

Introduction to Machine Learning (EL-GY 9123) – Spring 18

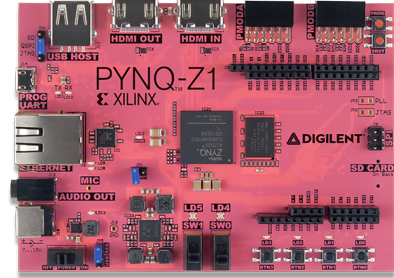
Project Plan – Anurag Marwah (am8482@nyu.edu)

Team Members

- Anurag Marwah (Net ID: am8482)

Project Title

VGGNet on FPGA – “An Image Classifier using a pre-trained Convolutional Neural Network and its FPGA Implementation”



Project Abstract

The objective is to perform image classification using a pre-trained Convolutional Neural Network from Keras Applications [1], implement it on an FPGA board, and compare its running time with its PC implementation. The CNN in consideration is VGGNet [2] and the FPGA board to be used is Digilent Pynq-Z1 [3][4], which houses the Xilinx Zynq SoC, and has native support to Linux, Python APIs, and runs Jupyter Notebook. The FPGA design is generated via a software Xilinx Vivado HLS and then programmed through a micro-SD card. The board runs Linux on boot-up and interfaces with the PC via the USB for the Linux Terminal, and via the Ethernet for the Jupyter Notebook interface, which is accessible through any browser on the PC using the Ethernet IP Address and Port information of the FPGA board. The test data for classification would comprise of a set of images downloaded from the ImageNet website [5] via the Python Flickr API [6]. The intent is to keep the image categories mutually exclusive.

Github Link

The Github link for the project is given below:

<https://github.com/anuragmarwah/VGGNet-on-FPGA>

Milestones

S. No.	Task – Sub-Task	Expected Date of Completion	Current Status
1	Create Github Repository	April 23, 2018	Completed
2	FPGA Board		
2-a	Search and finalize an FPGA Board that can interface with Jupyter Notebook	May 1, 2018	Completed
2-b	Purchase the FPGA Board online	May 2, 2018	Completed
2-c	Learn how to use Vivado HLS Software	May 6, 2018	Yet to start
2-d	Receive the FPGA Board	May 10, 2018	Yet to start

2-e	Run a sample program made using Vivado on the FPGA Board	May 11, 2018	Yet to start
2-f	Install python libraries on the FPGA board that are necessary for machine learning	May 11, 2018	Yet to start
3	<i>Jupyter Notebook File</i>		
3-a	Import the VGG Model	May 2, 2018	Completed
3-b	Finalize a list of Test Classes	May 3, 2018	Pending
3-c	Download the Test Data	May 3, 2018	Pending
3-d	Pre-process the Test Data	May 4, 2018	Pending
3-e	Predict the Output Class	May 4, 2018	Pending
3-f	Print the Run-time	May 4, 2018	Pending
3-g	Print the Test Accuracy	May 4, 2018	Pending
4	<i>FPGA Implementation of VGGNet</i>		
4-a	Design the Vivado HLS model for the project	May 13, 2018	Yet to start
4-b	Generate Bitstream file	May 14, 2018	Yet to start
4-c	Create TCL file	May 14, 2018	Yet to start
4-d	Program the FPGA	May 14, 2018	Yet to start
4-e	Run the Jupyter Notebook File on the FPGA	May 14, 2018	Yet to start
4-f	Predict the Output Class	May 14, 2018	Yet to start
4-g	Print the Run-time	May 14, 2018	Yet to start
4-h	Print the Test Accuracy	May 14, 2018	Yet to start

Overall Project Status 18% Completed

References

1. Keras Applications Web-page ([Link](#))
2. VGGNet Research Paper – “VERY DEEP CONVOLUTIONAL NETWORKS FOR LARGE-SCALE IMAGE RECOGNITION – Karen Simonyan & Andrew Zisserman” ([Link](#))
3. Digilent Pynq-Z1 FPGA Board Reference Web-Page ([Link](#))
4. PYNQ-Z1 Board Reference Manual ([Link](#))
5. ImageNet website ([Link](#))
6. Python Flickr API ([Link](#))