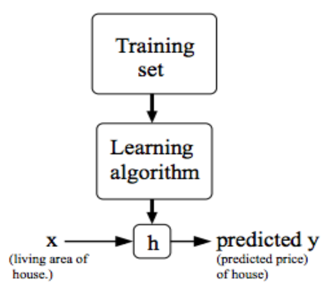
10 days faculty Internship Report (21st MAY to 30th MAY, 2019)

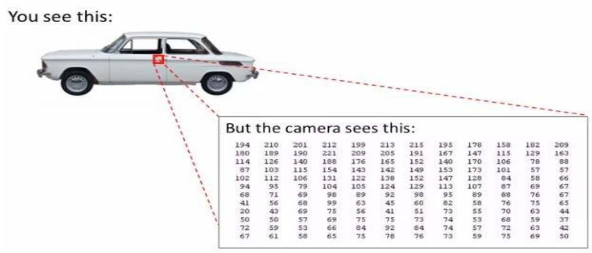
I , Megha Gaur (Assistant Professor, CSE, IET,Agra) worked as faculty intern (from 21st May to 30th May 2019) under the supervision of Dr. Vineeth N Balasubramanian(Assistant Professor, CSE,IITH) at Indian institute of technology, Hyderabad (IITH). This internship report stresses on the work experience I have gathered as an Intern. During my internship period, I learned about the computer vision or more precisely I can say classifiers in deep learning. This report is written at the end of the internship by me to the institute.

The first few of days; I studied about the machine leaning algorithms and their classifications. Now days approaches towards learning the machine have been drastically changed. I updated myself about the deep learning so basically computer vision is a field of computer science that works on enabling computers to see, identify and process images in the same way that human vision does, and then provide appropriate output. It is like imparting human intelligence and instincts to a computer. In reality though, it is a difficult task to enable computers to recognize images of different objects. Computer vision is closely linked with artificial intelligence, as the computer must interpret what it sees, and then perform appropriate analysis or act accordingly. You probably use it dozens of times a day without even knowing it. Each time you do a web search on Google or Bing that works so well because their machine learning software has figured out how to rank what pages. When Facebook or Apple's photo application recognizes your friends in your pictures, that's also machine learning. Deep learning methods can achieve state-of-the-art results on challenging computer vision problems such as image classification, object detection, and face recognition. In supervised learning, we are given a data set and already know what our correct output should look like, having the idea that there is a relationship between the input and the output. Supervised learning problems are categorized into "regression" and "classification" problems. In a regression problem, we are trying to predict results within a continuous output, meaning that we are trying to map input variables to some continuous function. In a classification problem, we are instead trying to predict results in a discrete output. In other words, we are trying to map input variables into discrete categories.



I studied about the cost function, and model representation. If we try to think of it in visual terms, our training data set is scattered on the x-y plane. We are trying to make a straight line (defined by h_\theta(x)hθ(x)) which passes through these scattered data points. Our objective is to get the best possible line. The best possible line will be such so that the average squared vertical distances of the scattered points from the line will be the least. Ideally, the line should pass through all the points of our training data set. In such a case, the value of J(\theta_0, \theta_1)J(θ0,θ1
) will be 0.

After that I went through the linear algebra. Basics of metrics, vectors, scalar multiplication, transposition and inverse transposition is required to do process the images further. Octave is the programming language, in which I am able to implement the learning algorithm. In fact, there are so many languages like Python, NumPy to implement but octave is prototyping language. So, we can quickly get the working prototype of our new developed algorithm. Octave is open source software easily available on internet. So, I learned the basic programming skills in Octave. I designed some if-else, decision making programming in Octave. Now, I am able to generate a few matrices, add things and use the basic operations in Octave and how to use data around and start the process data in Octave. After having theoretical knowledge about the deep learning and machine learning algorithms, let's consider an example of computer vision and suppose you want to use machine learning to train classifier an image and tell us whether or not the image is car.



Concretely, we use machine learning to build a car detector, what we do is we come up with a label training set, with, let's say, a few label examples of cars and a few labels example of things that are not cars, then we give our training set to learning algorithm trained a classifier and then, you know, we may test it and show the new image and ask "What is this new things?". We hope that it will recognize that this is a Car. I studied in deep why we need of nonlinear hypothesis in this case. Further, I covered the working of neural network. Neural networks are a model inspired by how the brain works. It is widely used today in many applications: when your phone interprets and understands your voice commands, it is likely that a neural network is helping to understand your speech; when you cash a check, the machines that automatically read the digits also use neural networks. At a very simple level, neurons are basically computational units that take inputs (dendrites) as electrical inputs (called "spikes") that are channeled to outputs (axons). In our model, our dendrites are like the input features x1,…, xn, and the output is the result of our hypothesis function. In this model our x0 input node is sometimes called the "bias unit." It is always equal to 1. Just because a learning algorithm fits a training set well, that does not mean it is a good hypothesis. It could over fit and as a result your predictions on the test set would be poor. The error of your hypothesis as measured on the data set with which you trained the parameters will be lower than the error on any other data set.

Given many models with different polynomial degrees, we can use a systematic approach to identify the 'best' function. In order to choose the model of your hypothesis, you can test each degree of polynomial and look at the error result.

One way to break down our dataset into the three sets is:

- Training set: 60%
- Cross validation set: 20%
- Test set: 20%

We can now calculate three separate error values for the three different sets using the following method:

1. Optimize the parameters in Θ using the training set for each polynomial degree.
2. Find the polynomial degree d with the least error using the cross validation set.

I successfully completed 10 days faculty internship. First and foremost I would like to express my deepest gratitude towards my internship supervisor Dr. Vineeth Vineeth N Balasubramanian, Assistant Professor, CSE, IITH for his constant guidance, valuable time and encouragement throughout my internship work. A grateful acknowledgement also goes to TEQIP-III for giving this great opportunity. It has been a great learning opportunity for me as well as my professional carrier. I also express my sincere thanks to the Director, IET, Agra for allowing me to use the needed facilities under TEQIP-III for availing this opportunity. I am also thankful to the authority of IIT Hyderabad for providing laboratory, library and computer facility.

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