Study and Implementation of Artificial Neural Networks in low powered Embedded Systems

R.Lokesh Krishna,Vedansh Yadav

Guide:Dr.Amritanshu Pandey

Abstract:

The era of machine learning was hugely promoted by the drastic growth of computational capabilities and a high amount of parallelism in such computers.The pre existing CPU and GPU based platforms do a great job in training these neural networks but they fairly satisfy the demands of deployment in real life cases and mobile applications.Thus, there is growing demand for relatively low profile embedded systems to deploy compromisable and cost efficient Machine learning related solutions in day to day automation and human free areas of operation.Through this project we try to study and implement a ANN based framework on the famous 8bit microcontroller atmega328 and compare it with pre existing methodologies.

Problem Statement:

The task of shape and colour detection is quite frequently needed in various aspects of our lives nowadays,but it requires seemingly high profile hardware than it really it needs.The general approach is to use a webcam and a full fledged desktop like arrangement or at the minimum to use a raspberry pi and pi cam to solve the above problem.Our team upon investigation found the need for such amount of sophisticated systems irrelevant and bit of overkill for the task in hand.Hence we decided to develop a cost efficient implementation and compare its performance with pre existing approaches.

Problem Formulation:

- Our approach is twofold,we formulate it as a more generalized frame work were any seemingly complex task that demands a high end hardware and a large Neural Network to solve can be diminished into a more collective task , with smaller Neural networks solving smaller and simpler tasks and together will be combined to solve the overall complex task.Thus smaller neural network will require relatively way cheaper resources as in our case.
- We propose to build a robot with locomotion,perception and shape/colour detection capabilities with the utmost minimalistic hardware possible.We have decided to use the **OV7670 camera** module couple up with the **arduino uno /** and run a neural network (**Multi layer Perceptron**) locally ,onboard the robot with no form of centralized server type processing required and solve the problem of shape detection.