Training: Machine Learning & Deep Learning (Computer Vision)

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Brief Introduction to ML:

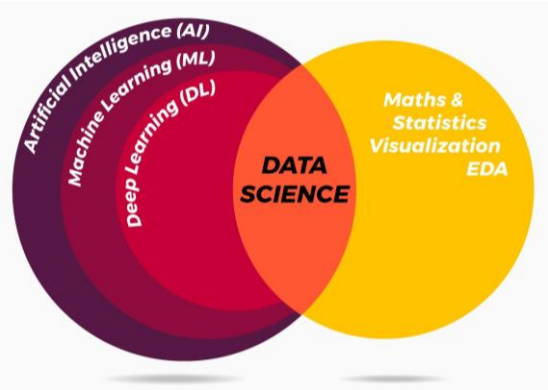
Learning, like intelligence, covers such a broad range of processes that it is difficult to define precisely. A dictionary definition includes phrases such as “to gain knowledge, or understanding of, or skill in, by study, instruction, or experience,” and “modification of a behavioural tendency by experience.” There are several parallels between animal and machine learning. Certainly, many techniques in machine learning derive from the efforts of psychologists to make more precise their theories of animal and human learning through computational models. It seems likely also that the concepts and techniques being explored by researchers in machine learning may illuminate certain aspects of biological learning.

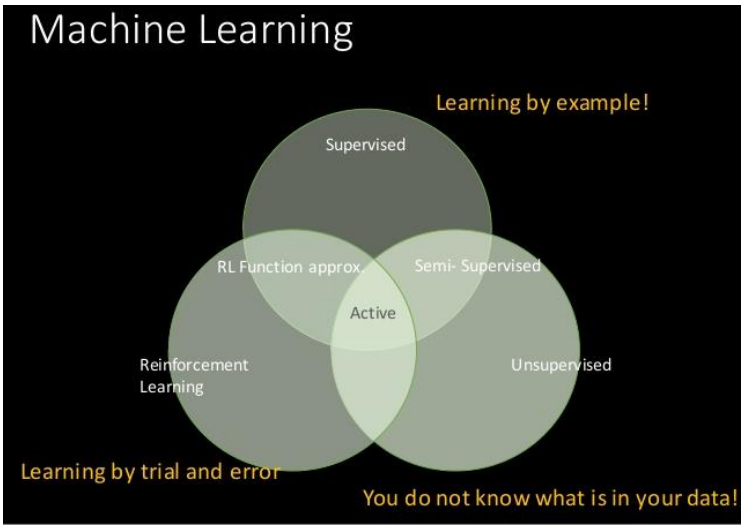
As regards machines, we might say, very broadly, that a machine learns whenever it changes its structure, program, or data (based on its inputs or in response to external information) in such a manner that its expected future performance improves. Some of these changes, such as the addition of a record to a database, fall comfortably within the province of other disciplines and are not necessarily better understood for being called learning. But, for example, when the performance of a speech-recognition machine improves after hearing several samples of a person’s speech, we feel quite justified in that case to say that the machine has learned.

Machine learning usually refers to the changes in systems that perform tasks associated with artificial intelligence (AI). Such tasks involve recognition, diagnosis, planning, robot control,

prediction, etc. The “changes” might be either enhancements to already performing systems or ab initio synthesis of new systems.

Prerequisites to this training module:





Assumed *minimum* CS prerequisites: Familiarity with Python, Numpy and Pandas
Other helpful python modules to know beforehand (not a prerequisite) **:** Scikit Image, OS
Assumed *minimum* Math prerequisites: Basics of statistics, calculus and linear algebra. (You would know all of this anyway from school)

We encourage you to refer material apart from the stuff given below as well to expand your understanding. We have tried to curate a list of resources we found would utilize your time in the best way.

This assignment, in particular, has a lot more material for the allocated time in the proposed timeline. Finish off the things as fast as you can, to explore more concepts included here. Try to be ahead of the given timeline here to cover extra material given in this guide (It is highly encouraged and recommended to do so)

Details of material in this training module:

(You will not have to complete all of these. What all you have to complete will be given below)

1. **Machine Learning crash course, Google**
    - You are required to do around 10.5 hours of content from this course.
    - This must be done in 2 days at max. (Brutal, but doable with enough focus)

- An advantage of the course is that a lot of important info mentioned in the videos is rehashed (better) in the subsequent text. Useful for referencing later on.
- **Just before starting the Neural networks part, watch the 3Blue1Brown Series given below.**
- Do everything in this course diligently until Embedding. Skip everything after (*and including*) Embedding
- *Note that the "Regularization: Sparsity" module is optional* (but recommended)
- This might feel overwhelming, but we would like to point out that *understanding* is infinitely more important than mugging up stuff. For example: Even if you forget exactly what **prediction bias** or **bucketing** means, it's alright as long as you know that the average of predictions should be near the average of labels in the dataset and why you can't measure this average the same way when using logistic regression.
- Link to the course

2. **Neural Networks series by 3Blue1Brown, YouTube**
    - Consists of 4 episodes
    - Gives an extremely good intuitive (although basic) understanding of Neural Networks
    - A total of ~64 minutes of (brilliant) content
    - Worth watching more than once to clear up doubts later on
    - Your objective is to understand the intuition. Don't try to memorise the math. As long as you're able to understand everything Grant is saying, that is enough. However, make sure that you understand *everything* in these videos.
    - Mantra: Pause and Ponder
    - Link to the videos

3. **Udacity Course: "Intro to Tensorflow for Deep Learning"**
    - Highly recommended course
    - Complete lessons 3, 4 and 5. This amounts to about 6 hours worth of material.
    - You do not have to do all the lessons. Ignore everything from lesson 7 onwards.
    - You are expected to do this in 1 day at max.
    - Link to the course

4. **Tensorflow Core tutorials:**
    - Good tutorials for understanding TF modules
    - To be done once a basic understanding of ML is achieved
    - Look at left side column on what to learn
    - There are two types of tutorials, basic and advanced. We recommend doing the basic tutorials.
    - Link to the tutorials

5. **Keras Guide**
    - After TF core tutorials

- Look at left side column for what to learn
- Ignore RNNs
- Link to the Guide

Timeline:

Day 1:

Machine Learning Crash Course: Complete at least 6+ hours worth of material (Essentially, complete as much required so that you can finish the course along with the YouTube playlist tomorrow)

Day 2:

Machine Learning Crash Course: Finish the rest of the course
3B1B's Neural Networks: Complete this playlist before starting the Neural Networks part of the crash course

Day 3:

Udacity's Course: Complete Lessons 3,4,5 (Lessons 1 & 2 are somewhat of a recap of what you've learnt in the past 2 days. Please go through them first if time permits)

Ahead of the timeline:

1. Complete *Lesson 7* of the Udacity course (We assume you've done *Lesson 1* and Lesson *2* before reaching here).
2. Now you will be given a small assignment to do. **(This assignment is not related in any way to the actual project you will be doing after the training week.)** There are two projects given below: Intermediate and Advanced. You can choose any **ONE** assignment to do from below. You will receive the problem statement and the dataset for this when you ask for it from your mentor. But note that this will **NOT** be given unless you have completed all the above material or you know it from before. This project might require slightly more knowledge than what the above material provides. For those reasons, these can be helpful:
    a. TF core tutorials (the basic tutorials)
    b. Keras Guide (ignore RNNs, Transfer Learning)

Intermediate Assignment:
A database of pictures will be given. Your task will be to create a program that can separate the images into 2 classes based on one attribute. [Dataset and complete problem statement will be provided by your mentors when asked]

Advanced Assignment:
A database of pictures will be given. Your task will be to create a program that can separate the images into multiple classes based on 3 attributes. [Dataset and complete problem statement will be provided by your mentors when asked]