Image Classification In Python

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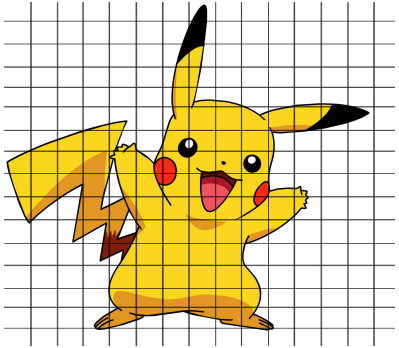
Agenda

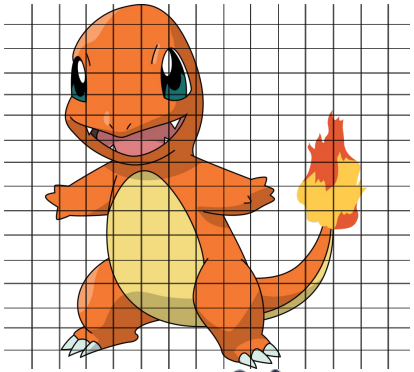
- ❏ Image Classification: What, Why and How?
- ❏ Dataset Details
- ❏ Tools and Libraries
- ❏ Supervised classification
- ❏ Demo
- ❏ Q/A

WHAT is Image Classification?

Assigning pixels in the image to categories or classes of interest.



It's a Pikachu!!



Char ... Charmander!

WHY Image Classification?

1. Automated Image Organization - Google Photos, Facebook Tag suggestion
2. Image search - Myntra Image shopping, etc.
3. Face Recognition - Phone locks, Login systems
4. Healthcare Industry - Cancer cell recognition, etc.
5. Automobile Industry - First steps towards Self Driven Cars

**https://analyticsindiamag.com/8-uses-cases-of-image-recognition-that-we-see-in-our-daily-lives/*

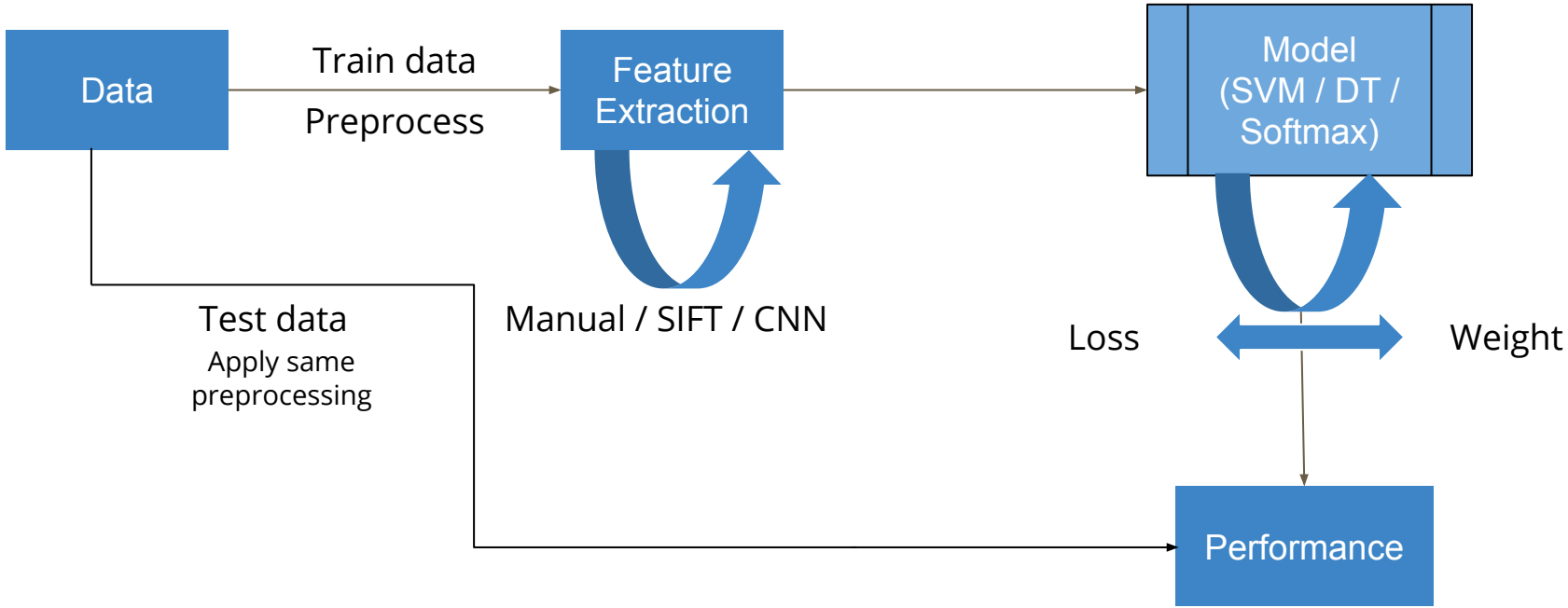
**https://indatalabs.com/blog/uses-image-recognition*

HOW to do Image Classification?

Image Classification Task can be broadly divided into 4 steps:

1. Loading and Preprocessing Data
    a. Train-Validation-Test Split (60%-20%-20%)
    b. Data Augmentation, Class balancing, etc.
2. Defining Model architecture
    a. Feature Definition and Extraction
3. Training the model
    a. Loss functions, Weight Update rules, Training iterations, etc.
4. Estimation of performance
    a. Test Prediction
    b. Benchmarking / KPIs

HOW to do Image Classification?



Dataset : Who's that Pokemon?

Dataset

Kaggle Pokemon Classification Dataset:

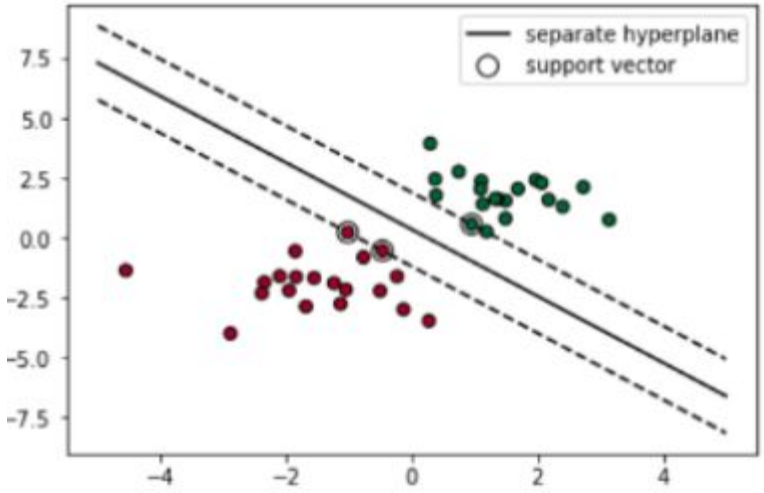
https://www.kaggle.com/rounakbanik/pokemon

Randomly picked 10 pokemons - 60%-40% split into train-val:

Horsea, Mankey, Mew, Scyther, Snorlax, Spearow, Tauros, Vaporeon, Venusaur, Vileplume

Data Intro and Visualization

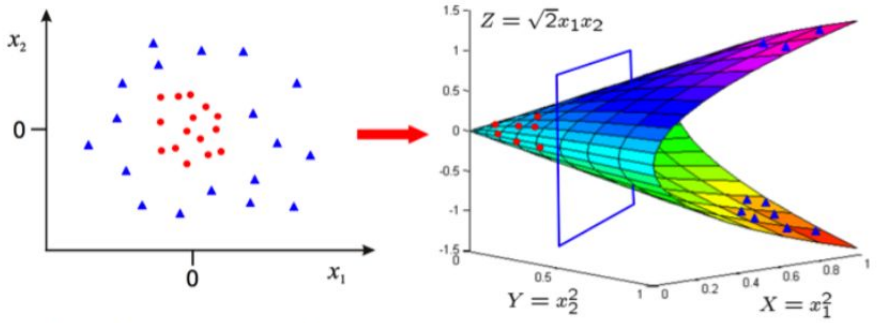
Supervised Classification : SVM



- Maximum Margin Classifier
- Find linearly separable hyperplane - Decision Boundary
  - Soft Margins
- Linear Binary Classifier:
  - Use OvA, OvO combinations

**https://towardsdatascience.com/support-vector-machine-simply-explained-fee28eba5496*

Supervised Classification : SVM - Kernels



- Data is linearly separable in 3D
- This means that the problem can still be solved by a linear classifier

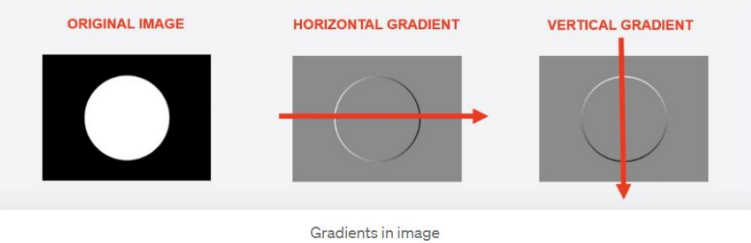
- Linear Kernel : K(x, xi) = sum(x * xi)
- Polynomial Kernel: K(x,xi) = 1 + sum(x * xi)^d
- Radial Kernel: K(x,xi) = exp(-gamma * sum((x – xi^2))

The kernel defines the similarity or a distance measure between new data and the support vectors.

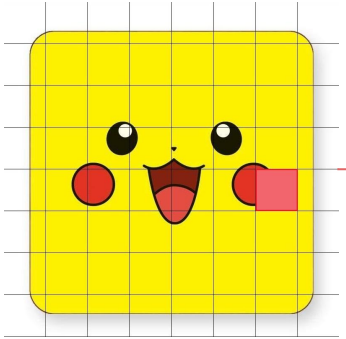
**https://towardsdatascience.com/support-vector-machines-a-brief-overview-37e018ae310f*

Supervised Classification : SVM

Histogram of Oriented Gradients (HOG) features:



Dark (low) to Light(high) pixel -> Positive gradient



	50	
20	x	100
	110	

Horizontal Gradient: 100 - 20 = 80
Vertical Gradient: 110 - 50 = 60

Gradient Magnitude = $\sqrt{(80)^2 + (60)^2}$ = 100
Gradient Angle = $\tan^{-1}(60/80)$ = 36.86°

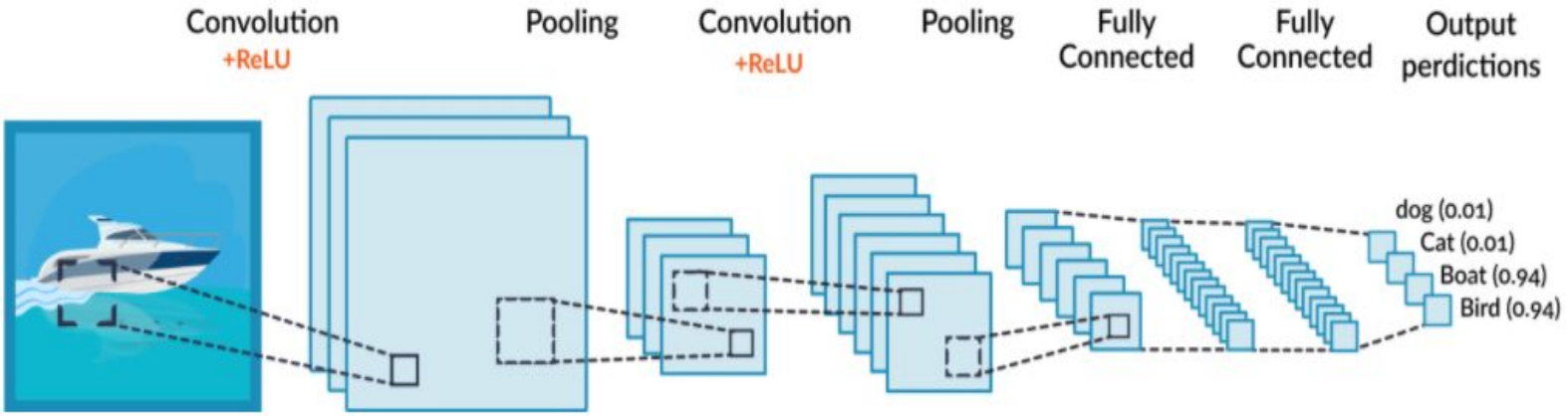
64 vectors into 9 bins (standard from HoG paper)

**https://medium.com/analytics-vidhya/a-take-on-h-o-g-feature-descriptor-e839ebba1e52*

SVM Demo

Convolutional Neural Networks

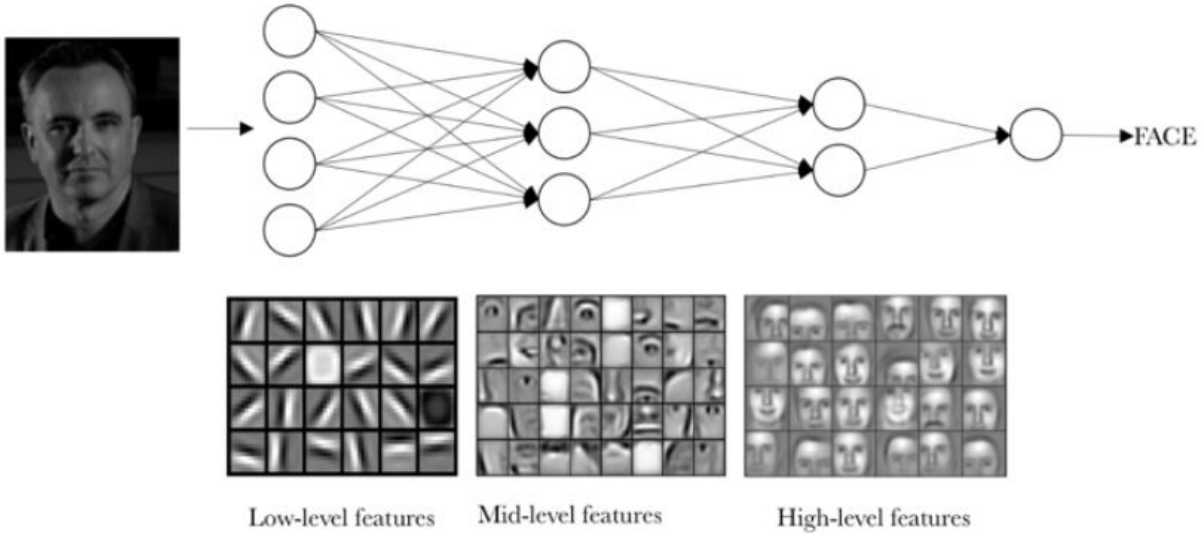
The convolutional neural network (CNN) is a class of **deep learning neural networks**.



*https://missinglink.ai/guides/convolutional-neural-networks/convolutional-neural-network-tutorial-basic-advanced/

Convolutional Neural Networks: Continued

Feature Engineering part is automated (What part, not how)



*https://towardsdatascience.com/convolutional-neural-networks-for-beginners-practical-guide-with-python-and-keras-dc688ea90dca

Convolutional Neural Networks: Continued

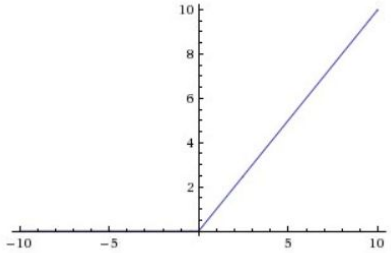
Convolutions

1x1	1x0	1x1	0	0
0x0	1x1	1x0	1	0
0x1	0x0	1x1	1	1
0	0	1	1	0
0	1	1	0	0

4		

ReLU: $f(x) = max(0, x).$

- Activation function to introduce non-linearity



*https://towardsdatascience.com/applied-deep-learning-part-4-convolutional-neural-networks-584bc134c1e2

CNN Demo

Image Processing In Python

- Object Detection
- Image Segmentation
- Clustering - Unsupervised

Adios Pythonistas!!