## Problem Statement

Automatic Number Plate Recognition System is the identification system of vehicles. It is an image processing technology used to identify the vehicles only by their license plates. Automatic Number Plate Recognition ANPR plays am major role in management of parking areas, and surveillance of illegally parked vehicles. Since every vehicle has a unique number plate so it can be identified by its number plate. The classification is utilized for the electronic toll-collection system (ETC) and to display available parking spaces to vehicles. The identification is also employed for managing parking facilities, monitoring and analysis of traveling time, and security systems such as observation of stolen vehicles and monitoring of unauthorized vehicles entering private areas [1].

## Applications

ANPR system has many application which are Highway Tool Collection, Red Light Violation enforcement, Border & Custom Checkpoints, Management of parking areas and to display the available space in parking.

## Proposed system description

The algorithm proposed of this system is specially designed to recognize the license plates of vehicles. First of all system need to train on some collected number plate data and cross validate

and repeat that process until machine get learned. When machine learned successfully then further processing will take place.

The input of the system is the image of a vehicle captured by a camera. The captured image is taken from 2 – 3 feet away. That image is processed through Number Plate Extractor (NPE) with give its output to segmentation part [1], [3].

Segmentation part take the extracted plate region and make further processing on it and separates the characters of image and store each character’s data in a row matrix.

Finally recognition part recognize the characters through the trained Neural Network and result the plate number.

In whole structure multiple functions of two different toolboxes of MATLAB are used. These toolboxes are Image Processing Toolbox (IPT) and Neural Network Toolbox (NNT).

## Artifical Neural Networks

Neural networks are composed of simple elements operating in parallel. These elements are inspired by biological nervous systems. As in nature, the connections between elements largely determine the network function. You can train a neural network to perform a particular function by adjusting the values of the connections (weights) between elements.

Typically, neural networks are adjusted, or trained, so that a particular input leads to a specific target output. Typically, many input/target pairs are needed to train a network.

Neural networks have been trained to perform complex functions in various fields, including pattern recognition, identification, classification, speech, vision, and control systems.

Artificial neural network is same as human nervous system. In a neural there are three types of layers:

1. Input layer
2. Hidden layers
3. Output layer

**Input layer** contains inputs data that we need to feed the neural network. Number of inputs depend on the data samples.

**Hidden layers** contains some hidden nodes and bias nodes. Number of nodes depends on user and complexity of network and can be increased accordingly.

Not just nodes but hidden layers can also be increased as per requirements. This network will call multilayer neural network.

**Output layer** contain output nodes. Number nodes depend on the classes of data number of classes and output nodes will remain same [2].

## Neural Network Design Steps

We will follow the standard steps for designing neural networks to solve problems in four application areas: function fitting, pattern recognition, clustering, and time series analysis. The work flow for any of these problems has seven primary steps [4].

1. Collect data
2. Create the network
3. Configure the network
4. Initialize the weights and biases
5. Train the network
6. Validate the network
7. Use the network

## Topologies of Neural network

Here are some Topologies / Architectures and algorithm that can be used for Artificial Neural Networks ANN:

* + - * Feed forward neural network
      * Recurrent neural network
      * Multi-layer perceptron (MLP)
      * Convolutional neural networks
      * Recursive neural networks
      * Deep belief networks
      * Self-Organizing Maps
      * Deep Boltzmann machine
      * Stacked de-noising auto-encoders

Non-linear / Logistic regression technique in which Feed forward network algorithm is used is followed here.