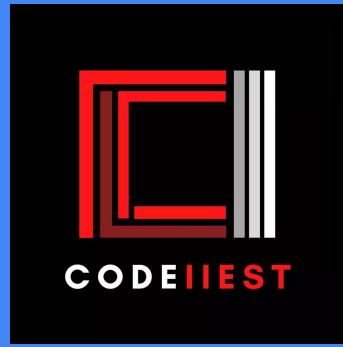
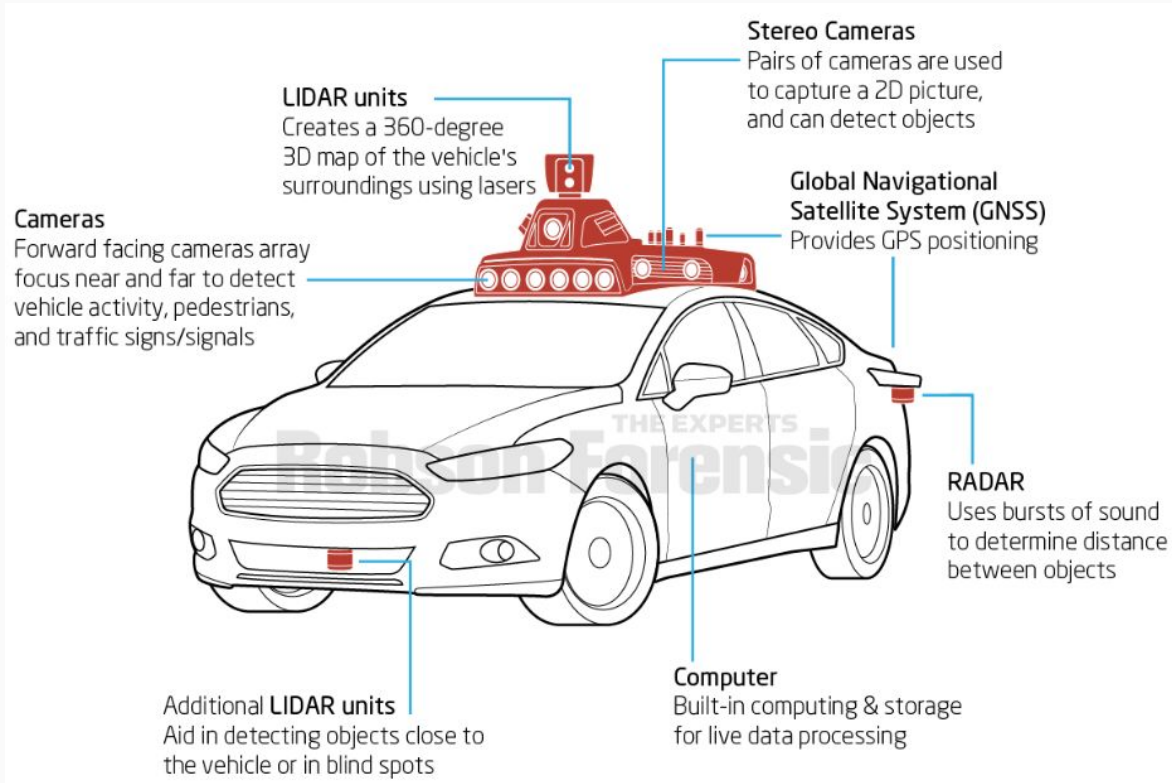


Object Detection in Automated Vehicles

November 17, 2022



An Automated Vehicle



<https://www.robsonforensic.com/articles/autonomous-vehicles-sensors-expert>

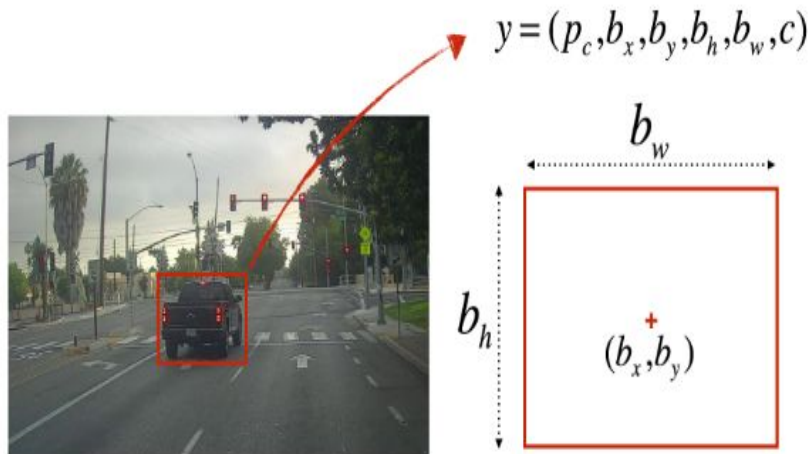
Classification vs Detection

Classification



Car Present or Not?

Detection



Breaking down the problem statement

Given an image/video of street locate objects like Cars, Pedestrians, and draw a bounding box around them.

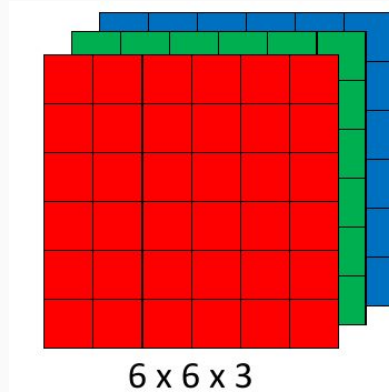
Steps:

1. Define the architecture of your model
2. Show your model a large set of labeled examples
3. Make it learn those examples through various iterations.

An image is just a matrix of numbers



6 x 6 x 3



6 x 6 x 3

Feature extraction using Convolutions

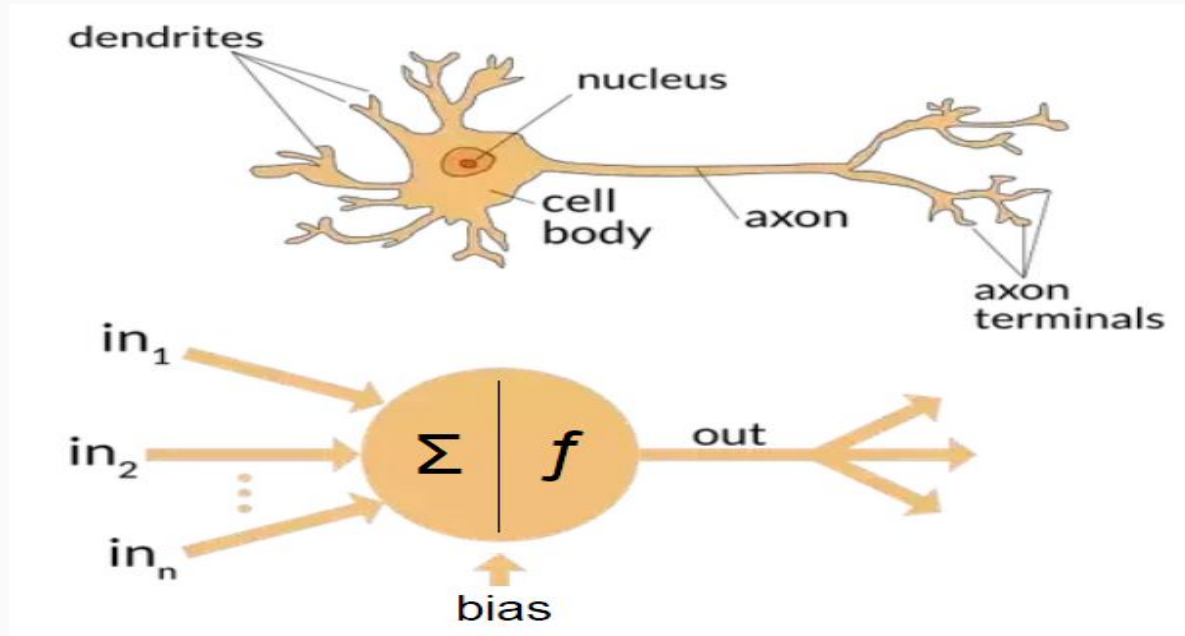


vertical edges

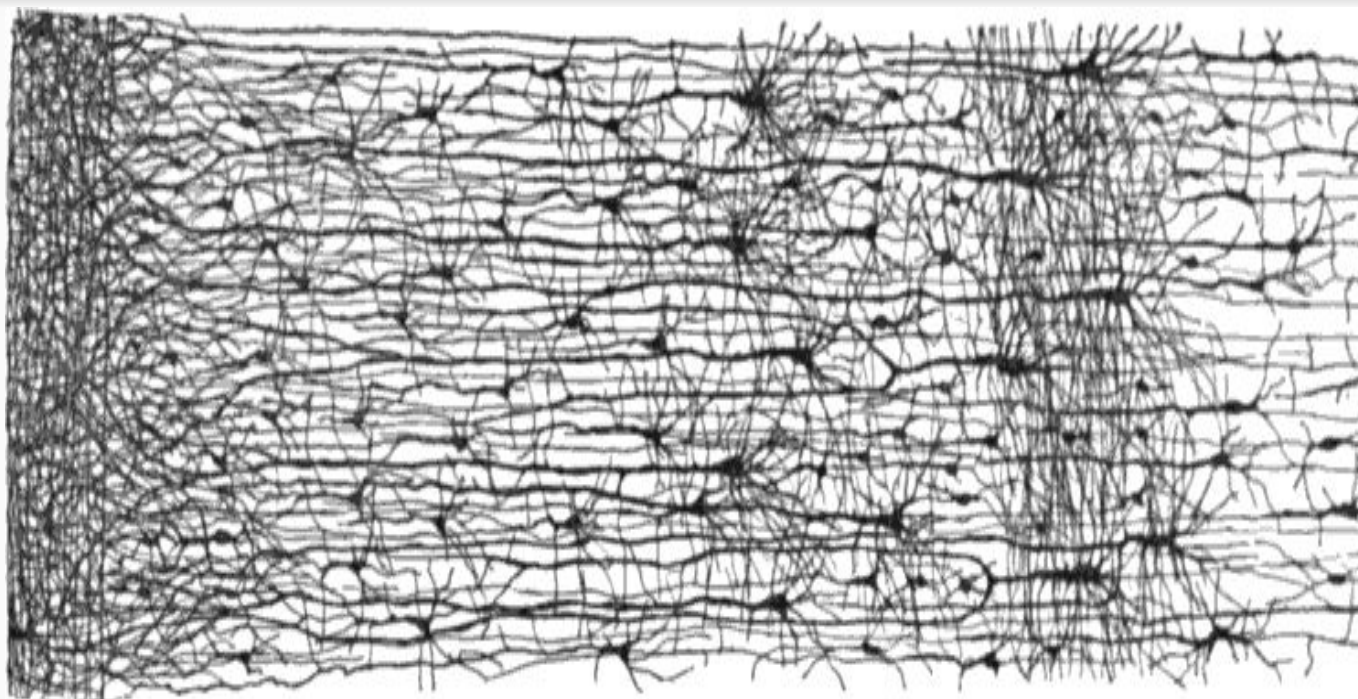


horizontal edges

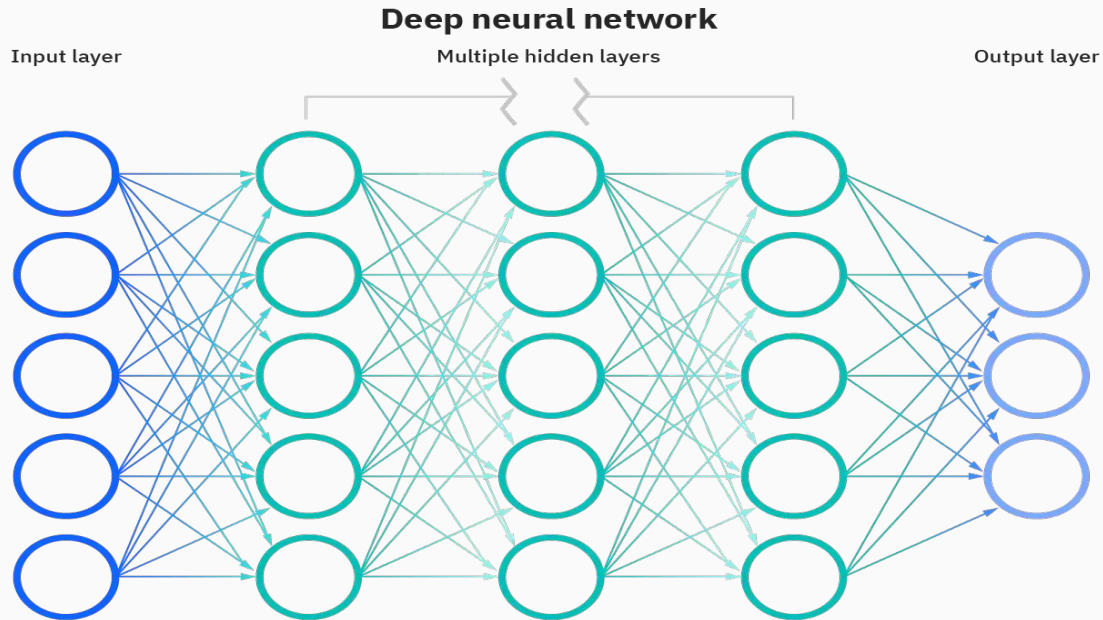
Perceptrons



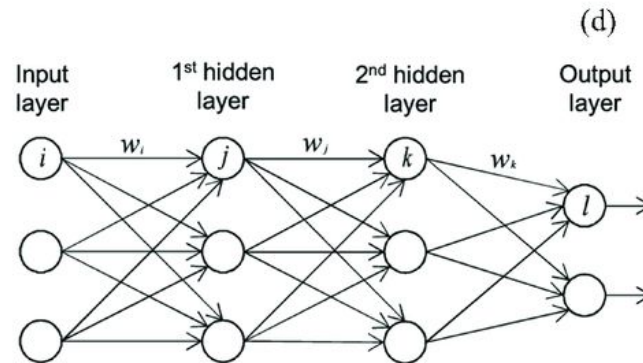
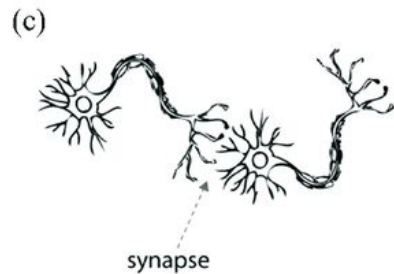
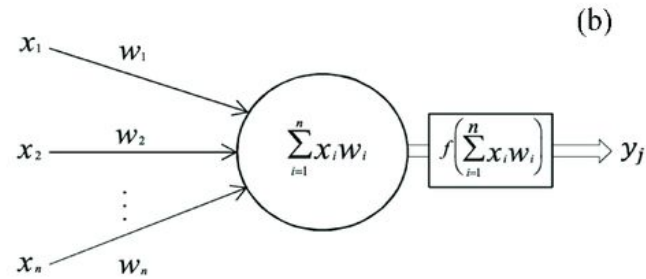
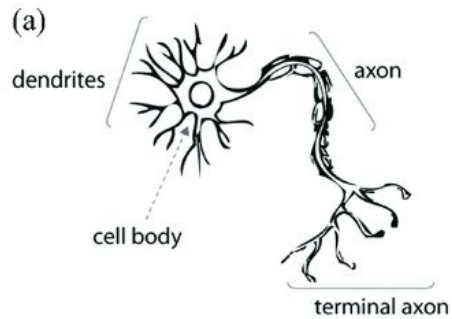
Biological Neural Networks



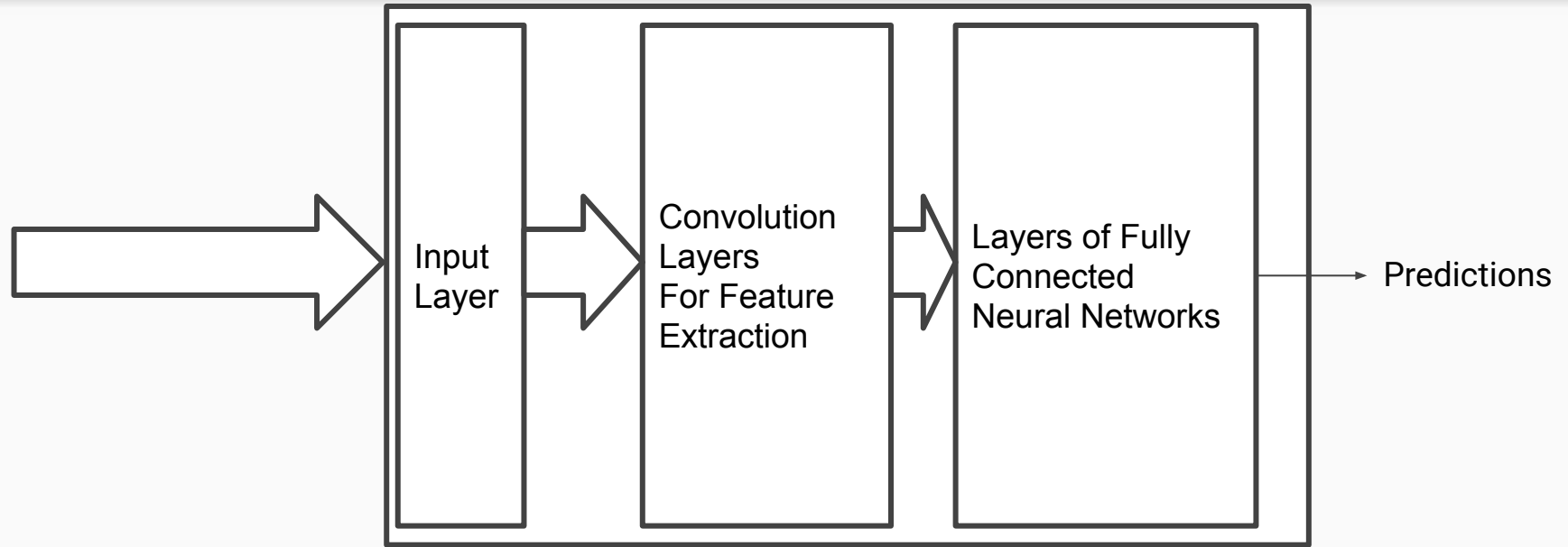
Artificial Neural Networks



Artificial Neural Networks



Architecture of our Model



```
import tensorflow as tf
from tf.keras.layers import Conv2D, MaxPooling2D, Dense, Input
from tensorflow.keras import Sequential

IMG_WIDTH= 150, IMG_HEIGHT=150

model=Sequential()

model.add(Input((IMG_HEIGHT, IMG_WIDTH, 3)))
model.add(Conv2D(32, (3, 3), activation='relu'))
model.add(MaxPooling2D(2, 2))
model.add(Conv2D(64, (3, 3), activation='relu'))
model.add(MaxPooling2D(2, 2))
model.add(Conv2D(128, (3, 3), activation='relu'))
model.add(MaxPooling2D(2, 2))

model.add(Flatten())

model.add(Dense(128, activation='relu'))

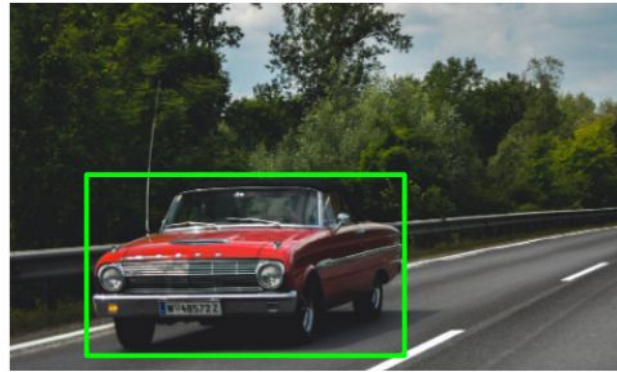
model.add(Dense(5, activation='sigmoid'))

model.compile(optimizer='adam', loss='binary_crossentropy', metrics='accuracy')

model.fit(Xtrain, Ytrain, epochs=20)

y_pred = model.predict(testImage)
```

Prediction and Bounding Box



Questions?