A Project Based Seminar Report

on

"Image Classification using CNN and TensorFlow"

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CERTIFICATE

This is to certify that the project based seminar report entitled "**Image Classification using CNN and TensorFlow**" being submitted by **Kajal Mohite(T150058588 / 3952** & **TE-09)** is a record of bonafide work carried out by him/her under the supervision and guidance of **Mrs. Jayashree Jagdale** in partial fulfillment of the requirement for **TE (Information Technology Engineering) – 2015 course** of Savitribai Phule Pune University, Pune in the academic year 2017-2018.

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ABSTRACT

The data in the real world is mostly in the form of unlabeled and unstructured format. Useful information cannot be easily derived from neural networks which are shallow i.e. the ones which have less number of hidden layers. Moreover, traditional classification methods face the noisy image problems. Hence deep neural network based convolutional neural network (CNN) classifier which has a large number of hidden layers and can derive meaningful information from images has been proposed by the researchers. The idea is of an image classification model using a convolutional neural network with TensorFlow. TensorFlow is a popular open source library for machine learning and deep neural networks. TensorFlow allows you to make the most of your available hardware. It also facilitates you with the language options to execute your computational graph.

A multi-category image dataset has been considered for the classification. Conventional back propagation neural network has an input layer, hidden layer, and an output layer but convolutional neural network, has a convolutional layer, and a max pooling layer. This proposed classifier was trained to calculate the decision boundary of the image dataset. Image features extracted by a CNN have achieved the state-of-the-art performance for image classification problems.

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CHAPTER 1
INTRODUCTION

1.1 Introduction To Image Processing

Digital image processing is the use of computer algorithms to perform image processing on digital images. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. Since images are defined over two dimensions (perhaps more) digital image processing may be modeled in the form of multidimensional systems.

Digital image processing has become the most common form of image processing and generally, is used because it is not only the most versatile method, but also the cheapest. Digital image processing technology has several applications. For example medical applications, space technology etc.

We wish to study the convolutional neural networks and deep learning technology for the classification of images. Further, from the implementation point of view we wish to deploy this technology and idea by using one of the most popular frameworks known as TensorFlow.

1.2 Motivation

Imaging can be defined as the representation of an object external form. That definition no longer holds true. More information within an image can be considered. Fluorescent tags, mechanical-biological parameters, internal structures are some of the recent additions. Fabrication while imaging and the characterization of materials as yet undefined can also be part of imaging. The extremely small images can be measured in nanometers also. Future imaging systems are expected to be less expensive. They will have to be easier to use. There are various types of imaging systems such as those used for chemical, optical, thermal, medical and molecular imaging.

The use of scanning techniques and statistical analyses for image analysis are needed to extract valid image values. The satellite applications programs of the future will be based on extensive research in the area of imaging. A number of different sensors will be used in the satellites orbiting the earth. Scientifically useful information will be extracted from these systems. New techniques will be needed to organize and classify the different sets of data obtainable from the orbiting satellites.

1.3 Aim and Objectives

The aim of the project is to design a image classification and recognition system which is both efficient and accurate.
We aim to build a model which helps the autonomous car to classify between the roads and helps it to recognize the traffic signs which thus prevents possible accents on the roads. Also the use of convolutional neural network to build this system removes the disadvantages of traditional computer vision model.Project objectives:
The purpose of image processing is divided into 5 groups:
Visualization : Observe the objects that are not visible.
Image Sharpening and restoration : To create a better image.
Image retrieval : Seek for the image of interest.
Measurement of pattern : Measures various objects in an image.
Image Recognition : Distinguish the objects in an image.
The main objective of the project is to improvise an image classification model for safety measures for automatic driving betterment with prevention of road accidents using traffic signs by improvising above mentioned key points.

1.4 Introduction

Image Processing today, has become the backbone of various applications and are utilized in a variety of areas including computer graphics, computer vision and much more. Image processing the method to convert image into digital form. Performing certain operation on the image to obtain the required information. It is the signal dispensation in which input is either image or video frame or photograph. Image Classification models are extremely useful in the industry today due to its wide applications such as Digital signature verification, medical applications etc.

CHAPTER 2

LITERATURE SURVEY

2.LITERATURE SURVEY OF Image Processing

Author	Title	Significance	Advantages	Disadvantages	Year
Famao Ye, Yenfein Sun, Hui Xiao	Remote Sensing Image Registration Using Convolutional Neural Network Features	Feature extraction Remote sensing Image registration Registers Robustness Transforms	The experimental result on multispectral SAR images demonstrated that proposed method provides performance compared with state of methods in terms of both accuracy and no. of correct corresponding using CNN.	CNN features from other models,such as AlexNet. GoogleNet and combine CNN features with other features to register to register image sensing images were not examined	2016
Hyoungil Jeong , Youngong Ko , Jungyun Seo.	Classifying multicategory images using deep learning : A convolutional neural network model	Tensile stress, Machine learning, Biological neural networks, Machine learning algorithms.	The proposed method has a high accuracy classifying images. This model can be applied for solving complex image classification problem related to medical imaging and other field.	A CPU based system was used so experiment has taken excess time.	2016
Libo Zhang, Tiejian Luo∗ , Fei Zhang and Yanjun Wu.	Semi-Supervised Deep Learning Using Pseudo Labels for Hyperspectral Image Classification	Hyperspectral imaging Feature extraction Neural networks Machine learning Training	Experimental results have shown that proposed method significantly outperformance other state of art supervisor and semi-supervised method	Use of exploring better ways for generating pseudo labels was felt which are more consistent to the underlying true labels.	2017

Table 1: Literature Survey

CHAPTER 3

METHODOLOGY AND ALGORITHMS

3.1 Identifying Traffic Signs with Deep Learning

Successful detection and classification of traffic signs is one of the important problem to be solved if we want self driving cars. Idea is to make automobiles smart enough so as to achieve least human interaction for successful automation. Swift rise in dominance of deep learning over classical machine learning methods which is complemented by advancement in GPU (Graphics Processing Unit) has been astonishing in fields related to image recognition , NLP , self-driving cars etc.

3.2 Deep Learning

Deep learning is a class of machine learning technique where artificial neural network uses multiple hidden layers. Lot of credit goes to David Hubel and Torsten Wiesel, two famous neurophysiologists, who showed how neurons in the visual cortex work. Their work determined how neurons with similar functions are organized into columns, tiny computational machines that relay information to a higher region of the brain, where visual image is progressively formed.

In layman's term brain combines low level features such as basic shapes, curves and builds more complex shapes out of it. A deep convolutional neural network is similar. It first identifies low level features and then learns to recognize and combines these features to learn more complicated patterns. These different levels of features come from different layers of the network.

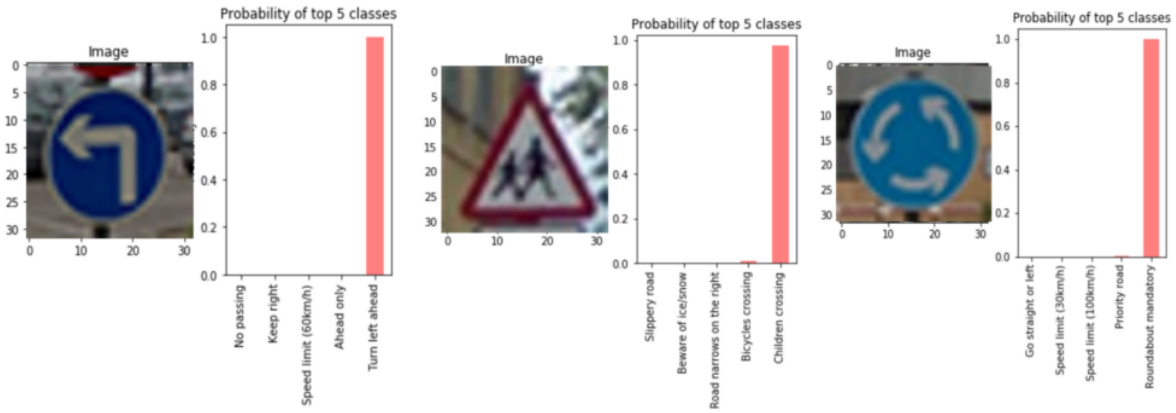

Figure 3.1: Traffic Sign Images and Classification Probabilities

ImageReference:https://towardsdatascience.com/identifying-traffic-signs-with-deep-learning-5151eece09cb

3.3 Using CNN

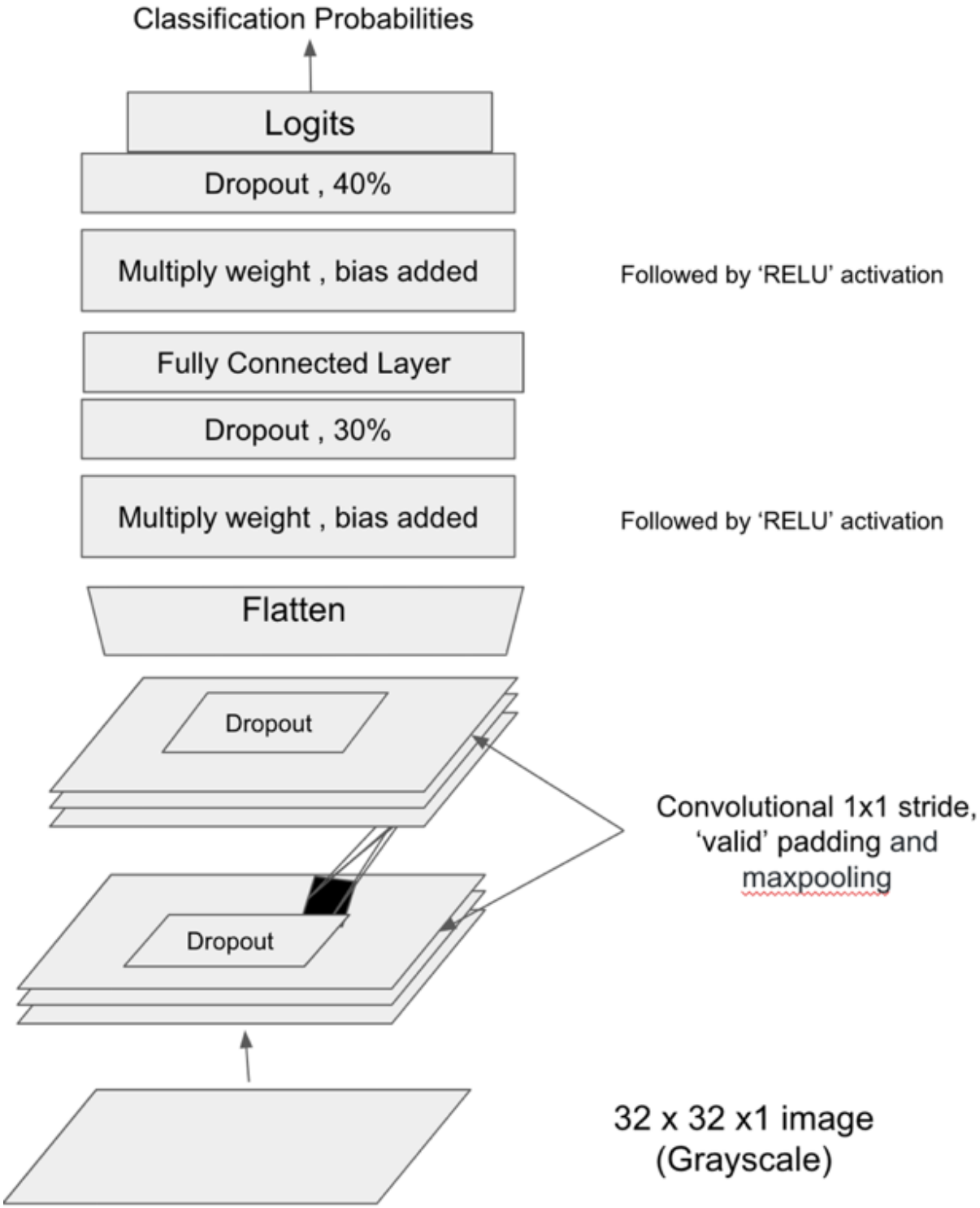

Figure 3.2: Model Architecture hyperparameters(Reference:Google Source)

3.3.1 Model Architecture And Hyperparameters

We decided to start with simple architecture. Idea is to start simple and add more complexity if required . Architecture is same as diagram posted above . Converting images to Grayscale which will help to achieve better accuracy.Tensorflow is usually used to implement deep conv net for traffic sign classification. We are planning to use RELU for activation to introduce non linearity and drop out of varying percentages to avoid overfitting at different stages.

CHAPTER 4

APPLICATIONS

- Traffic signs can be analyzed using forward-facing cameras in many modern cars, vehicles and trucks. One of the basic use cases of a traffic sign recognition system is for speed limits.

- Most of the GPS data would procure speed information, but additional speed limit traffic signs can also be used to extract information and display it in the dashboard of the car to alert the driver about the road sign.

CHAPTER 5

CONCLUSION

Hence Traffic sign detection in outdoor environments which are usefulness for Driver Support systems and Intelligent Autonomous Vehicles to take some decisions about their speed, trajectory and send a warning signal indicating over speed, warn or limit.

CHAPTER 6

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