Emergency Services Detection on Heavy Traffic Roads using Deep Neural Networks

Abstract:

Now-a-days vehicles are all-present. Due to increase in usage of vehicles it has led to jammed roads across the globe. These jammed roads couldn't be a problem in general terms, but this could be a major problem for emergency services like ambulance, fire trucks, police vehicles …etc. These emergency services are the one which are most affected by traffic jams, as here every second values as there are lives at stake. Here our main aim is to solve this problem using deep neural networks by feeding it with sound of siren from ambulance and the light produced by it. These deep neural networks find the patterns of sound and light produced from ambulance and use them to predict whether there is an ambulance or not. Basically we are using deep neural network as a classifier.

Keywords: Deep Neural Networks, Ambulance, Emergency services, Classifier, sound, light.

INTRODUCTION

Emergency services are on duty 24X7 and these are the most affected due to traffic jams. These traffic jams could cost them a lot as on other side we have lives at stake. In metropolitan cities due to increase in usage of vehicles, sometimes traffic jam may last from minutes to hours which could be a very serious to be concerned about. Mainly in areas where roads aren't properly designed to handle such heavy traffic this could be a major issue as emergency services cannot reach victims location for help. During these situations the space between vehicles is very small to give way for these services. In order to overcome this situation we need a better traffic management system.

Prior to this we have studied some methods to overcome this which include getting roads properly designed or re-designed, preemption transmitter which emits high intensity strobe light flashing at higher rate, using GPS(Global positioning system) and IR(Infrared) sensor to detect emergency vehicle presence, RFID tags are also used to detect the presence. There are also some CNN(Convolution Neural Network) based models which take input from CCTV's and predict the presence of emergency vehicle.

Prior we also have studied some sound based models which could detect the ambulance siren completely based on sound (i.e. detecting particular frequency). These methods also have some flaws, in order to overcome them we are using sound and light from ambulance. But the main drawback can be sometime the model predict the siren also as non-siren if there is an opaque object blocking the light..

Apart from other methods here we are using a model which detects the presence of emergency services using the light and sound produced by it. Here we are using the Deep Neural Networks as classifier which predicts the given light and sound input is whether produced from emergency services or not.

METHODOLOGY

Preprocessing:

We have collected data of emergency services sound from various sources which ended to be having less noise mixed with it, in order to make our model robust we manually added some noise into the audio tracks we collected. This helped us to make our model more robust and skip the overfitting part. By manually adding the noise we managed to increase the size of dataset.

When coming to light we did the same thing here to (manually modifying). We varied the intensity of light so that our model makes right choice during winter and rainy, because in this season the sensors may pick less intensity of light.

When coming to non-siren sounds we included sounds from horns to engine noises, coming to light we added headlights, lights from banners.

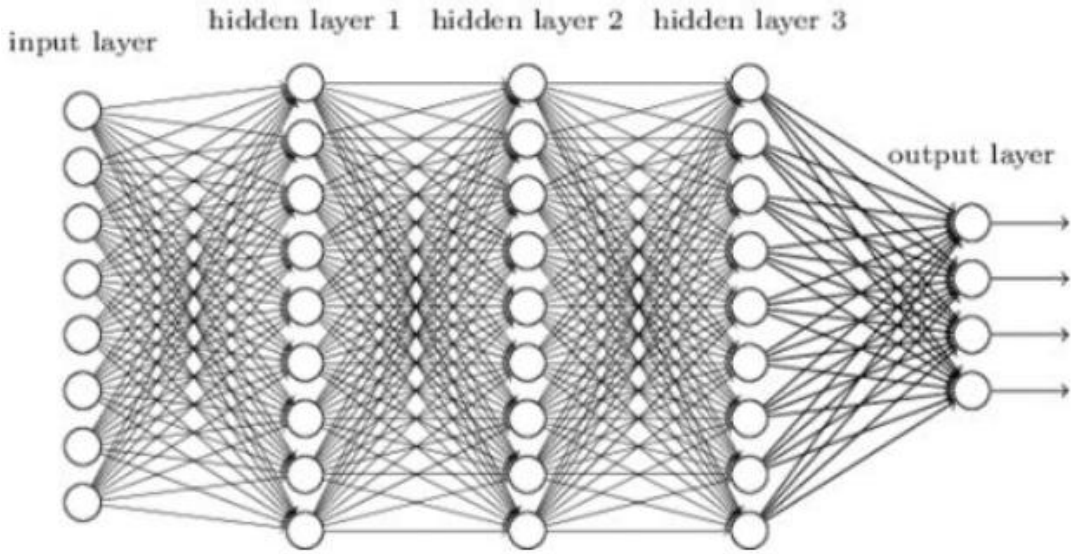
Model:

To predict the presence of emergency services we used Deep Neural Network model as classifier, where the two classes are:

Class Number	Class
1	Emergency vehicle present
0	Emergency vehicle not present

This method uses Adam (adaptive moment estimation) as an optimizer with learning rate 0.001. Here we used the learning rate 0.001 because using large number could affect the model accuracy or epochs to converge to global minima. Here for each neuron of every layer we use ReLu(Rectified linear unit) as activation function, except for last layer which has a two neurons we use sigmoid as activation function. The main use of ReLu is that it removes negative values meanwhile sigmoid restricts the output from single to be from 0 to 1 which helps to predict the probability of that particular class.

Here we used Adam as it has the advantages of both AdaGrad and RMS prop. It is computationally efficient



Adam Parameters	**Values**
Learning rate	0.001
Beta 1(β1)	0.9
Beta 2 (β2)	0.9
Epsilon (ϵ)	10e-8