

Machine Learning & its Application

Introduction

02/10/2023

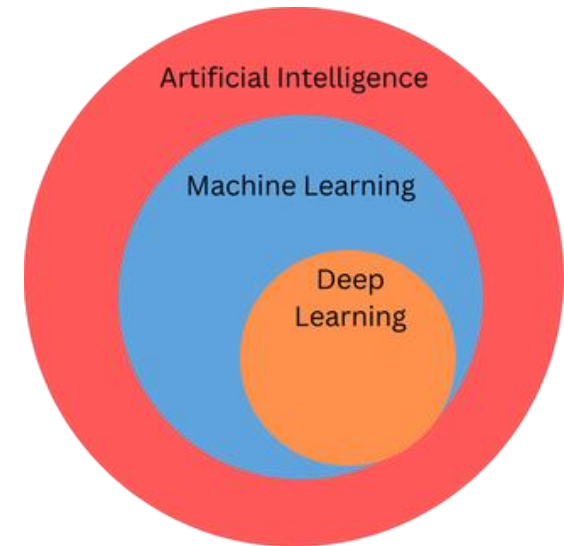
Done by: Issa Hammoud

Outline

- Introduction
- Learning Tasks
- Learning Solutions
- Course Content
- About the instructor

Introduction

- A machine learning algorithm is an algorithm that is able to learn from data.
- It is a subfield of what we call "*Artificial Intelligence*".
- We can distinguish 2 eras in machine learning history:
 - Classical approaches.
 - Deep Learning approaches.
- Classical ML solutions separate the learning into 2 steps:
 - Handcrafted rules to extract features from the data.
 - Learning algorithms applied on top of the features.

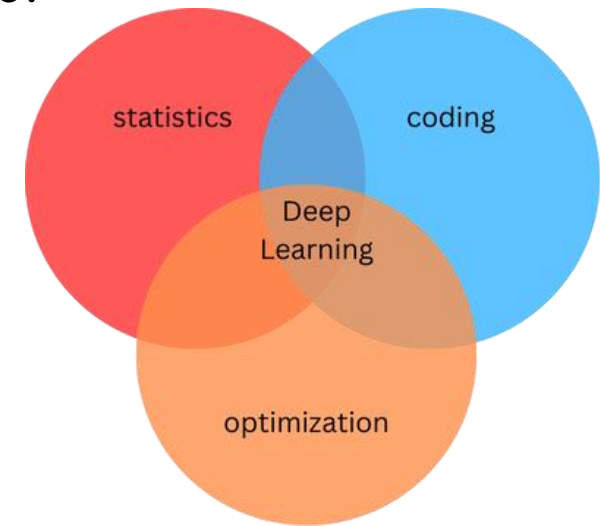


Introduction

- Deep Learning solutions learn both steps.
- An example of classical ML algorithms is Viola-Jones for face detection.
- It is done in 2 steps:
 - Extract features from face images using Haar filter.
 - Apply a boosting algorithm to classify the image into face or not.
- In deep learning, we can directly extract meaningful features and classify.
- We will focus in this course on Deep Learning solutions.

Introduction

- Deep Learning emerged for the first time in 1980, and then in 2006.
- It is the intersection of 3 domains:
 - Coding.
 - Statistics.
 - Optimization.
- We will see together how deep learning solutions work.
- But before, let's discover the different types of problems we can have.



Learning Tasks

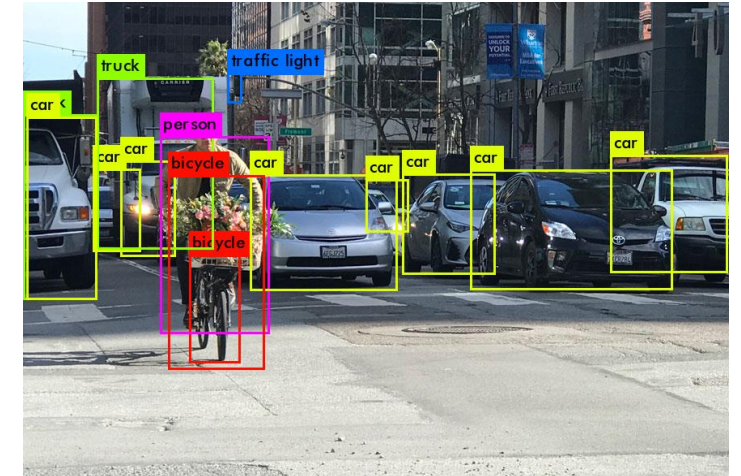
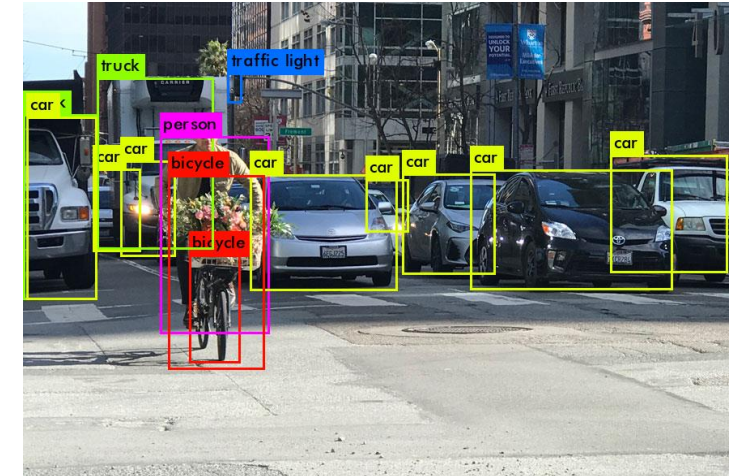
- Any task belongs to one of the following broad categories:
 - Regression: output real values for a given input, e.g. estimate a house price.
 - Classification: output a discrete value for a given input, e.g. classify images based on the gender.
- With more specialization, we can define more specified tasks, among others:
 - **Transcription**: convert image to text (e.g. OCR) or sound to text (speech recognition).
 - **Machine translation**: convert a text (e.g. in French) into another text (e.g. in English).
 - **Image Segmentation**: classify each pixel of an image into a category.
 - **Image denoising**: clean an image from a corrupted version.
 - **Object detection**: find (regress) the location and classify objects in an image.
 - **Anomaly detection**: fraud detection, visual inspection etc...

Learning Tasks

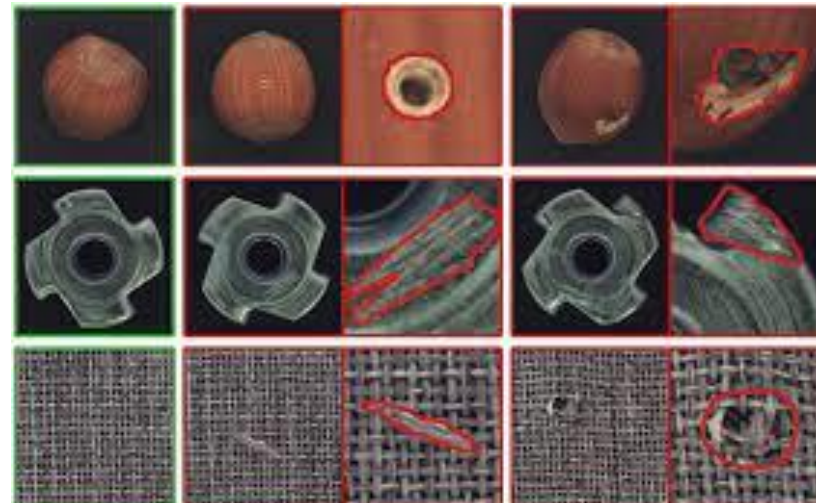
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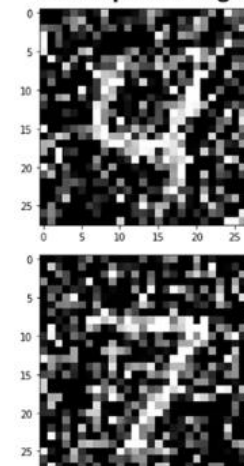
Segmentation Mask



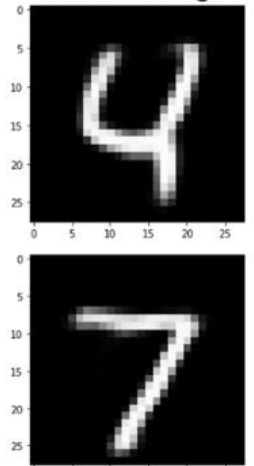
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Corrupted image



Predicted image



Learning Solutions

- Depending on the requirements, each tasks can have different kind of solutions.
- We can separate the solutions into 2 categories:
 - Supervised.
 - Unsupervised.
- Supervised learning is when we have a set of examples alongside their labels.
- Unsupervised learning is when we have data without labels.
- There are some settings in between supervised and unsupervised learning.

Learning Solutions

- In supervised setting we should have:
 - A training set to learn from.
 - A test set to check if the algorithm work correctly.
- For instance, to learn how to detect the presence of faces in images, we need:
 - A set of annotated images with a flag if there is a face or not to learn from.
 - A set of images without labels to test on.
- In unsupervised learning, we don't have labels.
- For instance, images in your phone are separated into directories by similarity.

Learning Solutions

- Some cases lie in between supervised and unsupervised:
 - Semi-supervised: some of the data are labeled and some aren't.
 - Self-supervised: transform an unsupervised problem into supervised by artificially creating labels.
- We will see during the course when such scenarios happen.
- We will cover both supervised and unsupervised techniques to solve real-world problems.

Course Content

- The course content is as follows:
 1. Linear Models (linear regression and classification) (02/10/2023).
 2. Gradient Descent & Backpropagation (02/10/2023).
 3. Neural Networks (03/10/2023).
 4. Practical Hands-on (03/10/2023).
 5. Convolutional Neural Networks (04/10/2023).
 6. Fully Convolutional Networks (04/10/2023).
 7. Metrics, Loss Functions & Debugging (05/10/2023).
 8. Practical Hands-on (05/10/2023).
 9. PCA, K-Means, DB-SCAN (06/10/2023).
 10. Practical Hands-on (06/10/2023).

About the instructor



Lebanese University
2013-2017

Came to France

Telecom Paris
2017-2019

M. Eng in Data Science

CGG
2019-2021

R&D Deep Learning
Engineer

7 Sensing Software
2021-Present

Computer Vision
Engineer