Year
2022

AI Visual Inspection system for road defection (L2)

YOUTH COLLEGE (INTERNATIONAL)

Reference Websites

Python Official	
https://www.python.org/	
Google Colab	
https://colab.research.google.com/	
Python Exercises	
https://www.w3resource.com/python-exercises/ https://www.w3schools.com/python/default.asp	
GitHub	
https://github.com/garyprojects/road_detect	

1. Introduction

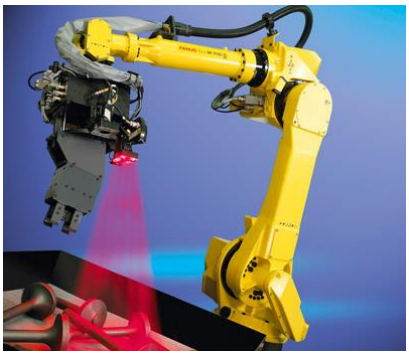
Computer vision is an interdisciplinary scientific field that deals with how computers can gain high-level understanding from digital images or videos.

Machine vision (MV) is the technology and methods used to provide imaging based automatic inspection and analysis for such applications as automatic inspection, process control, and robot guidance, usually in industry.

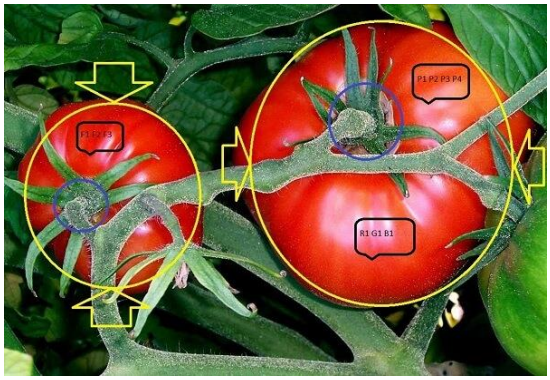
1.1 Applications:

Industrial

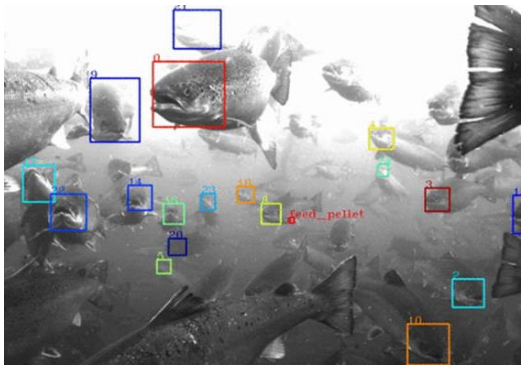
Manufacture



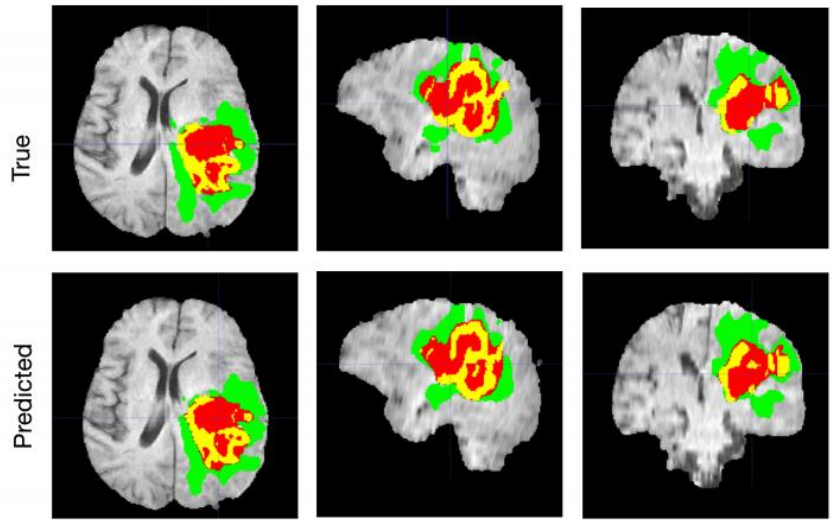
Agriculture



Aquaculture

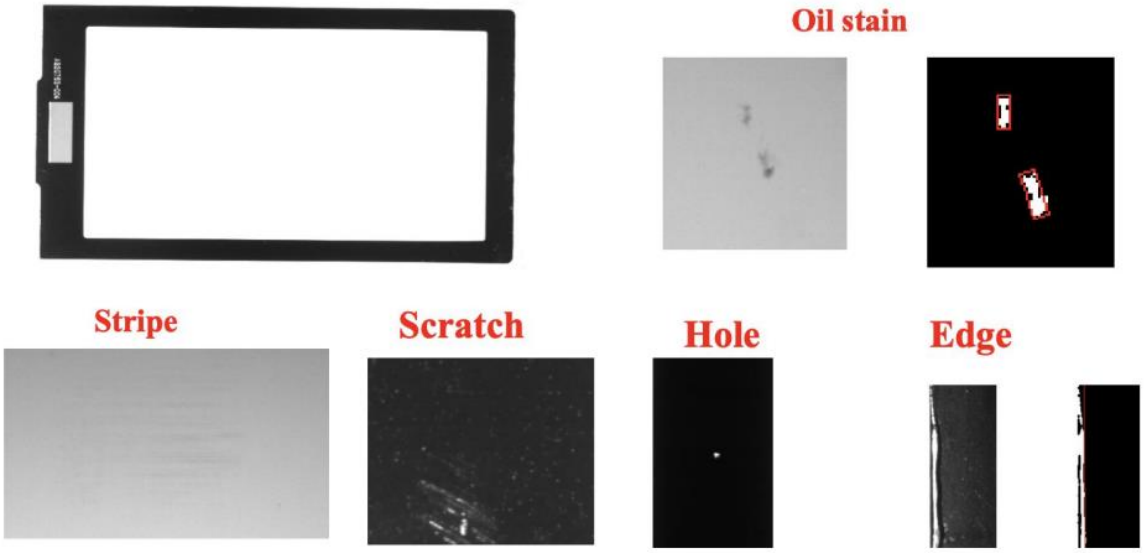


Healthcare



https://developer.nvidia.com/blog/automatically-segmenting-brain-tumors-with-ai/

1.2 Surface defect inspection

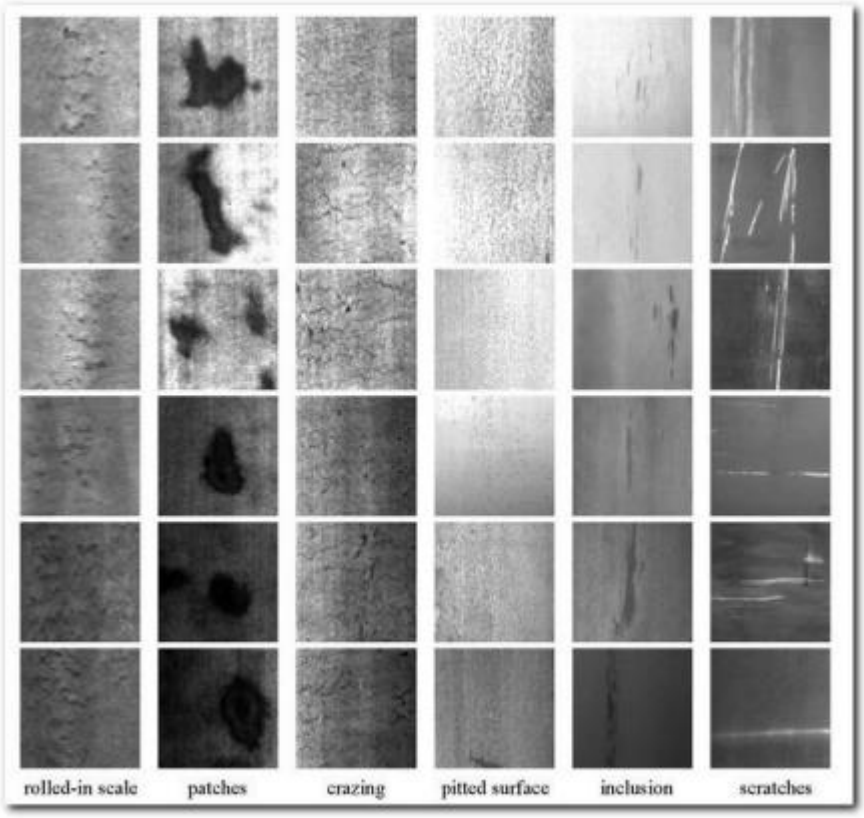


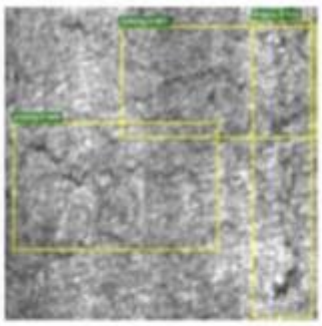
Surface defects of mobile panel

Classification

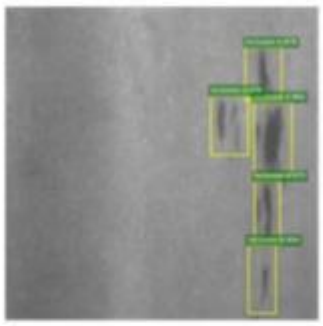
Code	Defect pattern	Sample image	Code	Defect pattern	Sample image
A	White spot		B	Gray dots	
C	Strip defect		D	Black spot halo	
E	Bubble defect		F	Solid black spot	
Defect-free					

Detection

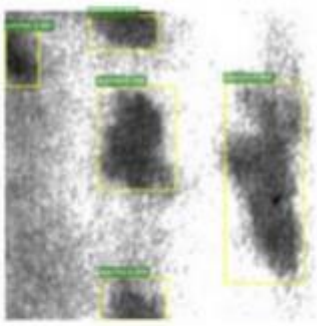




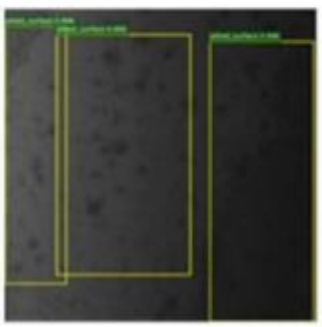
(a) crazing



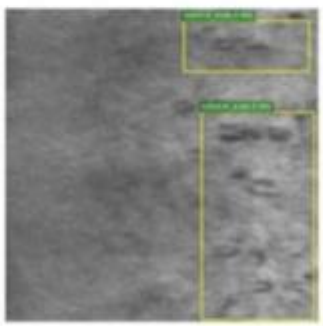
(b) inclusion



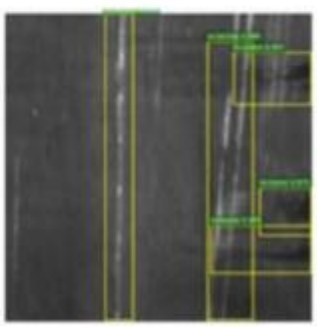
(c) patches



(d) pitted surface

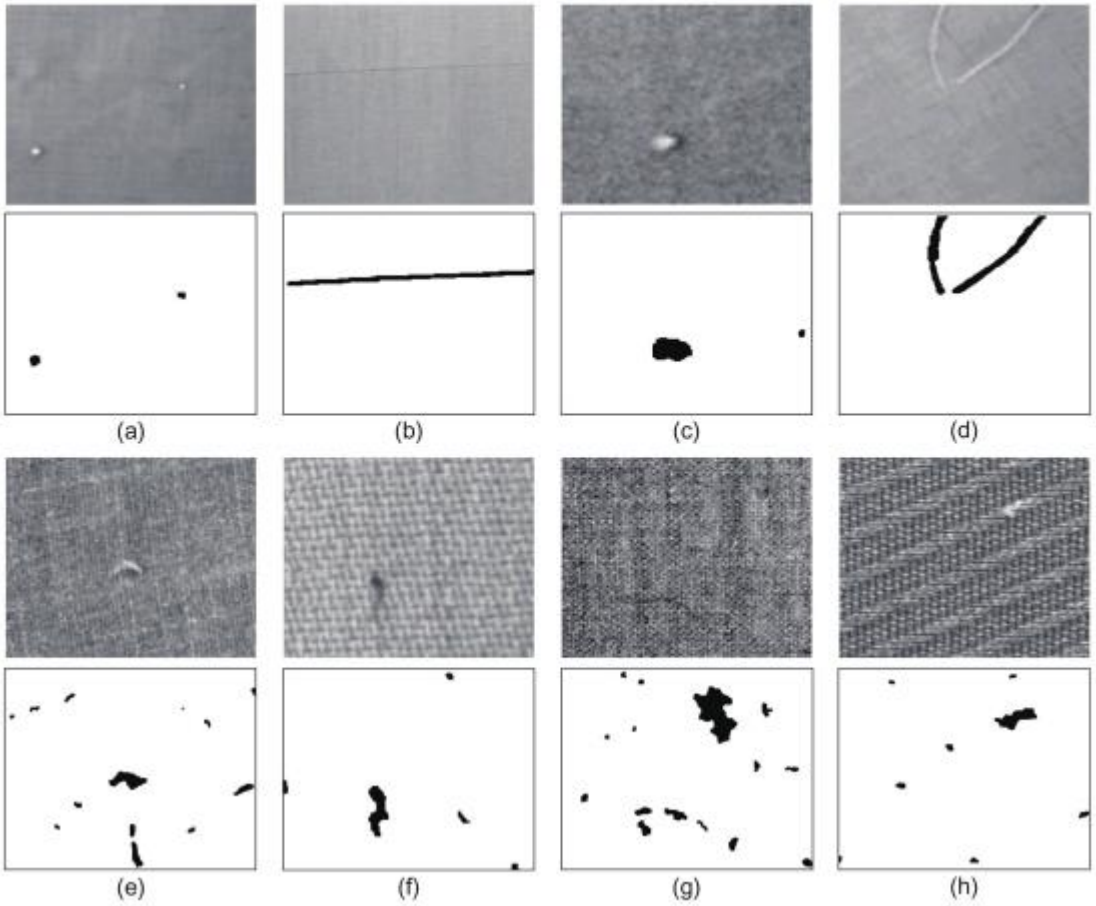


(e) rolled-in scale



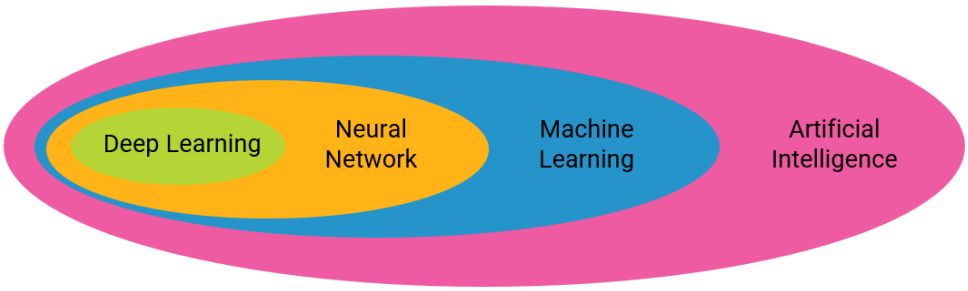
(f) scratches

Segmentation



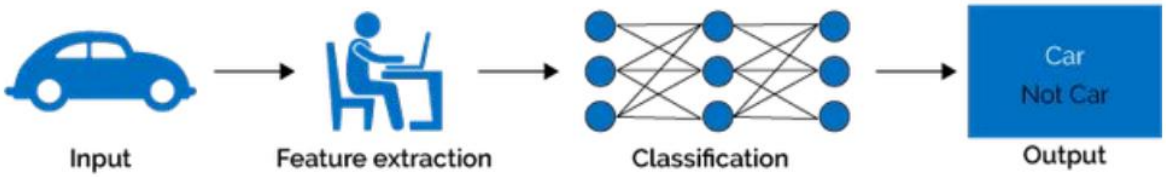
2. Artificial Intelligence

2.1 AI vs Machine Learning vs Deep Learning

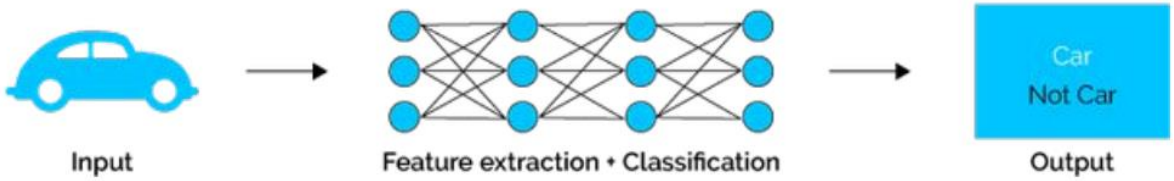


Traditional Computer Vision

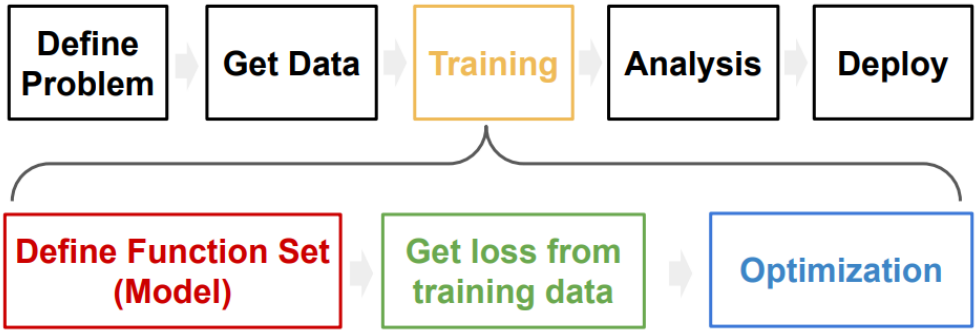
Machine Learning



Deep Learning

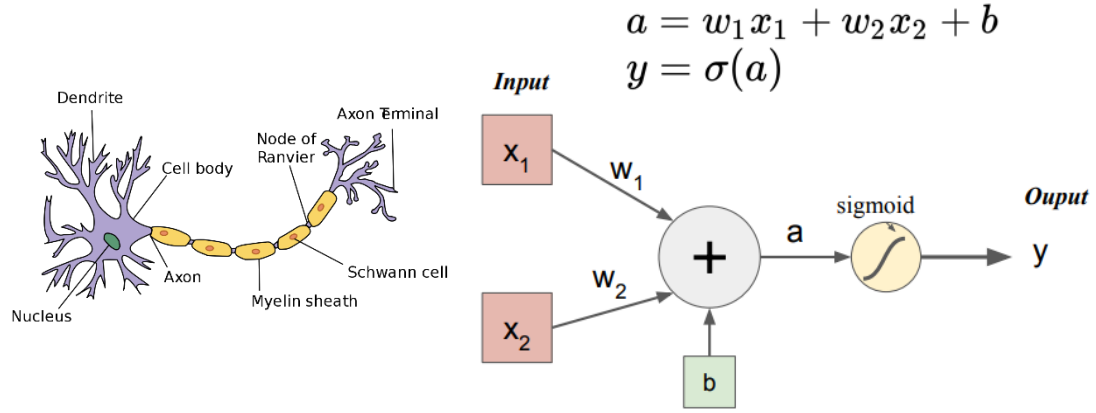


2.2 Machine learning process

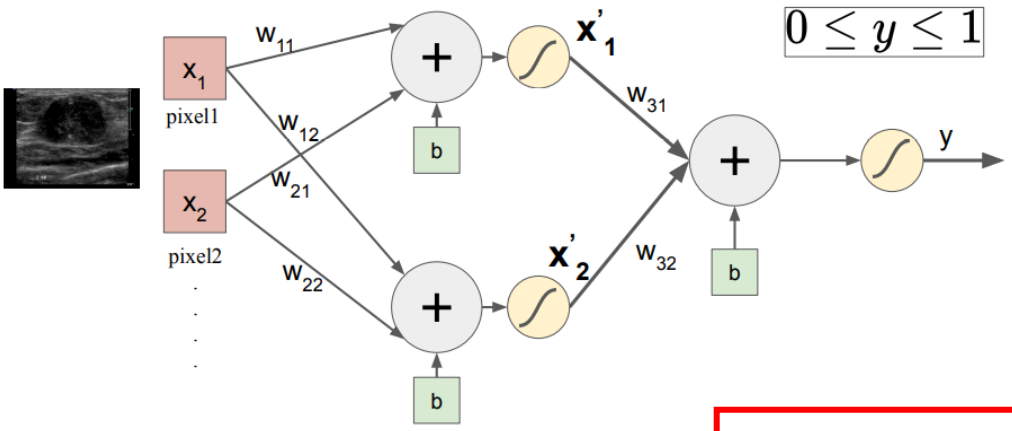


2.3 Define Model

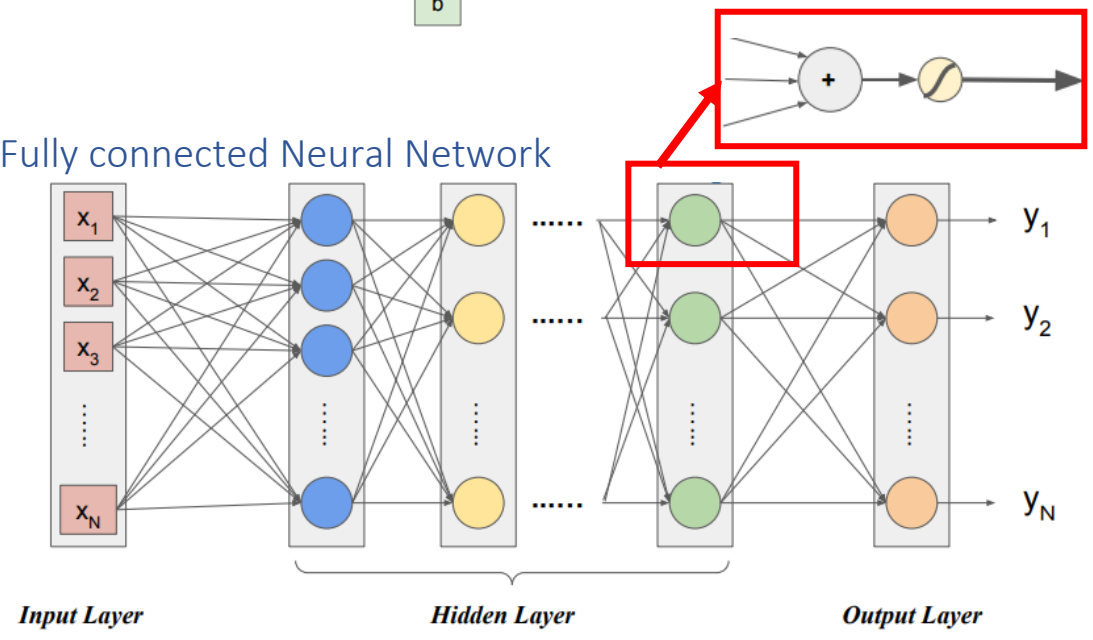
Perceptron/neuron



Binary Classification

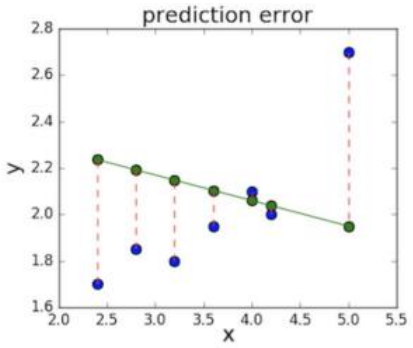


Fully connected Neural Network



2.4 Loss function

- It indicates the error between prediction and truth.
- How good is the model?



Regression loss function

MSE
(Mean square error)

$$\frac{\sum (y-\hat{y})^2}{N}$$

MAE
(Mean absulute error)

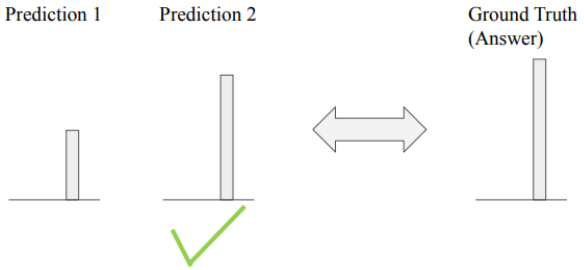
$$\frac{\sum |y-\hat{y}|}{N}$$

y : prediction
$\hat{y}$: answer
N : number of sample

Binary Cross Entropy (BCE)

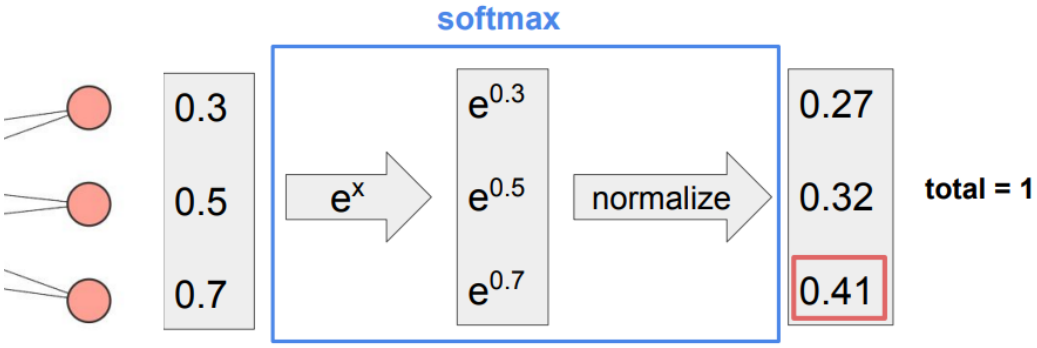
$$BCE = -\frac{1}{N}\sum_{i=1}^{N} \hat{y}_i log y_i + (1-\hat{y}_i) log(1-y_i)$$

$y : 0 \sim 1$
$\hat{y} : 0, 1$



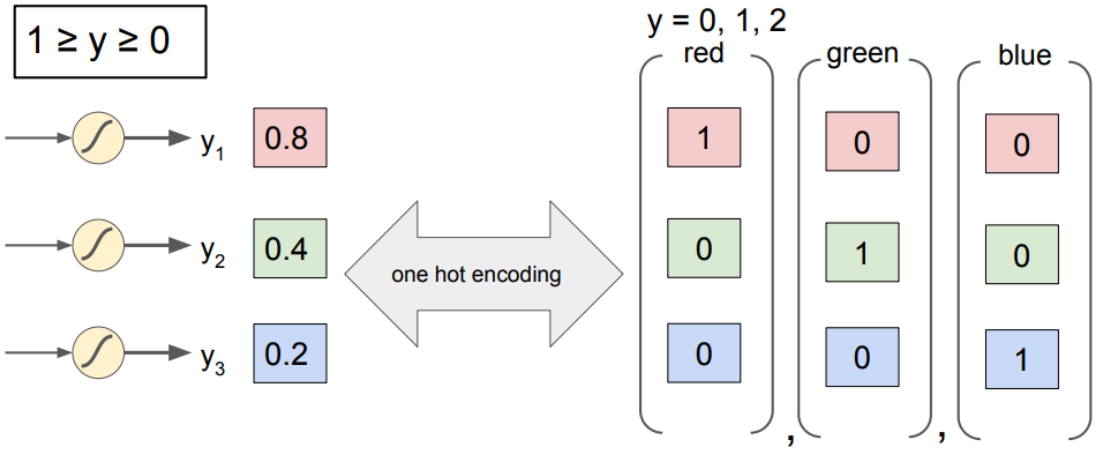
2.5 Multi-class Classification

Softmax

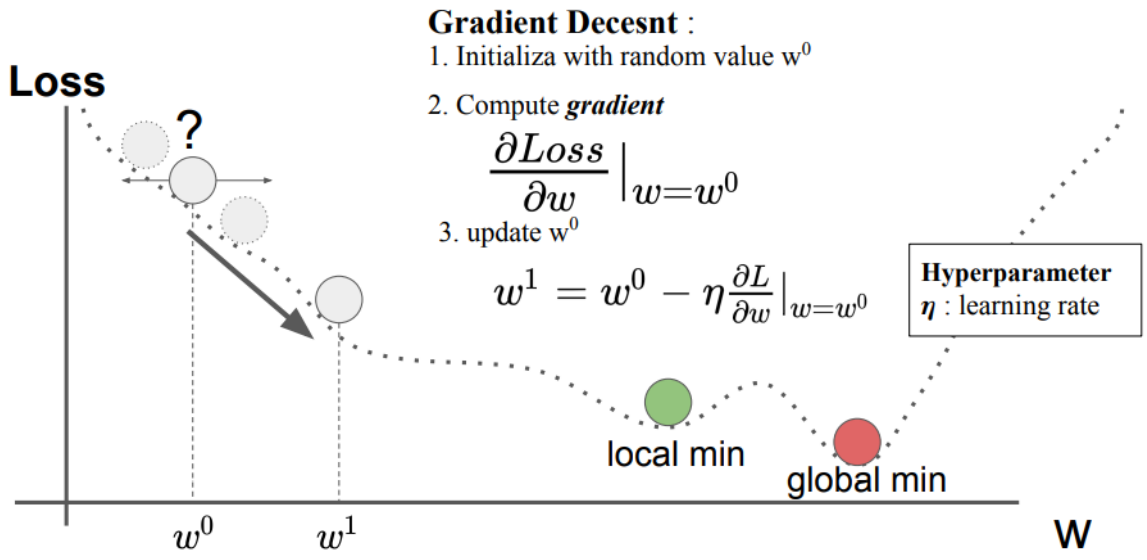


$$softmax(z) = \frac{e^{z_j}}{\sum_{k=1}^{K} e^{z_k}}$$

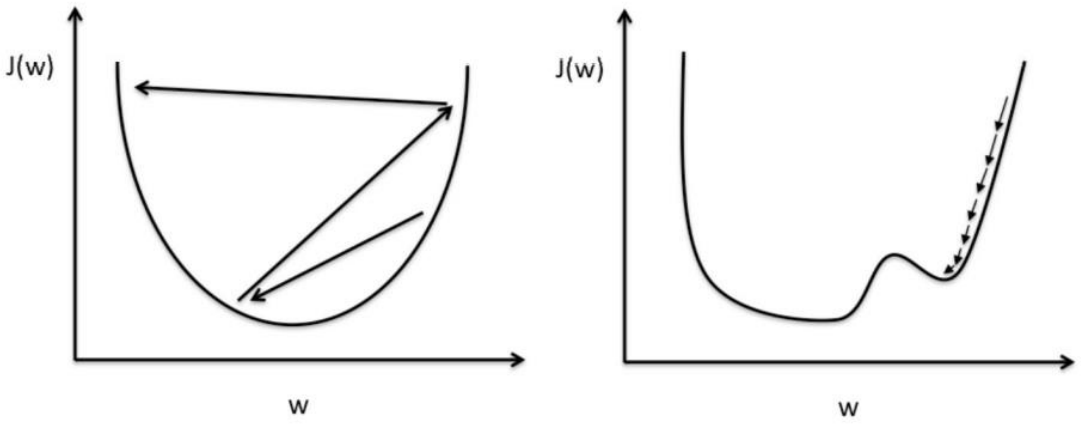
One hot encoding



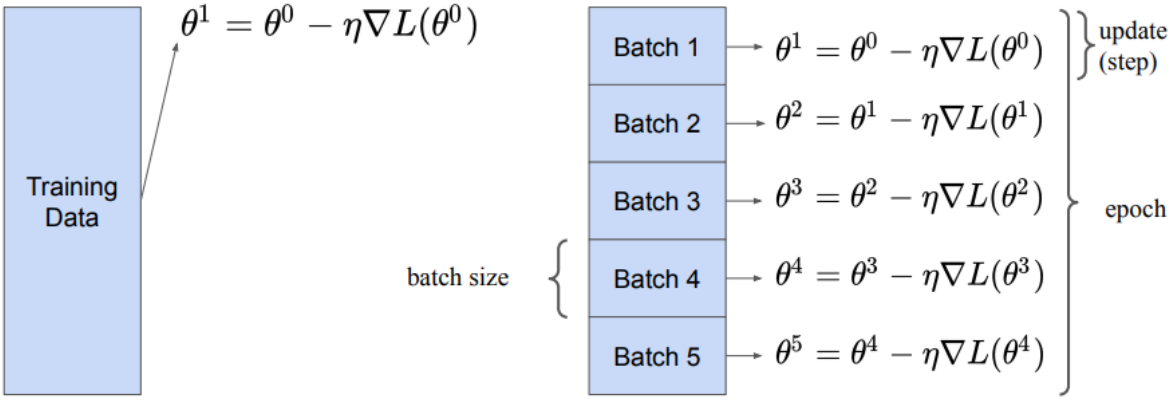
2.6 Optimization



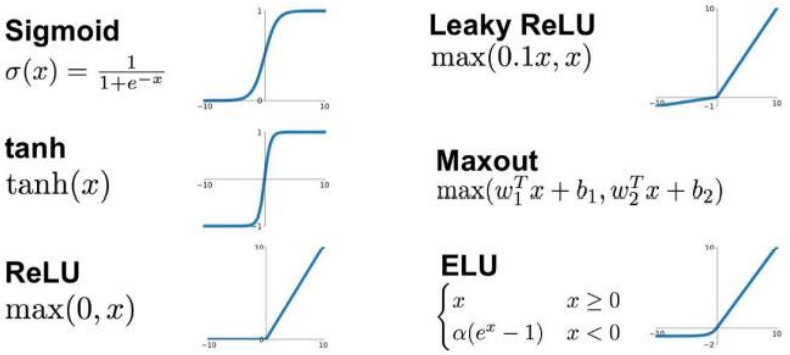
2.7 Learning rate



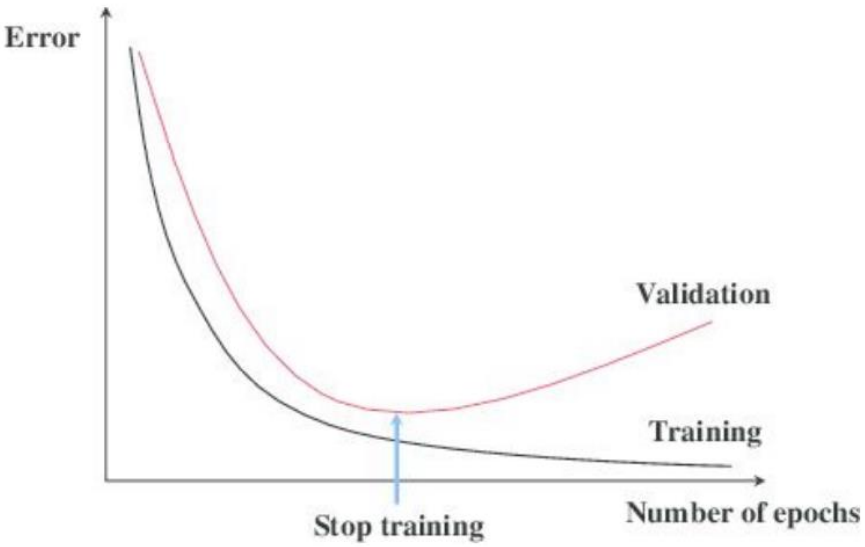
2.8 Batch size



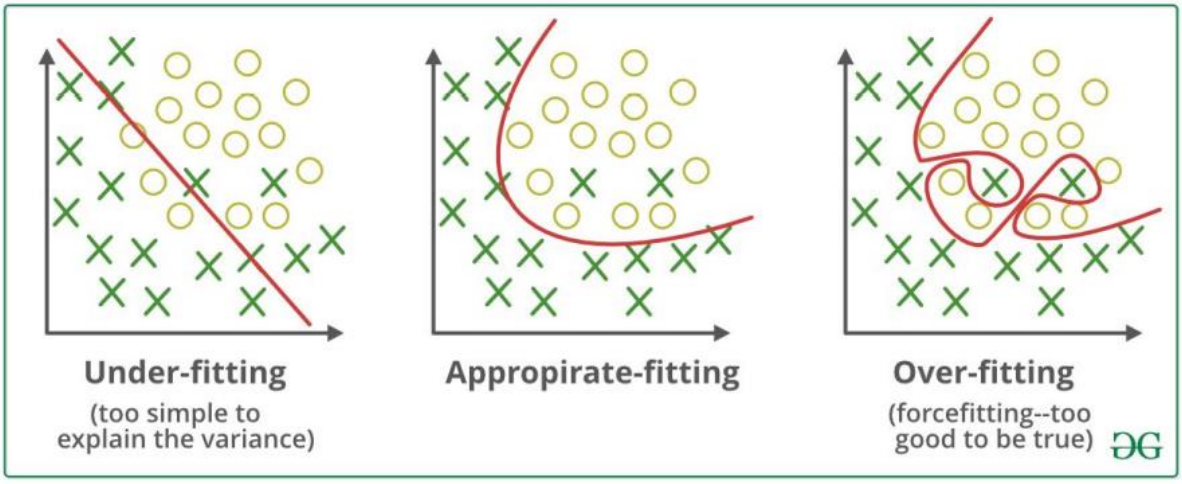
2.9 Activation Layer

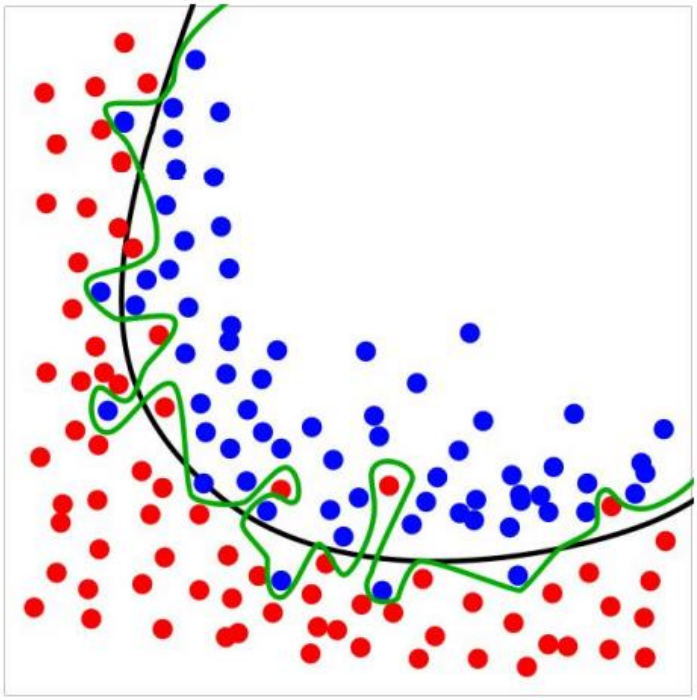


2.10 Early Stopping



2.11 Over-fitting

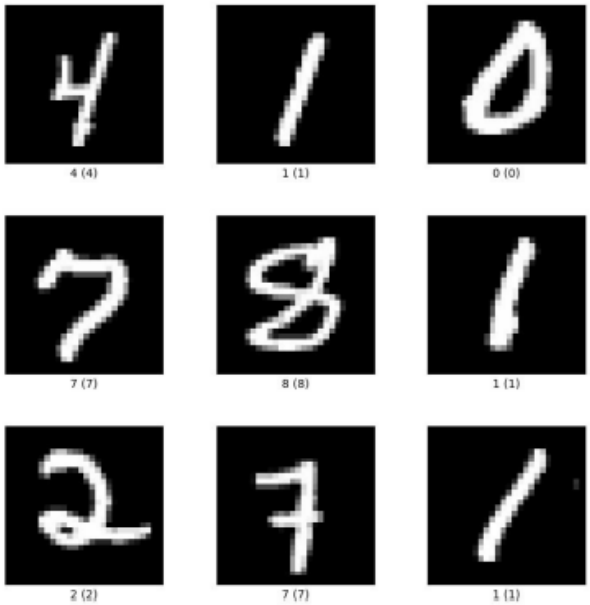




Over-fit Model

Exercise 1 – MNIST Handwritten Digit Classification

File: handwritten.ipynb



Exercise 2 – CIFAR10 Object Recognition

File: objectRecognition.ipynb