano 33 BLE Sense board. Modify the provided script to print data in the [timestamp, received, accX, accY, accZ] format.
3. Create a Python script to export the collected data from the Arduino serial monitor to the local computer using serial communication.
4. Connect two Arduino Nano boards via Bluetooth. See Studio: 2.Bluetooth with Arduino Nano.
5. Make a combined script that collects and saves data via Bluetooth by combining scripts from steps 2-4.
6. Create a design of experiment (D.O.E.) to outline the data that should be collected. See Studio: 4.Data Collection.
7. Design and build the hardware for the peripheral Arduino Nano. See Studio: 3.Designing the Hardware.
8. Collect data based on the D.O.E. in step 6, using the hardware in step 7 and script from step 5.
9. Using the Analyze tab in the provided GUI from the design lab, export segments of data that correspond to punches for each collected data CSV. See Studio: 5.Data Cleaning and Preprocessing.
10. Upload the data segments to Edge Impulse, using a two model design. See Studio 6:Machine Learning with Edge Impulse and Studio: 8.Combining Models.
11. Train the models in Edge Impulse. See Studio: 6.Machine Learning with Edge Impulse. Compared to the studio, you will likely have to do more parameter and filter tuning before finalizing the model. However, be careful with overturning. See Studio: 7.Model Performance.
12. Test and deploy the models using the final hardware. See Studio: 9.Deploying Models.
13. Bonus: Create a Graphical User Interface to present to a customer as a final product. See Studio: 10.Graphical User Interface.

Lab: Advanced Embedded Machine Learning with Arduino Nano 33 BLE Sense
This lab prompt is designed for 300-400 level courses as an advanced embedded machine learning project. After reviewing the preceding studios, create a motion recognition training project, similar to the one discussed in the studios. Your project should classify if there is a motion or not, and if so, what type of motion. Choose a motion/sport, other than boxing, to base your project on. This is a design project: please add creative design features on top of those covered in the studios to enhance the final product.