Active Shooter Prediction

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Introduction

The project focuses on using the surveillance camera's stream to predict possible target attacks. The images contain objects which can be fed to a supervised algorithm to detect deadly objects. Once the objects are detected, the next point would be to predict the vector of movement or the personnel itself. Is it moving towards a particular target e.g. a school or institution? Or is it just police personnel on his duty? There is some more research needed to figure out the vector of movement. It may be that the person is wanted for a crime. So along with detecting objects, faces could be recognized.

Motivation

Attacks on schools and other institutions have become a new norm in the United States where gun violence is quite prevalent. Most of the stories tell us that the active shooter was on the school premises and was seen by a few folks but failed to take any action on it. Even if the target of the shooting may be informed just in time, the chaos might end with taking the wrong action e.g., closing a door on the East vs West or asking teachers to lock the classrooms.

Data

Some data is already available which can be used for supervised learning GitHub - ari-dasci/OD-WeaponDetection: Datasets for weapon detection based on image classification and object detection tasks https://www.researchgate.net/publication/351298349_A_Gun_Detection_Dataset_and_Searching_for_Embedded_Device_Solutions

Background

Linear regression gives a best fit line, which can't pass through all the data points. We need a better approach to solve this problem to classify if data belongs to one of the two categories. e.g. from a given set, we want to determine if a person is obese or not. Linear regression won't give us a clear answer, but the logistics regression classify it much better.

It uses a Sigmoid function to convert a best fit line to a S-curve line.

$$sigmoid(z) = \frac{1}{1 + e^{-z}}$$

where e is Euler's number

$$e = 2.718$$

Convert a value of z to a 0 or 1

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##See Figure \@ref(fig:Linear_vs_Logistics_regression))
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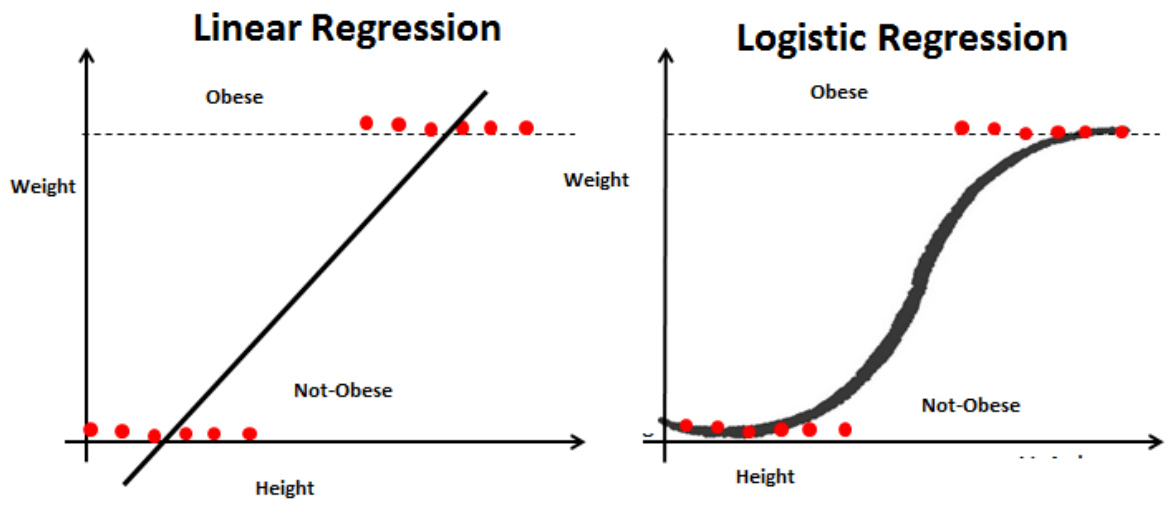

Figure 1: Linear vs Logistics regression for classifying obesity

linear regression + sigmoid function = 0/1

value < 0.5 classify value > 0.5 classify to other way

Neuron

Logistics regression can be thought of as representing a single Neuron, which uses a linear equation and an activation function (e.g. LED light). So we can represent a single Neuron to classify. e.g. Age (single factor) -> linear equation -> activation function -> value between 0 to 1

$$y = \sum w^i x^i + b$$

convert to an equation

e.g. Age + Income + Education -> weighted linear equation -> activation function -> value between 0 to 1

if value > 0.5 then the Neuron is activated otherwise it's not activated

Neural network

Training

Backward error propagation is used for training a Nueral network. Basically everytime a prediction goes correct or incorrect, the algorithm gives a feedback to the network to correct itself. If the model was correct, it accentuates otherwise it makes a correction when it was incorrect.

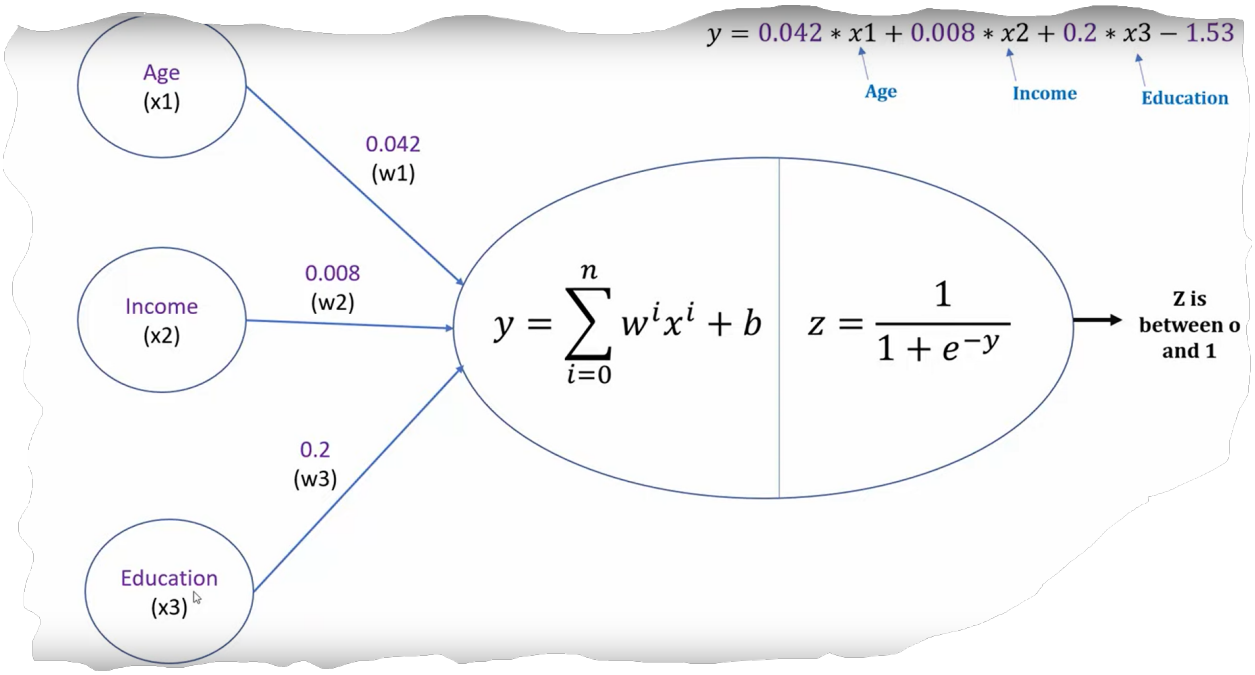

Figure 2: Neuron as a combination of weighted linear equation + activation function

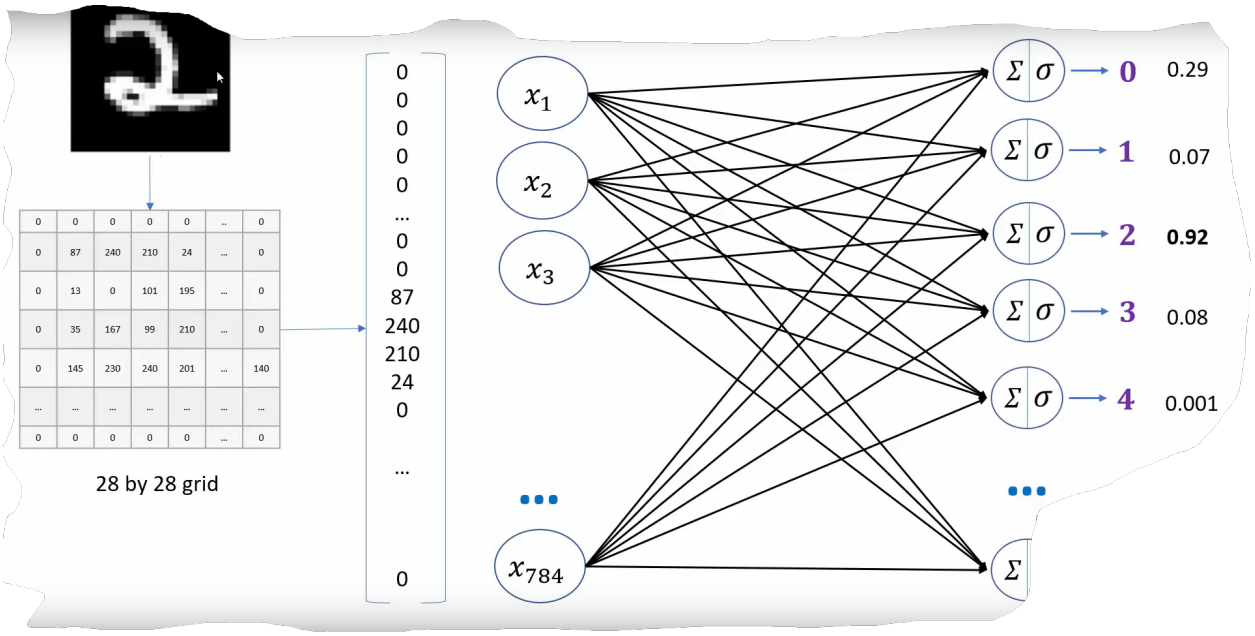

Figure 3: Neural network for recognizing letter 2

Deep learning