

# Identify number plate in vehicles

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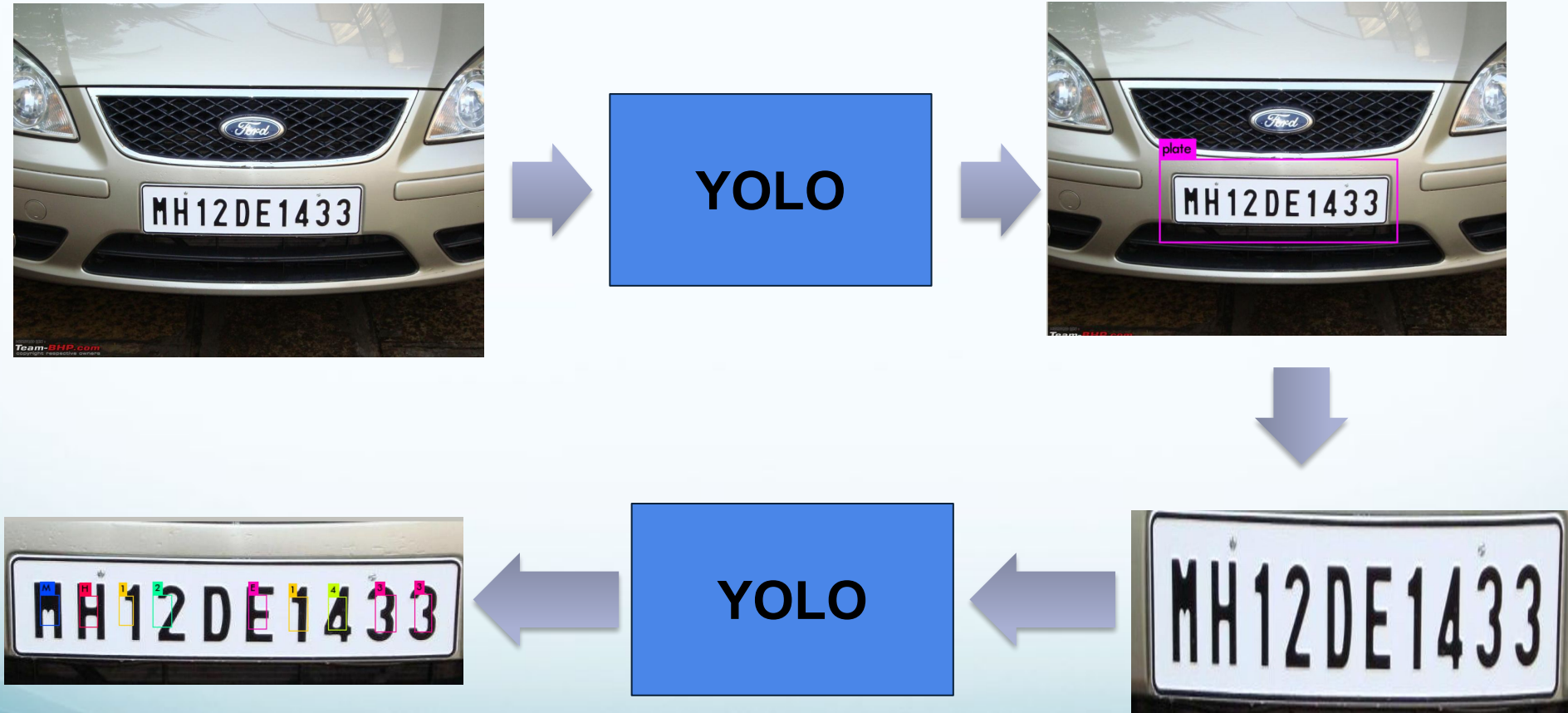
# Deep Learning

- Deep Learning is advanced Machine Learning.
- Uses multilayers of non linear processing units for feature extraction and transformation.
- Each layer in deep learning learns to transform the input from previous layer into a composite representation.

# Differences between Deep Learning and Machine Learning

	Machine Learning	Deep Learning
Data Dependency	Lesser amount of data is sufficient for traditional machine learning algorithm.	It needs large amount of data to understand it perfectly.
Hardware Dependencies	ML can work smoothly on low-end machines.	Deep learning heavily depends upon high-end machines. GPU is integral part of its working because deep learning inherently do lots of matrix multiplication operation which can be effectively optimized by the GPU.
Feature Engineering	Most of the applied features need identified by expert or hand coded.	Features are learned by the deep learning model progressively in each layer.
Problem Solving Approach	It divides problem into subparts which are solved independently and combined to obtain the desired result of the problem.	It solves the problem end to end. For example, in YOLO an image is passed, it would give out the location and name of the object.

# Number Plate Recognition Flow Diagram



# YOLO

## (You Only Look Once)

- State-of-the-art, real Time object detection system.
- Why YOLO ?
  1. It is extremely fast and accurate.
  2. Simple Approach - Single neural network is applied to full image. This network divides the image into regions and predict the bounding boxes and probabilities for each region.

# Classification and Object Detection



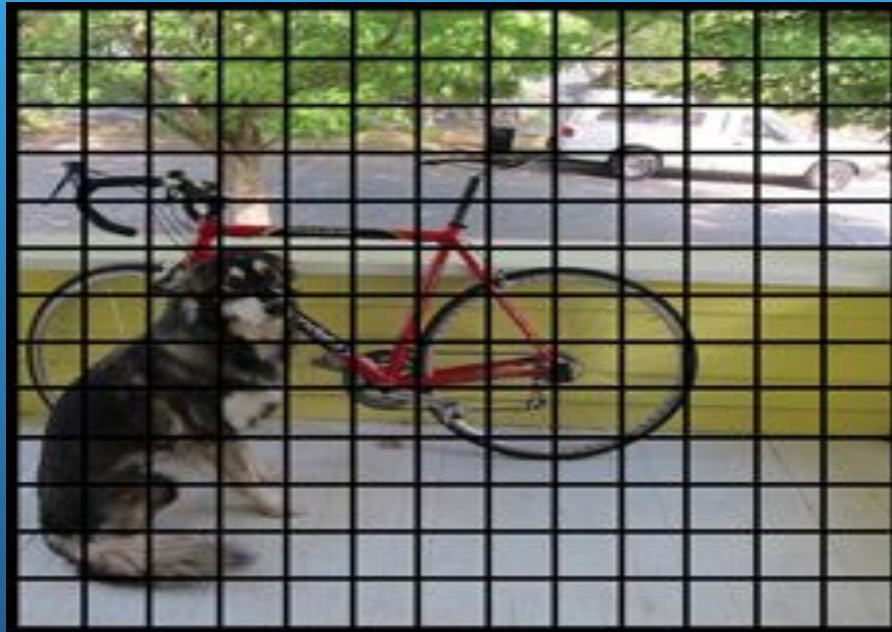
1: tabby, tabby cat (57.03%)  
2: tiger cat (14.65%)  
3: washbasin, handbasin, washbowl, lavabo  
4: Egyptian cat (6.06%)  
5: toilet seat (1.66%)

**Classification**



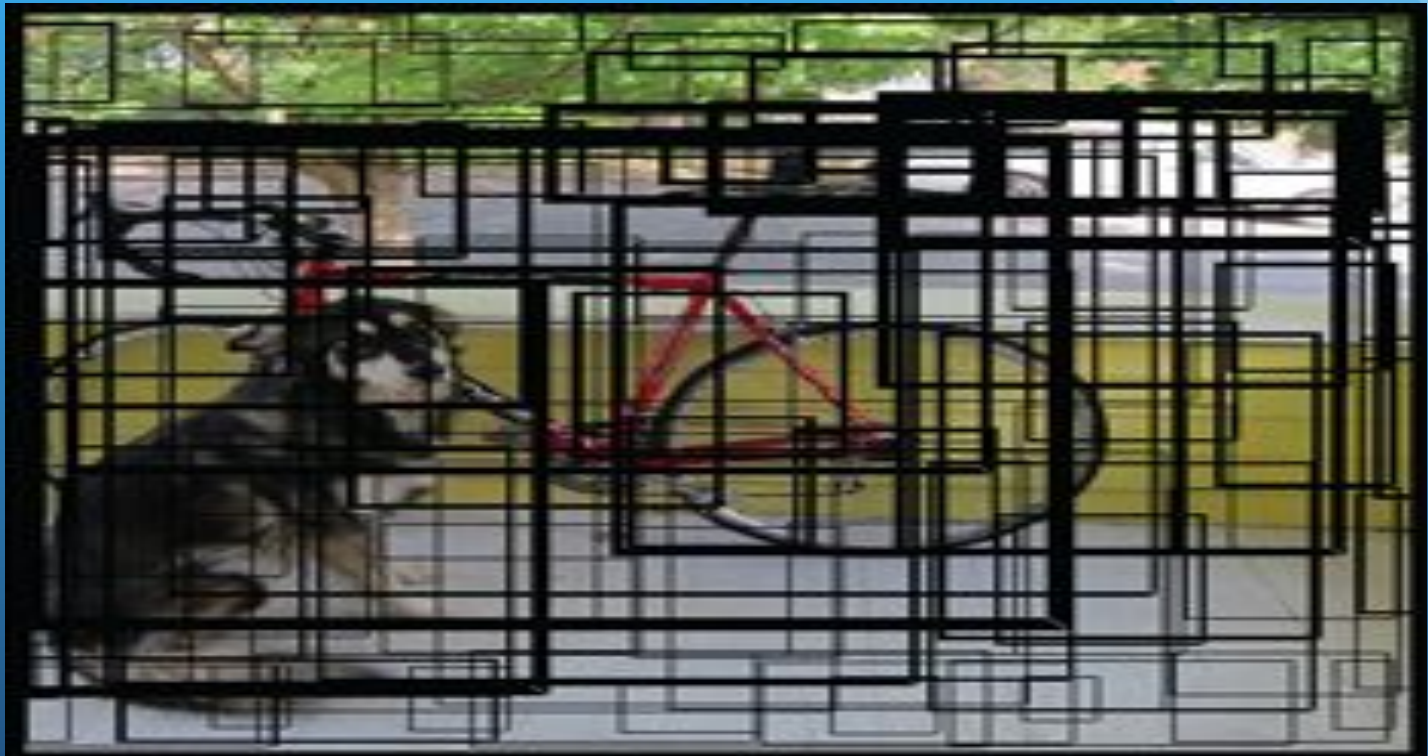
**Object detection**

# 13\*13 Bounding Box

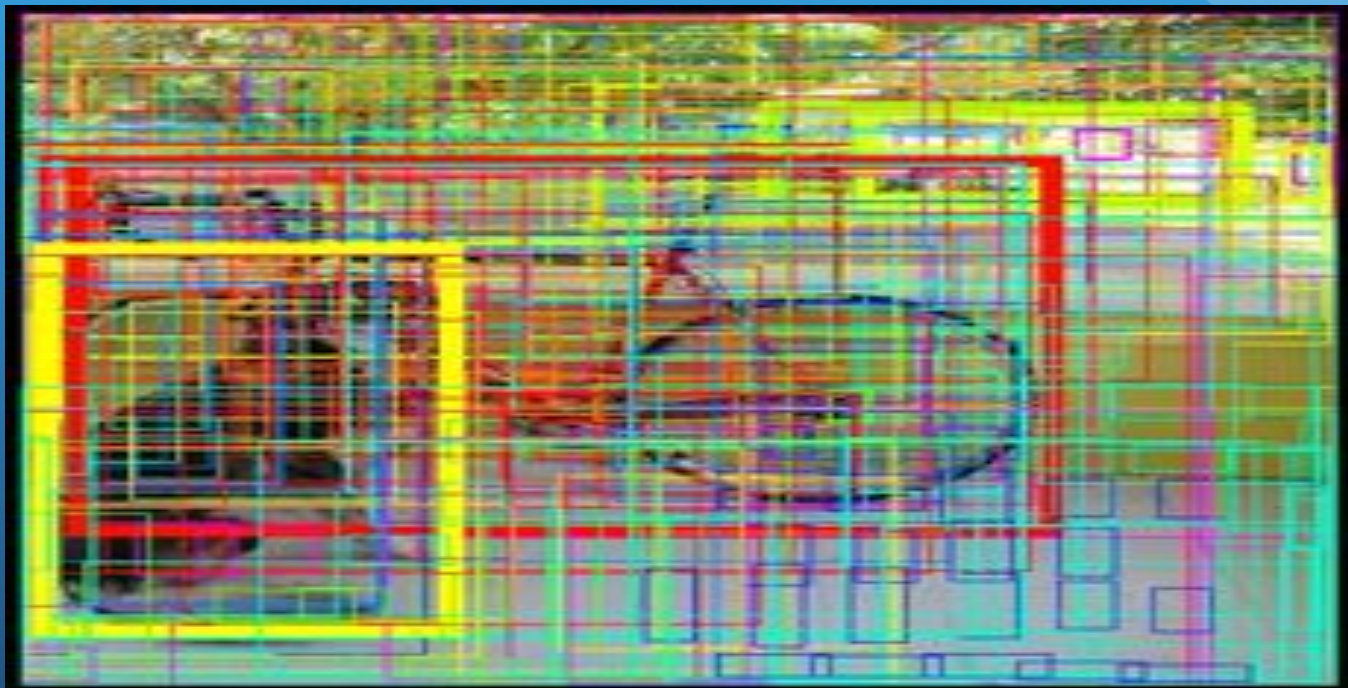




The predicted bounding boxes may look something like the following (the higher the confidence score, the fatter the box is drawn):



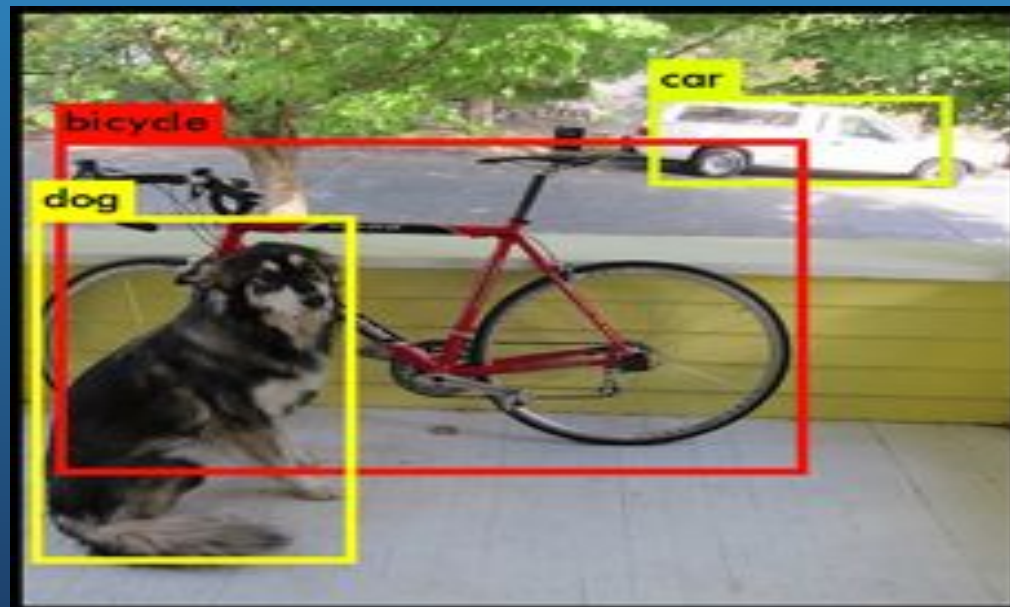
- For each bounding box, the cell also predicts a *class*.
- For example, the big fat yellow box on the left is 85% sure it contains the object “dog”.



Since there are  $13 \times 13 = 169$  grid cells and each cell predicts 5 bounding boxes, we end up with 845 bounding boxes in total.

It turns out that most of these boxes will have very low confidence scores, so we only keep the boxes whose final score is 30% or more (you can change this threshold depending on how accurate you want the detector to be).

From the 845 total bounding boxes we only kept these three because they gave the best results -

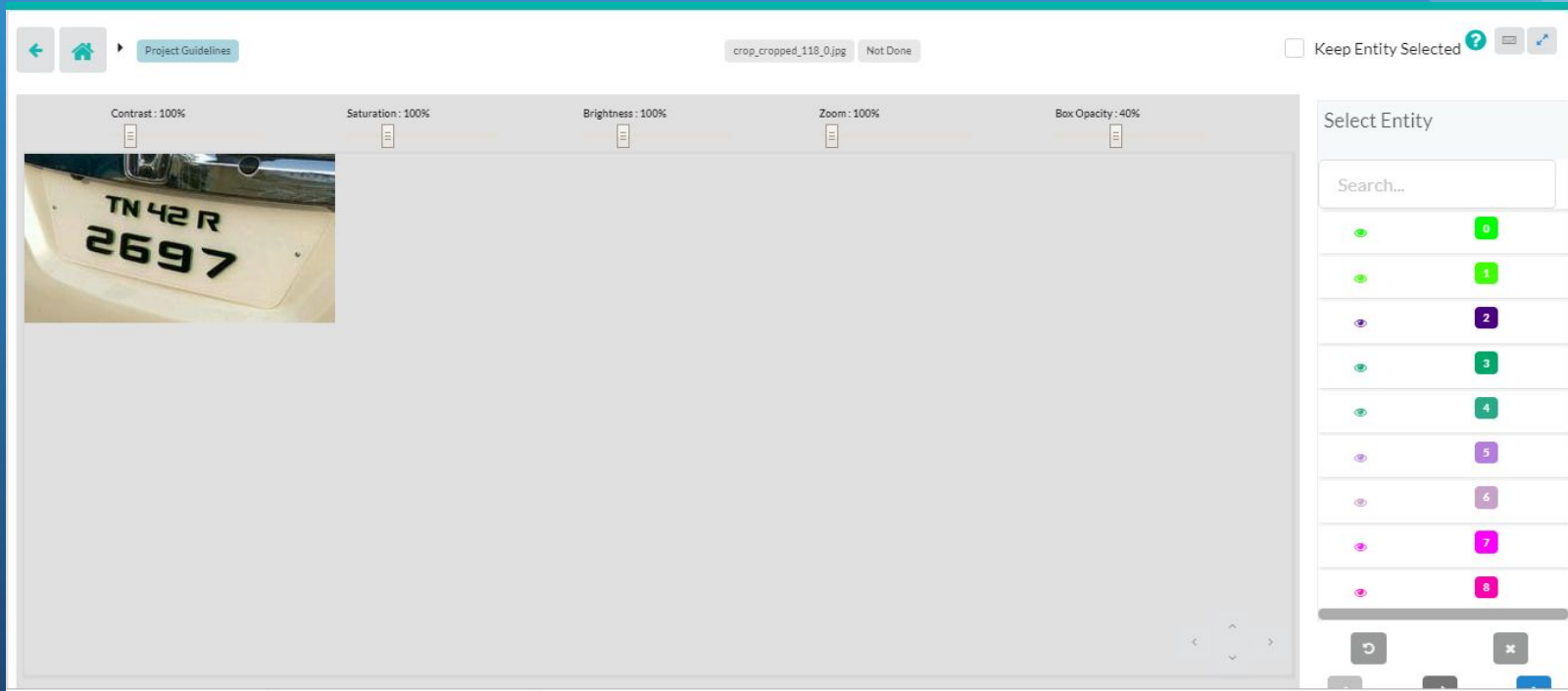


# Training data

- \* The data set used for training the YOLO model, contains images in which the coordinates of the bounding box of number plate is known beforehand.
- \* The coordinates of bounding box is given by  $(X_c, Y_c, W, H)$  for training YOLO.

# Building Training Dataset

- [www.dataturks.com](http://www.dataturks.com) is used for building a bounding box around the character and labelling the characters in the same .




Contrast: 100%

Saturation: 100%

Brightness: 100%

Zoom: 100%

Box Opacity: 40%



X

T

Select Entity

U

P

Q

R

S

T

U

V

W

X

Move To Done (ctrl+enter)



I. The dataset for the bounded characters is in the JSON format.

II. Label denotes the character inside the bounding box, points are the 4 coordinates of rectangle, imageHeight is the height and imageWidth is the width of the bounding box.

```
{
  "content": "http://com.dataturks.a96-i23.open.s3.amazonaws.com/2c9fafb068c19d770169ae699b7d1164/b9aa03af-7548-423e-baa8-8cf7cfcf4e76__crop_cropped_103_0.jpg",
  "annotation": [
    {
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      "shape": "rectangle",
      "points": [
        [0.223226319478139, 0.11302806712962964],
        [0.3664281093320395, 0.11302806712962964],
        [0.3664281093320395, 0.5123939043209876],
        [0.223226319478139, 0.5123939043209876]
      ],
      "notes": "",
      "imageWidth": 229,
      "imageHeight": 128
    },
    {
      "label": "7",
      "shape": "rectangle",
      "points": [
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        [0.6528316890398405, 0.1280984760802469],
        [0.6528316890398405, 0.5236967110339507],
        [0.5391126206264489, 0.5236967110339507]
      ],
      "notes": "",
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      "imageHeight": 128
    },
    {
      "label": "6",
      "shape": "rectangle",
      "points": [
        [0.37063992668068363, 0.5425347222222222],
        [0.5159476252089062, 0.5425347222222222],
        [0.5159476252089062, 0.9117597415123457],
        [0.37063992668068363, 0.9117597415123457]
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      "notes": "",
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        [0.796033478893741, 0.5199291087962963],
        [0.796033478893741, 0.91552734375],
        [0.669678958434417, 0.91552734375]
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      "shape": "rectangle",
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        [0.9434470860962856, 0.9117597415123457],
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        [0.8128807482883176, 0.504858699845679],
        [0.669678958434417, 0.504858699845679]
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      "imageHeight": 128
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    {
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      "shape": "rectangle",
      "points": [

```

# YOLO for Number Plate Detection





characters are identified.



# Drawbacks of using lesser dataset

- Sometimes one or more characters remain unidentified.



- The characters might be detected wrongly.





Thank You