

A  
PROJECT REPORT  
ON

# Prism: Graphics Accelerated Data Analysis using Deep Neural Networks

by

Parth Sane	113A1079
Santosh Shettar	113A1083
Amish Thakkar	113A1091

Under the guidance of  
**Prof. Ravindra Agarwal**

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NERUL, NAVI MUMBAI-400 012  
UNIVERSITY OF MUMBAI  
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## CERTIFICATE

This is to certify that project titled "Prism: Graphics Accelerated Data Analysis using Deep Neural Networks" is a bona-fide record of Project-B carried out by the following students of final year in Computer Engineering.

Sr. No.	Name here	Roll no here	Exam No.
1	Parth Sane	113A1079	
2	Santosh Shettar	113A1083	
3	Amish Thakkar	113A1091	

This project is carried out for the partial fulfillment of requirements for the degree of Bachelor of Engineering (B.E.) in Computer from University of Mumbai, Mumbai for academic year 2016-2017.

Prof. Ravindra Agarwal	Dr. Rizwana Shaikh	Dr. Vikram Patil
Guide (Internal)	Head of Department (Electronics and Telecommunication)	Principal (S.I.E.S. GST)

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We have examined this report as per university requirements at SIES Graduate School of Technology, Nerul, Navi Mumbai on -----

Signature:

Signature:

Name:

Name:

(Examiner-I)

(Examiner-II)

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## **Abstract**

When a customer of say a corporate telecom major like Airtel decreases spending on his or her number, they tend to provide more offers to the customer. Now this logic may sound straightway outrageous but this is true based on churn models. Churning refers to customers leaving a service and switching to another provider. The standard industry practice is to generate churn models for every consumer, so that they can provide business intelligence to increase customer retention and spending. Thus this translates to greater profit for a company. Although such processes can be carried out with a GPU, the software that exists like SAP handles everything on the CPU. This leads to longer delivery period for business intelligence and analytics which in turn means less time spent doing business and more time spent waiting. GPUs can generate huge number of threads and thus introduce parallelism in this area. In addition to the above advantage the churn models have assisted learning and cannot learn on its own unlike Deep Neural Networks which apply the concept of machine learning. This project aims to create a Windows based general purpose application to try predicting churn with better analytics. The scope of the project is limited to test data sets freely available on the internet as real data can only be obtained from corporates who are rather unlikely to share sensitive data with non-employees. Thus we aim to create a churn model that uses GPU based DNNs which not only will improve execution time for large data sets, it will also prove to be a huge plus point for corporate customers who want to use this software.

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# Chapter 1

## INTRODUCTION

The concept of our project is to build a churn model which helps in predicting whether a user may churn or not i.e the user changes or leaves the existing service provider. Project is implemented in Matlab as it allows for rapid prototyping. Churn modelling requires computing of large datasets. Our project mainly focuses on computing these large data sets with the help of GPU acceleration.

Our technique lies in the paper presented by Sane and Agrawal [8]. We convert the textual data into an image using Min-Max normalisation as described in the paper cited above. This conversion is an intermediate step which helps us feed data into the neural network. As mentioned the main highlight exists in preprocessing the data for predictive analysis [1].

### 1.1 Background

As we can see in [1] churn analysis and prediction is a big part of managing customer relationships. The idea behind this project was to fundamentally increase the efficiency of this analysis process by introducing the concept of Prism. The concept of Prism is to split the data and perform analysis on it parallelly on a Graphics Processing Unit (GPU). This decreases the time spent on analysing and executing neural networks by putting them on a GPU.

### 1.2 Objective

Objective of the project is to demonstrate a significant speedup in execution time of analysis of data sets on Neural Networks.



## **1.3 Purpose, Scope and applicability**

Purpose, Scope and Applicability are important parameters to be discussed to give a definite direction to the project. They are described briefly as follows:

### **1.3.1 Purpose**

The project aims to provide a way to analyse your dataset faster than ever before by cutting down time required by graphics accerelation via GPU compute technology.

### **1.3.2 Scope**

The scope of the project is to clean,extract and transform datasets to implement on a Neural Network.

### **1.3.3 Applicability**

Applicabilty of done work is universal in the sense that data is independent of language. As long as the dataset under consideration is numeric, the technique is applicable.

# Chapter 2

## LITERATURE SURVEY

### 2.1 Literature Survey

The highlight of the paper is the idea of using the normalized data as an image and using the generated image as input to the neural network. This concept was inspired by the paper on churn data model viewed as periods of time [2].

#### 2.1.1 Dataset Used for the Experiment

Our experiment required data to be processed and used as an input. This was obtained online from bigml [5]. We, thus, obtained a labelled dataset, which enables us to use supervised learning approach for our neural network. Here, our sample dataset appears to be monthly rather than weekly as compared to the dataset used by Wangperpong et al. [4]. Our sample dataset consists of rows - customers and columns as attributes associated with customers. The attributes, which are significant, are not identified in our dataset, but we only consider numeric values while trying to predict the churn rate.

#### 2.1.2 Pattern Matching and Clustering Neural Networks Using Supervised Learning

Furthermore, there has been a lot of work done in pattern matching via supervised learning. Schwenker et al. [6] describe this concept very clearly in their detailed analysis of the topic. This approach to supervised learning is heavily applied to neural networks [7], [8]. Neural networks thus find far and wide reaching applications that can have major impacts on society like the traffic camera system in the reference [9].

## **2.2 Problem Definition**

Customer retention is a huge requirement for any service based business. This is especially more emphasised in the Telecommunications industry where cellular carriers must retain customers to remain profitable or risk losing money. Churn analysis aims to predict the churn which is the act of a consumer leaving or switching service. Thus these predictions offer a chance to act on potential loss of subscribers. But this deep analysis of data using Neural Networks requires immense computing power and time both of which are critical in a subscription model of business. The problem is to create a technique to demonstrate speedup in the analysis process of churn data and then provide predictions with accuracy over 90% reliably.

# Chapter 3

## IMPLEMENTATION

### 3.1 Hardware

The main system has i7, 6700k processor with 16gb DDR4 RAM clocked at 2133MHz. Graphics Processing Unit (GPU) which is Nvidia Titan X (Maxwell Gen.) 12gb GDDR5 VRAM. This particular system was running Windows 10 Pro x64 build 1607. For the sake of comparison we implemented the project on MacBook Air 13 inch early 2015 edition with specs of intel core i5 at 1.6kHz and 4gb DDR 3 1600MHz. This particular system did not possess a discrete GPU. Therefore it provided a good benchmark analysis of a graphics enabled version vs CPU only version of the project. MacBook Air was running MacOS sierra as the operating system.

### 3.2 Software

Matlab was chosen as the software to build the project. Dealing with large amounts of data meant that we needed a quick way to evaluate results and import and export data conveniently. All these features were readily made available by Matlab and hence it was the ideal software for completing the project. The GPU acceleration provided by Matlab is through the Cuda runtime which is transparently available to the programs with only slight modifications required for GPU based code.

The following steps are taken in software to execute the project:

1. Import data from the data source.
2. Run transformation of the dataset to an image.

Table 3.1: SYSTEM CONFIGURATION FOR EXPERIMENTAL SYSTEMS

Processor	Physical RAM	CUDA GPU name	MATLAB GPU support	Operating system and build
Intel Core i7 6700k @ 4 GHz	2 8 GB Kingston DDR4 Non ECC @ 2133 MHz	NVIDIA Titan X Maxwell Architecture 12 GB GDDR5	Yes	Windows 10 64 bit Build 1607, Custom PC Build
Intel Core i5 @ 1.6 GHz	4 GB DDR3 Non ECC @ 1600 MHz	N/A	No	MacOS Sierra 10.12.2 Build 16C67 on MacBook Air Early 2015, 13 inch

# Chapter 4

## RESULT AND DISCUSSION

Result and discussion here.

- concept is all about
  1. Graphs;
  2. Result: 3.
    - a. Conclusion, b. Application;
- deals with the analysis and simulation studies.
- Advantages and disadvantages.

Table 4.1: EXECUTION TIME ON EXPERMENTAL SYSTEMS

Computer description	CPU execution time (seconds)	GPU execution time (seconds)
High End Custom PC	0.001553	0.001051
MacBook Air Early 2015	0.004755	N/A

## Chapter 5

# CONCLUSION AND FUTURE SCOPE

Conclusion here.

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