

INTRODUCTION TO MACHINE LEARNING

Python & Tensorflow

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FCIS'17 Machine Learning Course

TODAY'S OBJECTIVES

Learning

- Overview on Artificial Intelligence fields
- General basics of Machine Learning
- Different types of learning

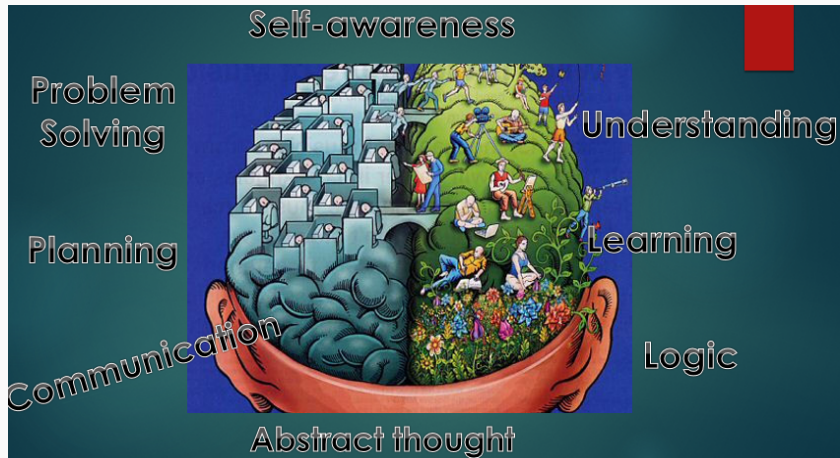
To Do

- Setup an environment for Machine Learning applications
- Getting familiar with Python and Tensorflow

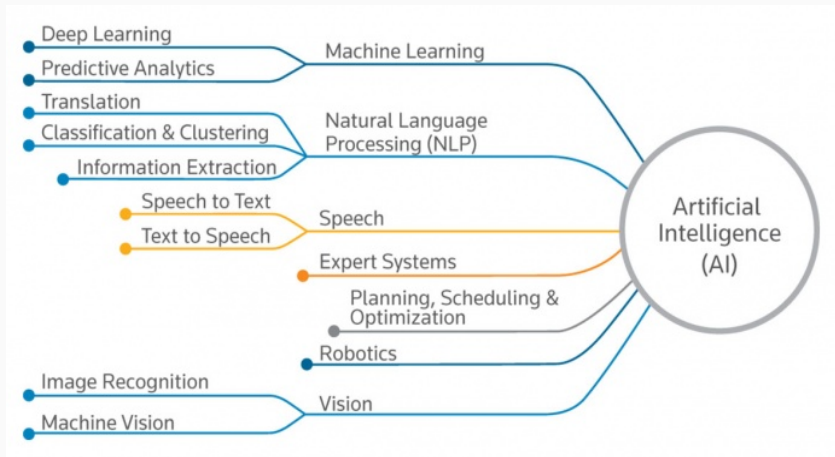
Quiz#1

- Define Intelligence?

ARTIFICIAL INTELLIGENCE



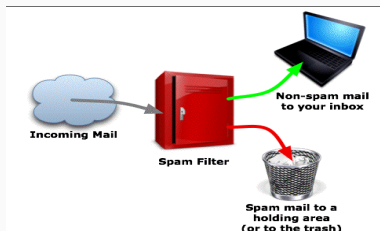
ARTIFICIAL INTELLIGENCE TAXONOMY



MACHINE LEARNING CHARACTERISTICS

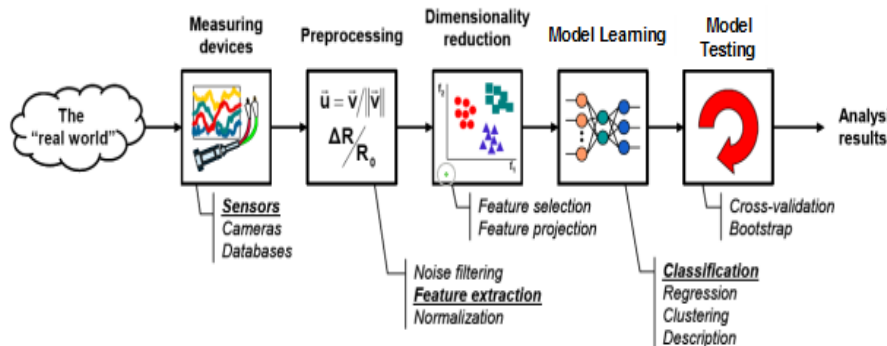
- The ability to **learn** without being explicitly programmed to do a single or group of tasks.
- Collection of **probabilistic**, **statistical** and **mathematical** models and algorithms
- Learning = ***Improving*** with ***experience*** at some ***task***
 - Improve over task, ***T***
 - With respect to accuracy measure, ***P***
 - Based on experience, ***E***

SPAM FILTERING EXAMPLE



- Spam - is all email the user does not want to receive and has not asked to receive
 - **T**: Identify Spam Emails
 - **P**: % of Spam emails that were filtered and % of non-Spam emails that were incorrectly filtered-out
 - **E**: a database of emails that are already classified by users before

THE LEARNING PROCESS



FEATURES AND LABELS

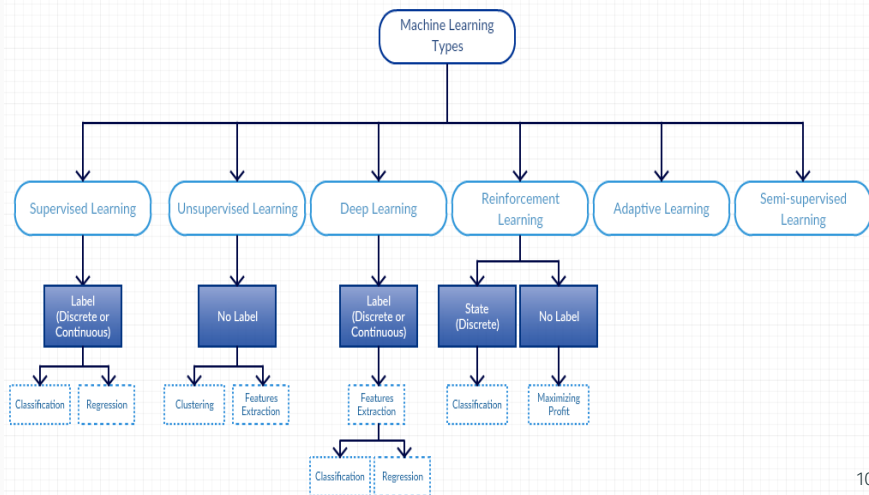
- In Machine Learning, **feature (X)** is an attribute, random variable, property or a phenomena that is observed according to a specific label, entity or object (Y)
- A label could have several features and dimensions [$X = x_0, x_1, \dots, x_n$]
- A label could be either a continuous or discrete value
- In case that the label is a **continuous** value, then it is considered to be a **Regression** problem
- In case that the label is a **discrete** value, then it is considered to be a **Classification** problem

FEATURES AND LABELS (CONT.)

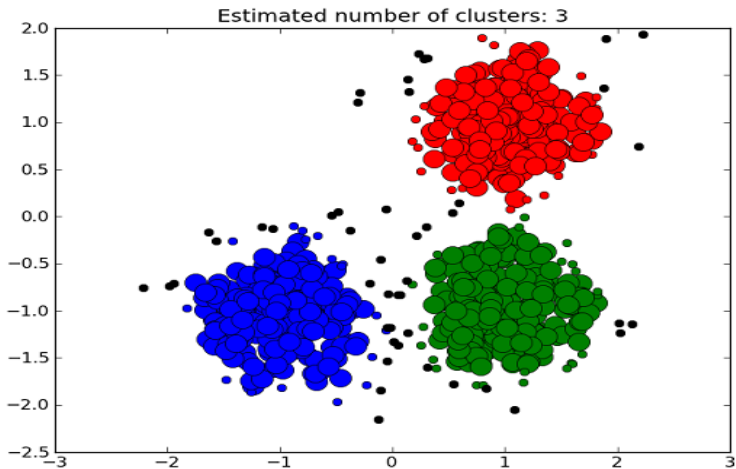
Quiz#2

- Assume that we are building a model to differentiate between Humans and Animals.
- Is it a **Regression** or **Classification** problem?
- Extract some important **features** that could help in the modeling process?
- Draw a simple diagram to show **the input** and **the output** of your Machine Learning model
- Choose the correct relation: 1) Any **Regression** is considered to be a **Classification** 2) Any **Classification** is considered to be a **Regression**

THE LEARNING TYPES



CLUSTERING



Supervised Learning

- Linear Regression (**Regression**)
- Logistic Regression (**0-1 Classes**)
- Shallow Neural Networks (**Multi-class**) (**Regression**)

Unsupervised Learning

- Vanilla Auto-encoder
- Restricted Boltzmann Machines (**RBMs**) [Optional]

Deep Learning

- Deep Neural Networks (**DNNs**)
- Vanilla Recurrent Neural Networks (**RNNs**)
- Long short-term Memory (**LSTMs**) [Optional]
- Convolutional Neural Networks (**CNNs**)
- Generative Adversarial Neural Networks (**GANs**) [Optional]



PROGRAMMING LANGUAGE AND FRAMEWORKS (CONT.)

new stars from 2017-04-20 to 2017-07-06

#1: 7929  tensorflow/tensorflow

#2: 2465  fchollet/keras

#3: 1894  caffe2/caffe2

#4: 1526  BVLC/caffe

#5: 1250  pytorch/pytorch

#6: 1233  Microsoft/CNTK

#7: 979  dmlc/mxnet

#8: 709  deepmind/sonnet

#9: 690  tflearn/tflearn

#10: 485  deeplearning4j/deeplearning4j

#11: 458  Theano/Theano

#12: 452  davisking/dlib

COURSE OBJECTIVES

- Knowing the state-of-art models that are used nowadays in research field
- Building end-to-end models for Machine Learning
- Learning to how to deal with different data types (numerical, text and images)
- Learning Python and its important libraries such as **Numpy** and **Matplotlib**

QUESTIONS?

PRACTICAL

MUST-KNOWN BASICS IN PYTHON

- Variables and Functions
- Loops and If-conditions
- List and Dictionary
- Importing libraries

PROBLEM#1

Given N numbers, apply **Bubble Sort algorithm** to sort the list in ascending order

- Sample Input: [9, 2, 10, 1, -1, 0, 0, 1]
- Sample Output: [-1, 0, 0, 1, 1, 2, 9, 10]

```
void bubblesort( int *a , int n )
{
    int temp; //for swapping
    for (int i = 0 ; i < n - 1 ; i++)
    {
        for (int j = 0 ; j < n - 1 ; j++)
        {
            if ( a[j] > a[j + 1] )
            {
                temp = a[j];
                a[j]=a[j + 1];
                a[j + 1] = temp;
            }
        }
    }
}
```

PROBLEM#2

Given a string **S**, output its characters frequencies

- Sample Input: **abccbaabraabaaccc**
- Sample Output: **a:7 b:4 c:5 r:1**

PROBLEM#3

Given a string **S**, output True if it is Palindrome and False otherwise

- Sample Input: **aba**
- Sample Output: True
- Sample Input: **abac**
- Sample Output: False

MUST-KNOWN BASICS IN TENSORFLOW

- Sessions
- Tensorflow Graph
- Constants, Variables and Placeholders

PROBLEM#4

Given matrices **U** and **V**, use Tensorflow to output their Dot Product and Element-wise Sum. Apply the Transpose operation on one of them.

THANKS!