

Image Classification

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What is Image Classification

- Classification between objects is trivial task for human but complex for computers to do
- One of the problems of computer vision
- Refers to labeling of images into one of a number of predefined classes
- Manually classifying images could be tedious task so automating it through computer vision would be prove to be more efficient
- Examples:
 - Labelling X-ray image as cancerous or not (binary classification)
 - Classifying handwritten digits (multiclass classification)
 - Assigning a name to a photograph of a face (multiclass classification)

Structure of Image Classification Task

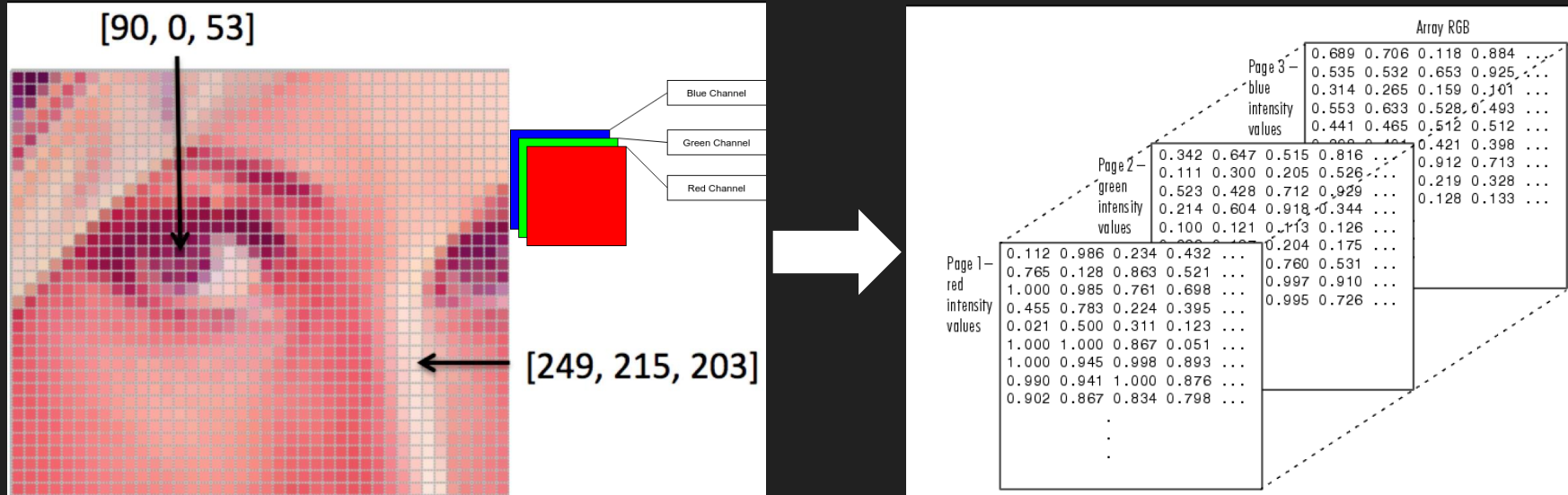
- Image preprocessing
 - Process or improve the image data
 - Suppressing unwanted distortions and enhancing important features
- Detection of an object
 - Localization of an object
 - Segmentation on an image and identify position on object of interest
- Feature extraction and training
 - Different statistical or deep learning methods are applied in this step
- Classification on object
 - Categorize detected objects into predifed classes by using a suitable classification technique that compares the image patterns with target patterns

Image Preprocessing

- Performing various operations on image data
- Images are just matrices of numbers
- Optimizing the numbers can give some performance boost
- Steps of image pre-processing
 - Read Image
 - Resize Image
 - Data Augmentation
 - Grayscale
 - Reflection, rotation, translation
 - Gaussian Blurring
 - Histogram Equalization

Reading Image

- Process of reading the image file and representing in a matrix form

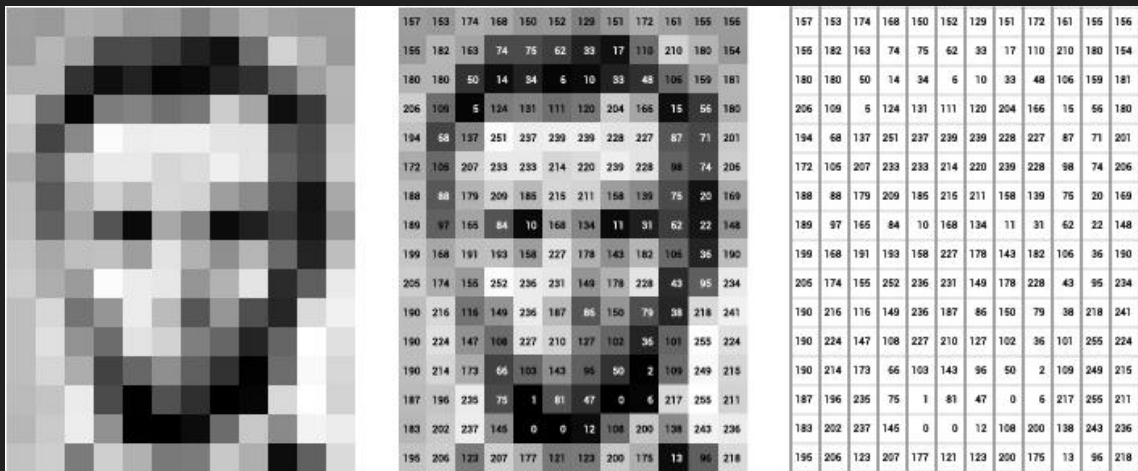


Resize Image

- Images may be of various dimensions
- Resizing is done to bring consistency in the data
- Scaling large images into small form factor also reduces computational complexity

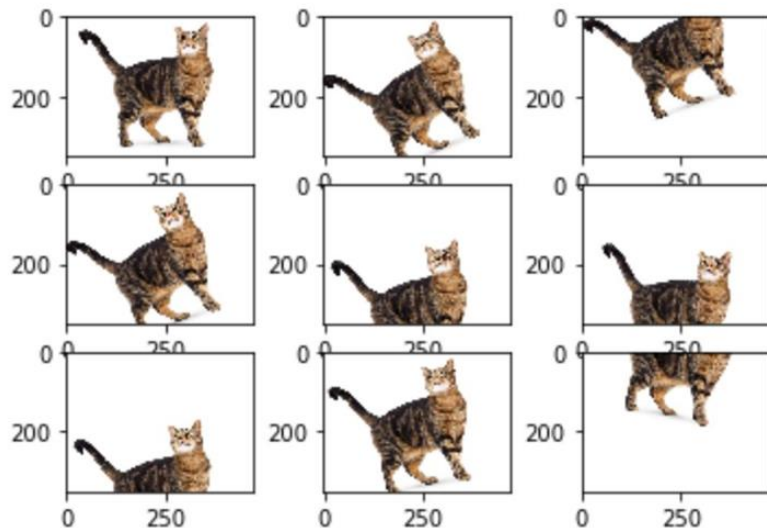
Data Augmentation

- Enlarges/Improves the dataset
- Grayscale
 - Converting the dimension of image matrix from (X, Y, 3) to (X, Y, 1)
 - Also reduces computational complexity



- Reflection, rotation, translation

- This changes the shape, size and appearance of the same image and gives different perspective of the same image



- Gaussian blurring
 - Used to reduce noise in the image



- Histogram Equalization

- Technique to increase global contrast of an image using the image intensity histogram

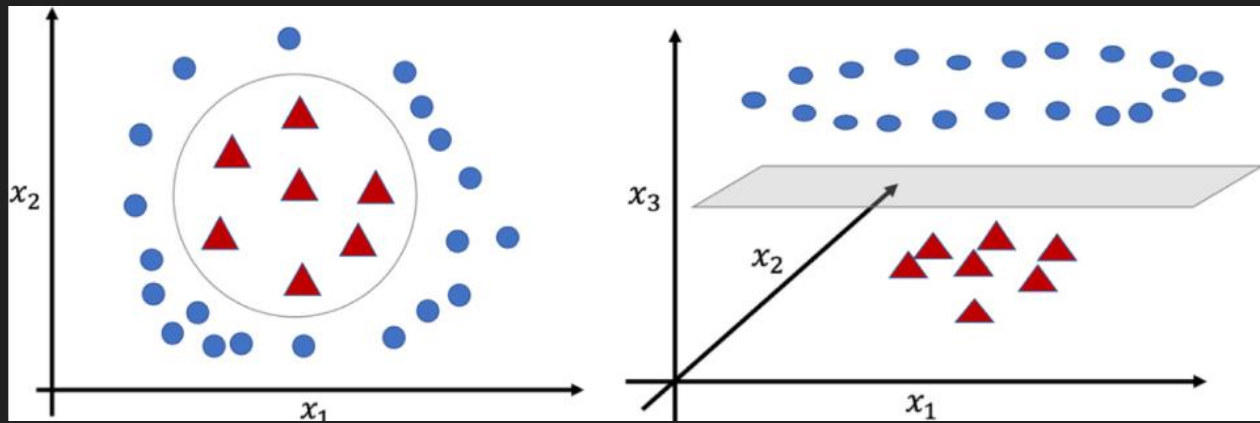


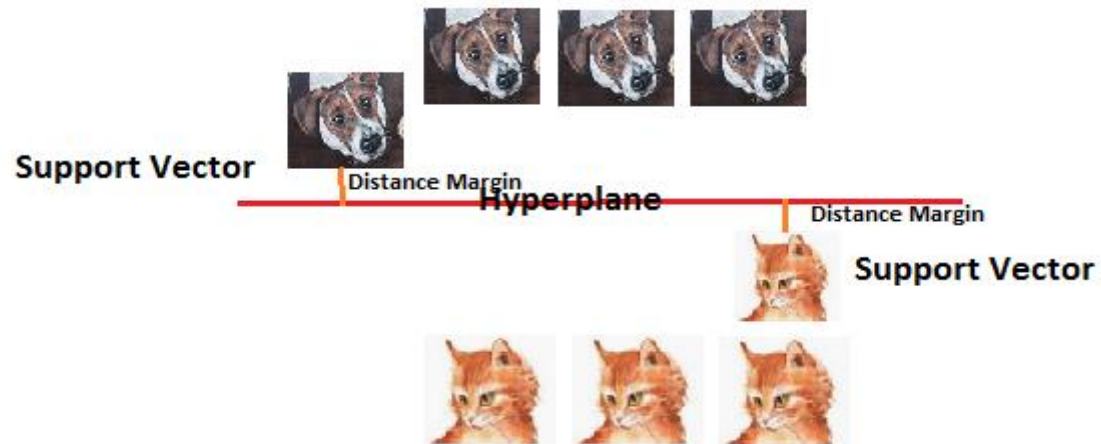
Image Classification Techniques

- Traditional Techniques
 - Support Vector Machines
 - Decision Trees
 - K Nearest Neighbor
- Modern Methods
 - Artificial Neural Networks
 - Convolutional Neural Networks

Support Vector Machines(SVM)

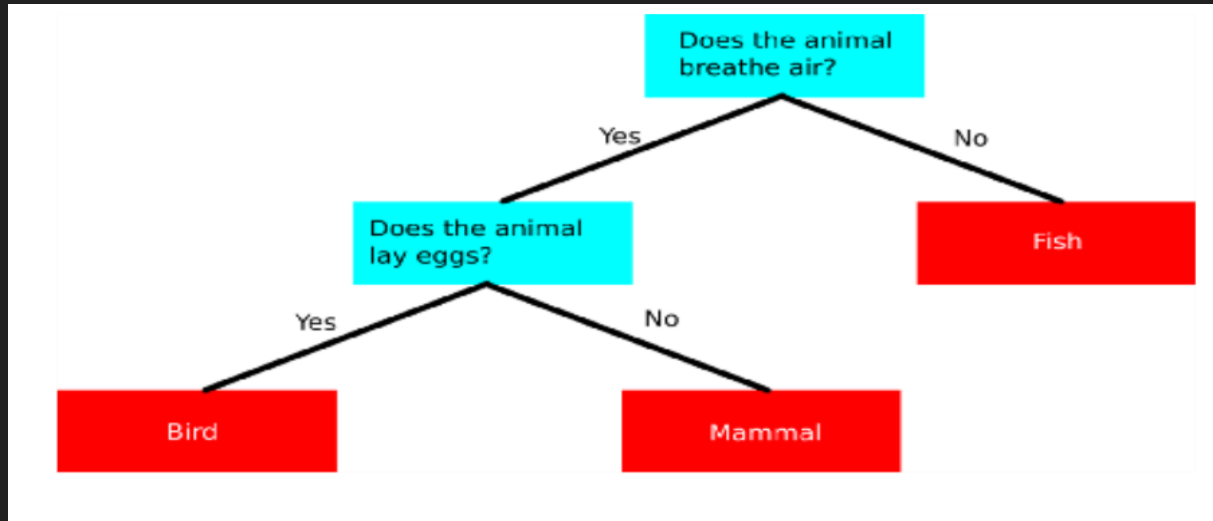
- Supervised machine learning algorithm
- Separates classes by forming a hyperplane in a n-dimensional space
- Depends on something called kernel function
- Most commonly used kernels are
 - Linear Kernel
 - Gaussian Kernel
 - Polynomial Kernel





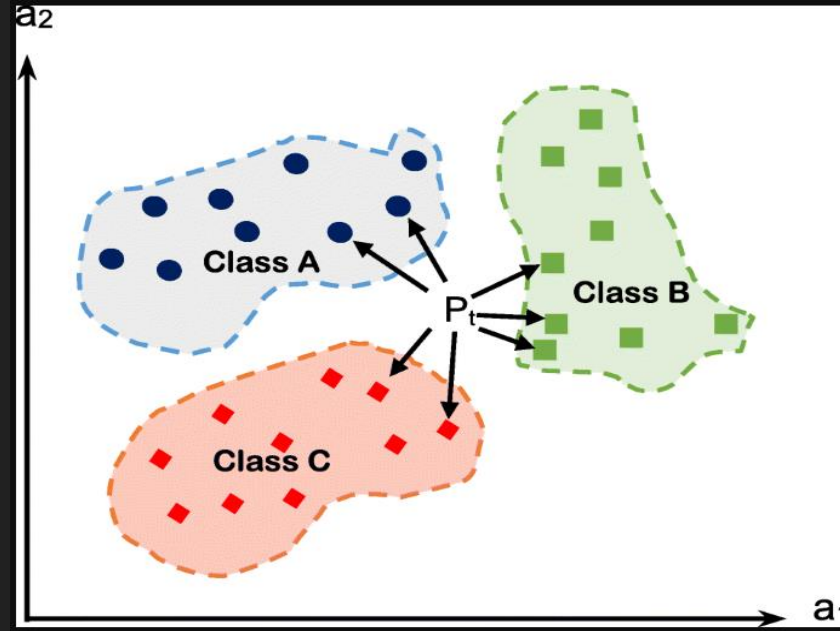
Decision Trees

- It is another supervised learning algorithm
- It uses tree data structure
- Contains hierarchical rule-based methods and permits acceptance and rejection of class labels in each intermediary level



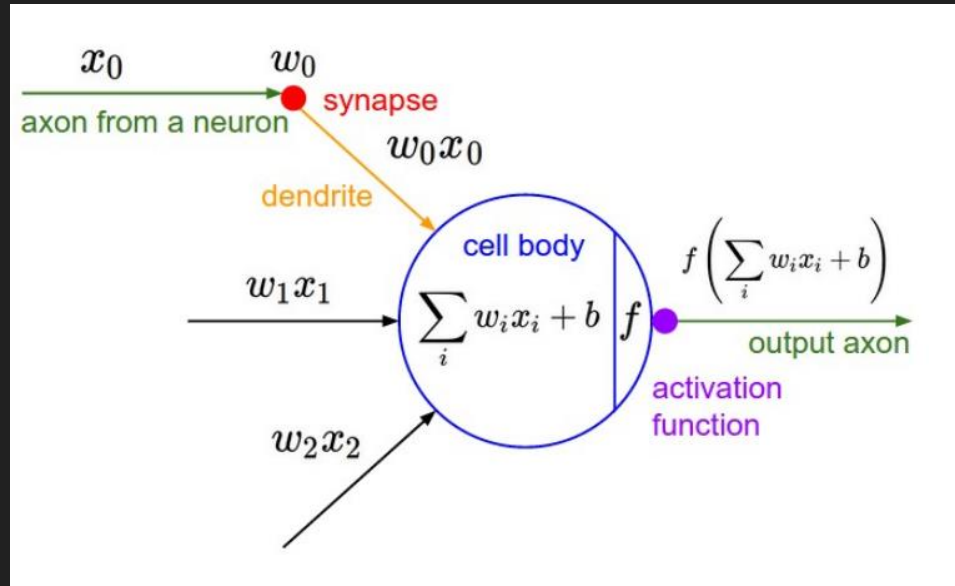
K-Nearest Neighbour

- It works on the basis of euclidean distance between feature vectors and classifies data points by finding the most common class among the k-closest examples



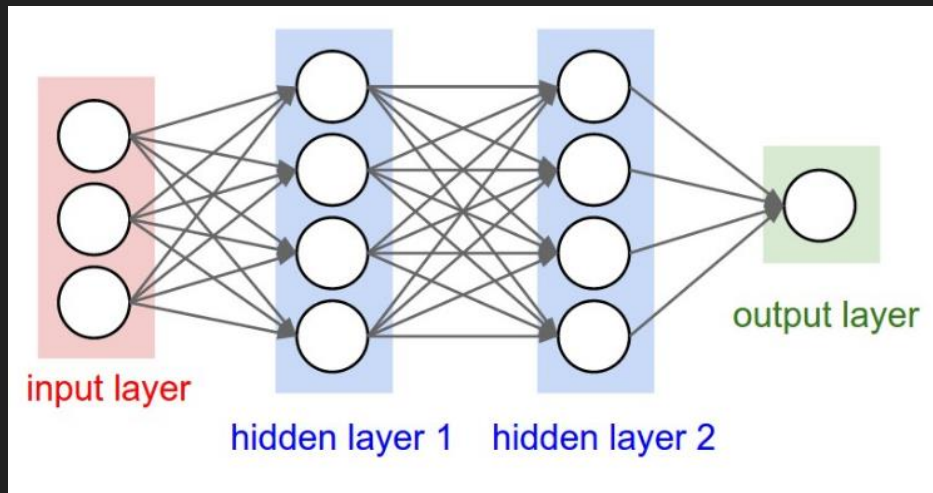
Artificial Neural Networks

- Inspired by biological neural networks
- Have nodes which are analogous to biological neurons
- Connections between different neurons have numerical values called weights



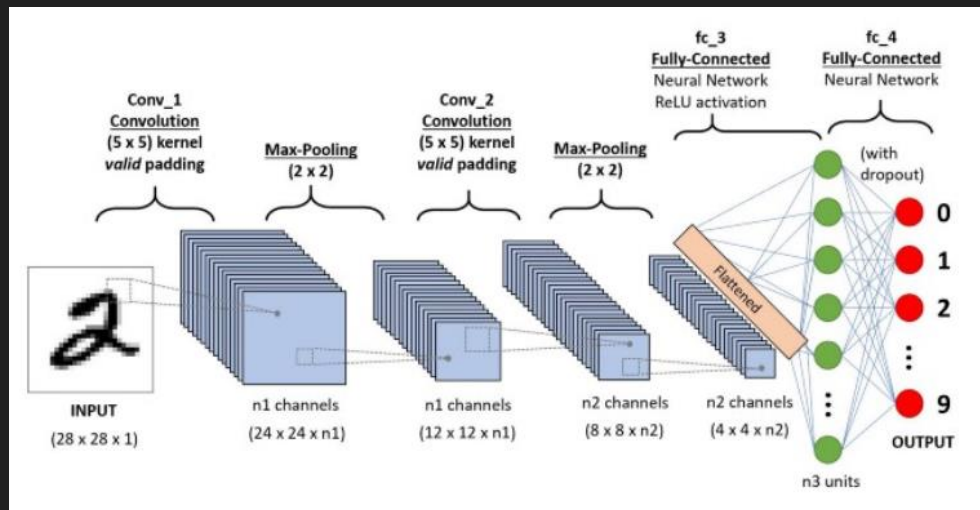
Artificial Neural Networks...(contd)

- Contains different layers that does individual tasks/individual feature detection
- Eg for a face detection task first layer can detect the face's shape, second layer can identify eyes, third can identify mouth, etc.



Convolutional Neural Networks(CNN)

- Special type of Artificial Neural Network
- SOTA in computer vision tasks
- Contains two parts: Convolutional Layers and Pooling Layers
- These two layers are arranged in different ways to achieve a CNN architecture



Thank You