EEE8126: Embedded Systems Architecture and Programming
Lab Test (Part of Project 2): C/C++in Embedded Programming
Module Instructor: Dr Rishad Shafik
[THIS TEST CONSTITUTES 25% OF THE TOTAL MODULE]

Submission:

- A PDF document containing the circuit diagram, showing/explaining connections. Please label the connections carefully. Max: 1 page.
- The embedded code file from Arduino Nano, showing the implementation of the machine learning algorithms, annotated and commented in major places.
- On Blackboard by **11 Jan 2018: 23.59 hours** (please return all components to me by next Monday 14 Jan 2018).

Instructions:

Construct a circuit based on Arduino Nano that can sense light and show the feedback to the user through the red and green LEDs. Your code will process the light information sensed and provide with feedback as follows:

1. Use linear regression to understand how hand gestures can affect the light intensity. Use a number of hand gestures to block the light into the photo sensor from different distances and see if you can read the light from the sensor and predict the hand movement/distance. You can use approximate distance calculations with +-10% errors. Note that you should first run a set of test movements to train the system. For example, you can ask the user to position to hand at a certain distances first to train your regressor.
2. When you have learnt the distance and light intensity relationship, use the regressor to identify/predict the hand distance from the light sensor and control the output LEDs as follows:
   a. If the hand is more than (e.g.) 10cm away, both LEDs should be off.
   b. As the hand approaches the green LED intensity should increase; every 1cm movement towards the light sensor should increase the green LED intensity by 20%.
   c. When the hand is within (e.g.) 5cm distance, the red LED will also start to glow. Every 1cm movement should increase the red LED intensity by 30%.
   d. When the hand is positioned very near the sensor, e.g. 1 or 2cm both LEDs should glow at full intensity.
   e. Use appropriate time delays in each iteration of your loop, to ensure suitably responsive solution (e.g. not too sensitive, not too insensitive).
3. For quick references to linear regression and gradient descent: see https://tinyurl.com/yd5p4vqp.

Marking Instructions

Features	Marks
All basic requirements met, plus the hardware/program is working as expected (with comments put in the appropriate places)	90-100%
Not all basic requirements met, but the program is approximately correct (or lacking appropriate coding formats and comments)	70-80%
Program is in working order, all classes are designed per se, but the main function is not functional yet	50-60%
Program is not working, the classes are inappropriately designed	10-40%
No show	0%