Deep Learning and Computer Vision

Basics

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Table of Contents

Table of Contents

Definition I

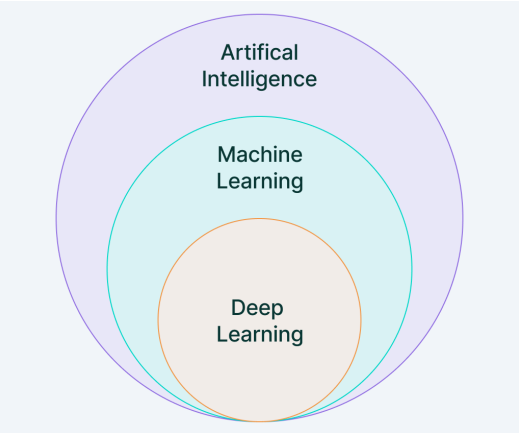


Figura: Deep Learning, Machine Learning, and Artificial Intelligence.

What it is

- Deep Learning is simply a branch of Machine Learning. The main difference is in the approach to modelling.
- In classic machine learning you try to find a model that fits the data, in Deep Learning you create a model that learns in a better way.

Definition II

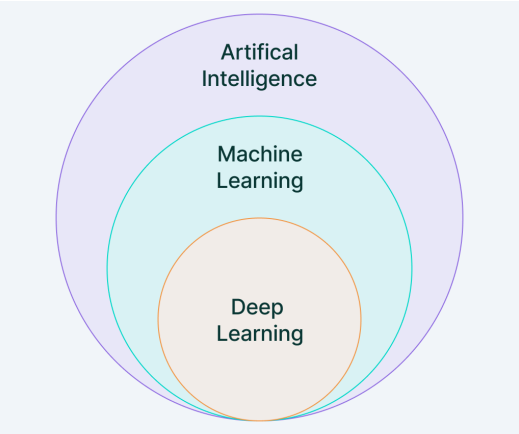


Figura: Deep Learning, Machine Learning, and Artificial Intelligence.

How it Works

- In Deep Learning, you design a neural network (a brain). This design is called "Architecture" and defines the kind of information the AI is more susceptible to learn from.
- For example, Convolutional Neural Networks are better at learning from images than numeric data.

Table of Contents

What it is

Self-driving cars [Tesla, 2016]

Medical Analysis [Intel, 2022]

- Computer Vision is the development of deep learning algorithms to teach a computer to understand visual inputs just like humans.
- For example, we can teach a self-driving car to recognize humans and pets, or teach a computer to identify anomalies in a patient's scans.

An Illustrative Example

Using Computer Vision in Medicine

- A patient under the effects of Epidural Anesthesia has an increase in body temperature as the body relaxes and blood flow increases. If only half the body warms up, it means the anesthesia is only taking effect on that half of the body, and corrective measures must be taken.
- Computer Vision applications can help us know this information in real-time.

Image Segmentation

- In image segmentation, we seek to identify which pixels belong to a certain object.
- When analysing the effects of epidural anesthesia, we needed to identify the patient's feet to see if the procedure was successful or not.

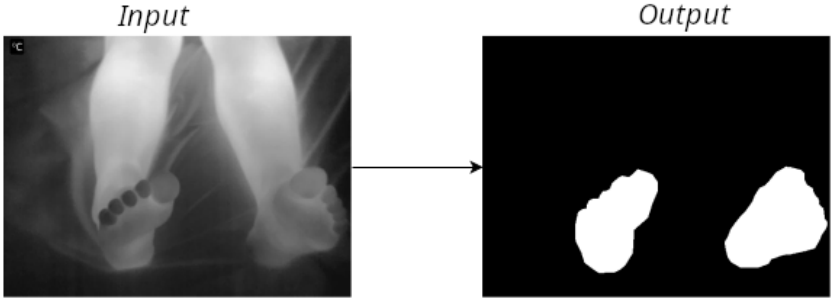


Image Registration I

Image Registration

- In image registration we mold an image to fit a given reference.
- In this example we mold a picture of a notebook to match the QR code reference.

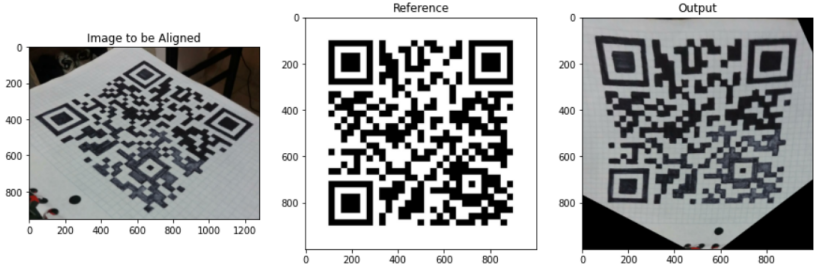


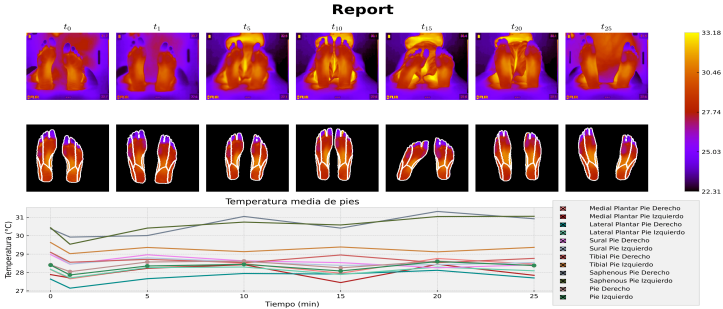
Image Registration II

Image Registration

- This is useful since we can use references to identify regions of interest without the need of a more complex algorithm.

Table of Contents

In Practice



In a real case, **Segmentation** allows us to remove background noise from the image. The segmented image is then used as our reference for the **Registration** process. When done properly, it is possible to observe the temperature change in the patient's feet, which helps determine the effectiveness of the epidural anesthesia.

References I

Intel (2022).
Computer Vision in Healthcare.

Tesla (2016).
Autopilot full self-driving hardware (neighborhood long).