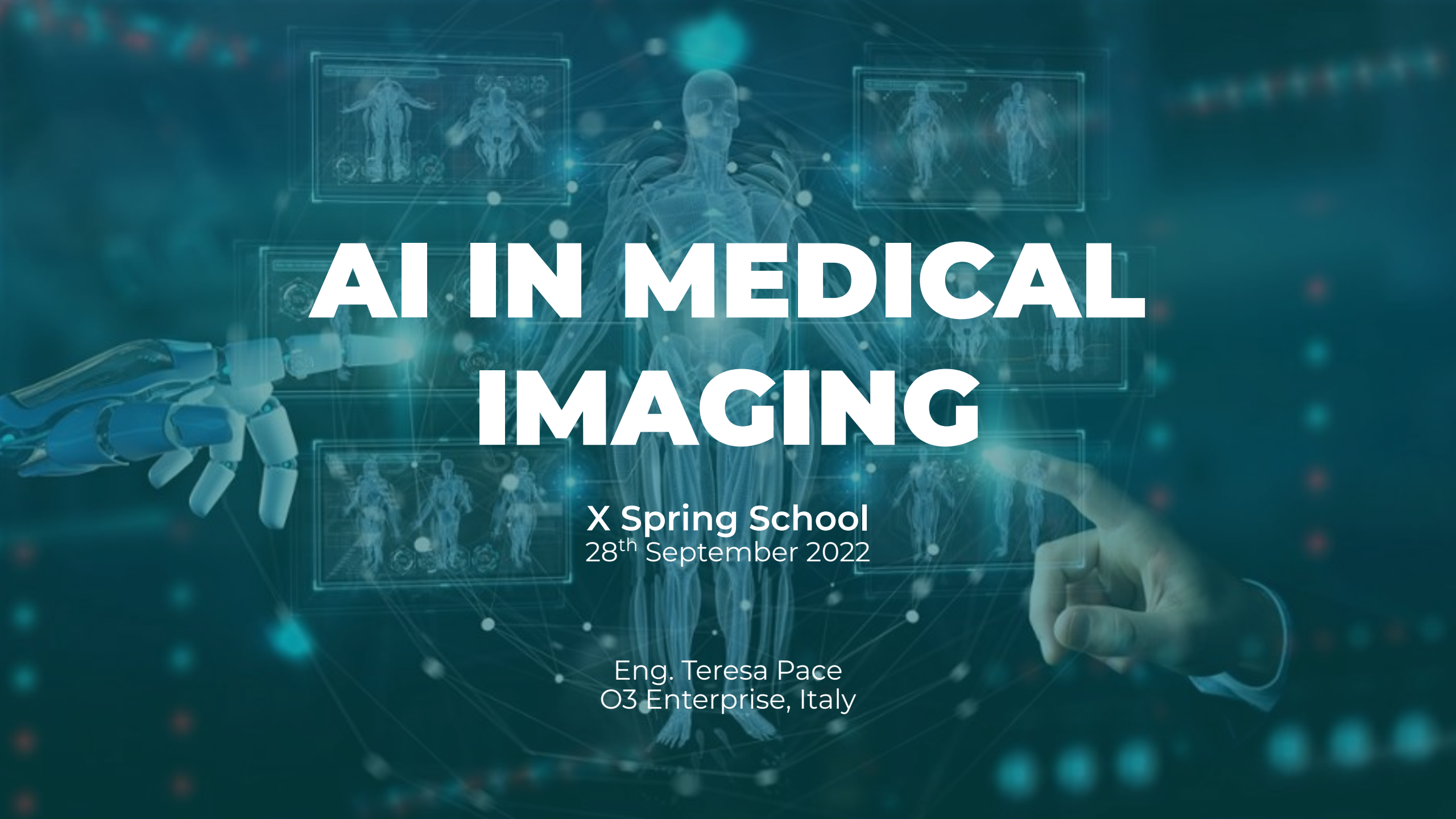


AI IN MEDICAL IMAGING

X Spring School

28th September 2022

Eng. Teresa Pace
O3 Enterprise, Italy

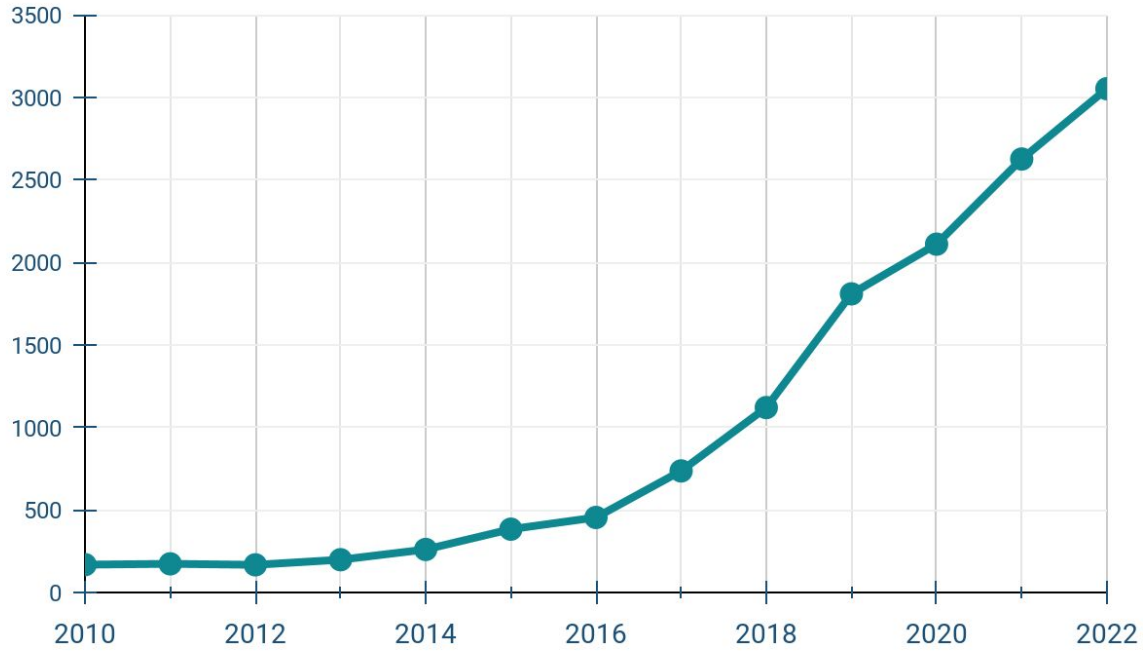
AI in medical imaging
Overview

- Potential of AI in medical imaging
  - **Applications**
- **Theoretical concepts**
  - AI, Machine Learning, Deep Learning
  - Artificial Neural Networks
  - Convolutional Neural Networks
- **Practical example**
  - Classification of tissues in colorectal cancer histology

One of the most promising areas of health innovation is the application of artificial intelligence (AI) in medical imaging, including, but not limited to, image processing and interpretation

Lakhani P, Prater AB, Hutson RK et al (2018) **Machine learning in radiology: applications beyond image interpretation.** *J Am Coll Radiol* 15:350–359

AI scientific publications



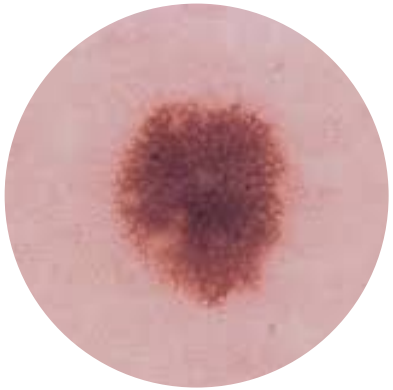
SUBJECT AREA (from Scopus)
Radiology, Nuclear Medicine and Imaging

OECD AI https://oecd.ai/en/data?selectedArea=ai-research&selectedVisualization=ai-scientific-publications-by-subject-area-from-scopus (2022)

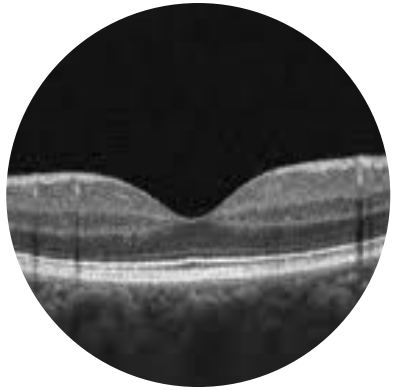
Applications in medical imaging

In medicine, AI systems have become dominant in all the main image-centric specialties

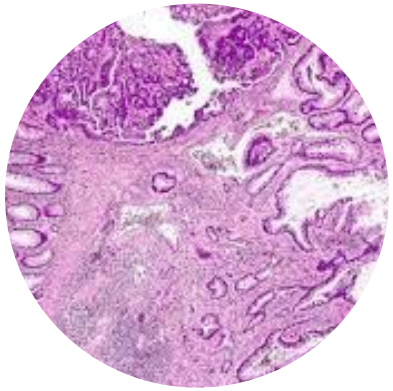
Radiology



Dermatology



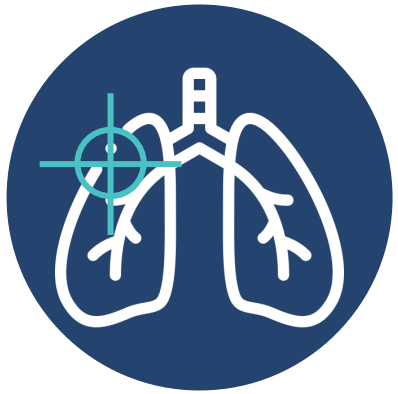
Ophthalmology



Pathology

Applications in medical imaging

AI applications within medical imaging could be divided into the following categories



Detection

Classification

Segmentation

Applications in medical imaging
Detection

Detect potential abnormalities within images on the basis of changes in intensities or appearance of unusual patterns

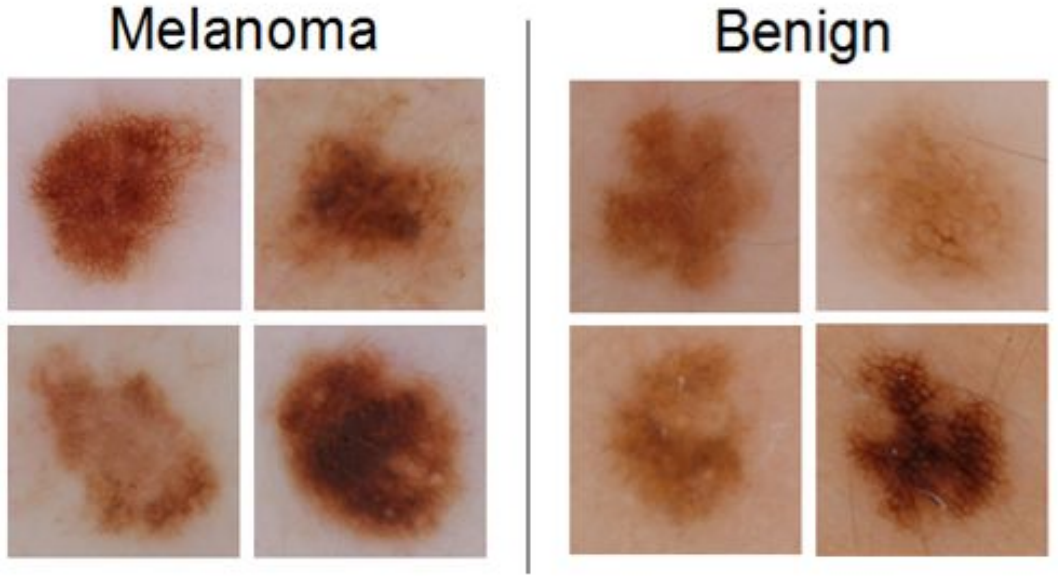
Mainly used for Computer-Aided Diagnosis (CAD) systems

Transpara by ScreenPoint Medical: AI applied to CAD

Applications in medical imaging
Classification

Diagnosis
Evaluate and classify abnormalities such as benign vs malignant

Staging
Classify abnormalities into multiple predefined categories such as the TNM classification of malignant tumors

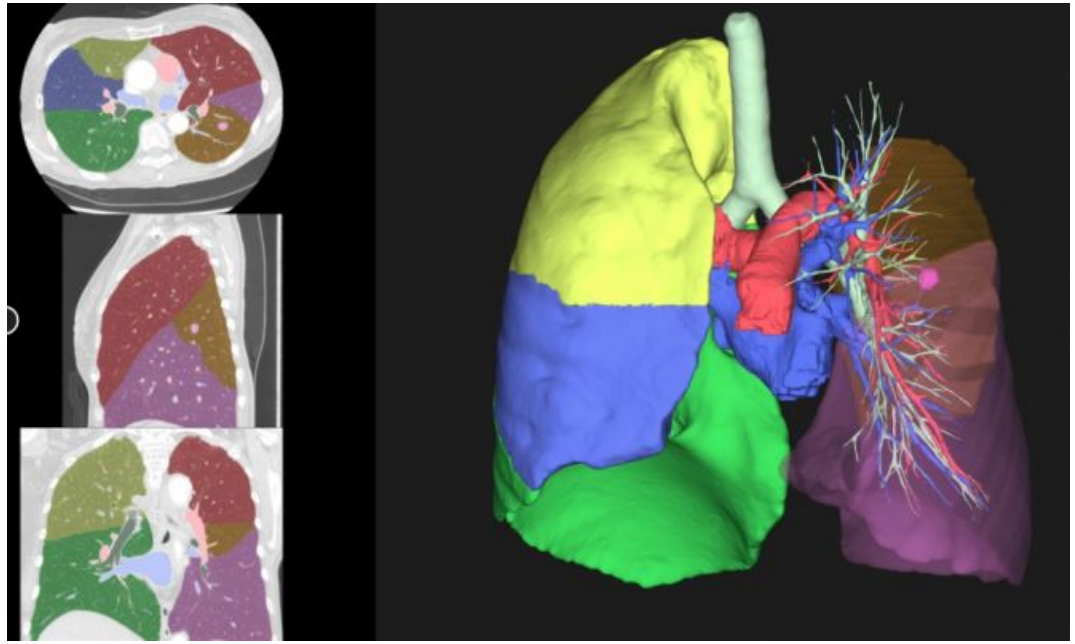


IEEE ISBI 2016 Challenge: Skin Cancer Classification Challenges

Applications in medical imaging
Segmentation

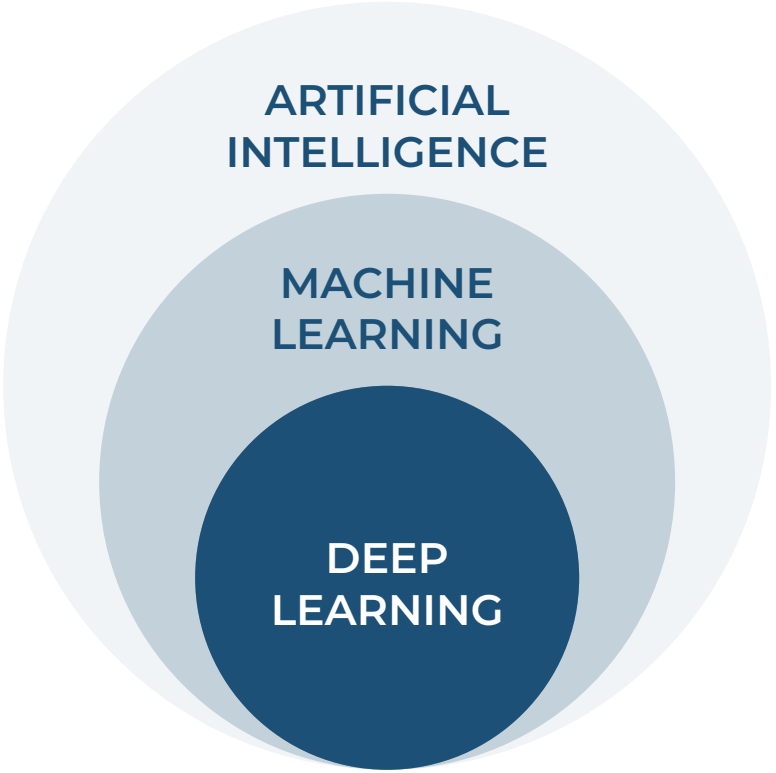
Define the boundary extend of organs, anatomical structures or abnormalities

Mainly used for quantitative evaluation of clinical parameters (organ volume and shape) for diagnosis and evaluating treatment response



REiLI by Fujifilm: Region Recognition AI technology

What is AI?

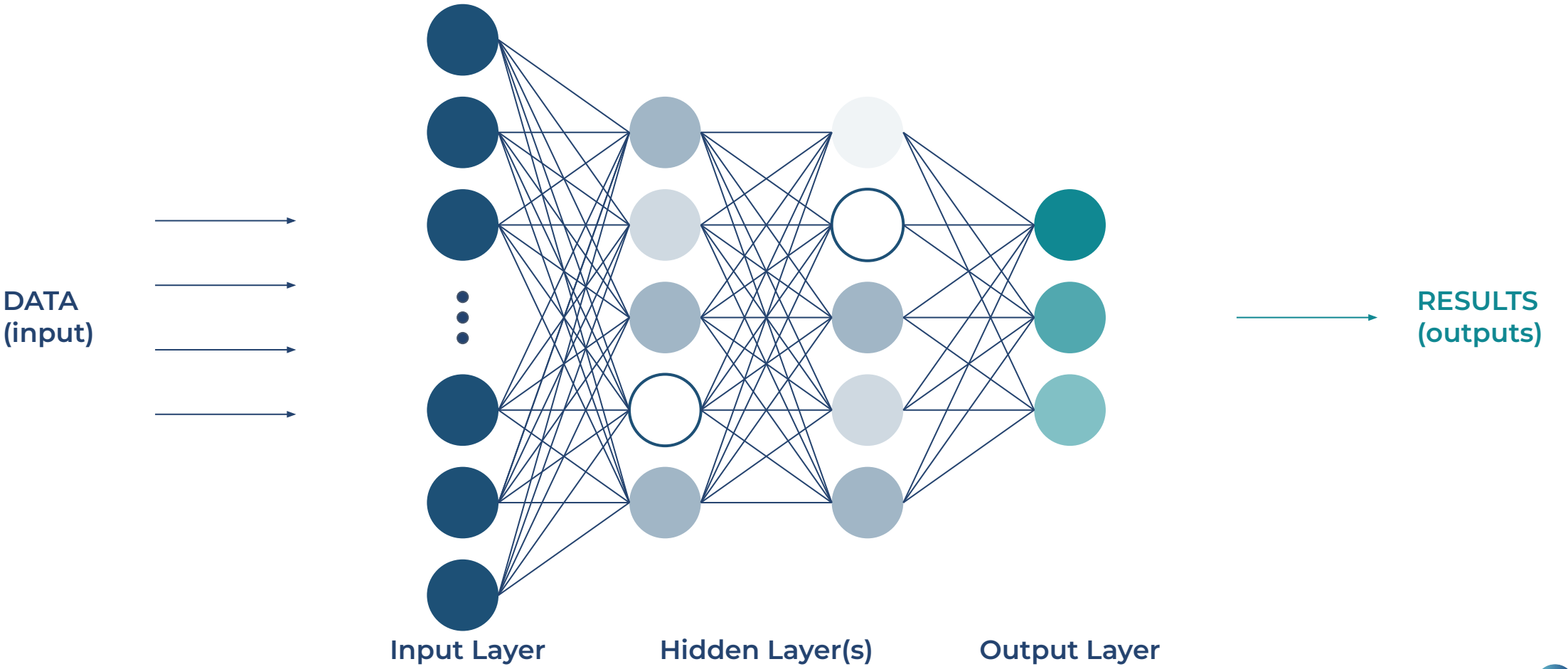


ARTIFICIAL INTELLIGENCE Effort to automate intellectual tasks normally performed by humans

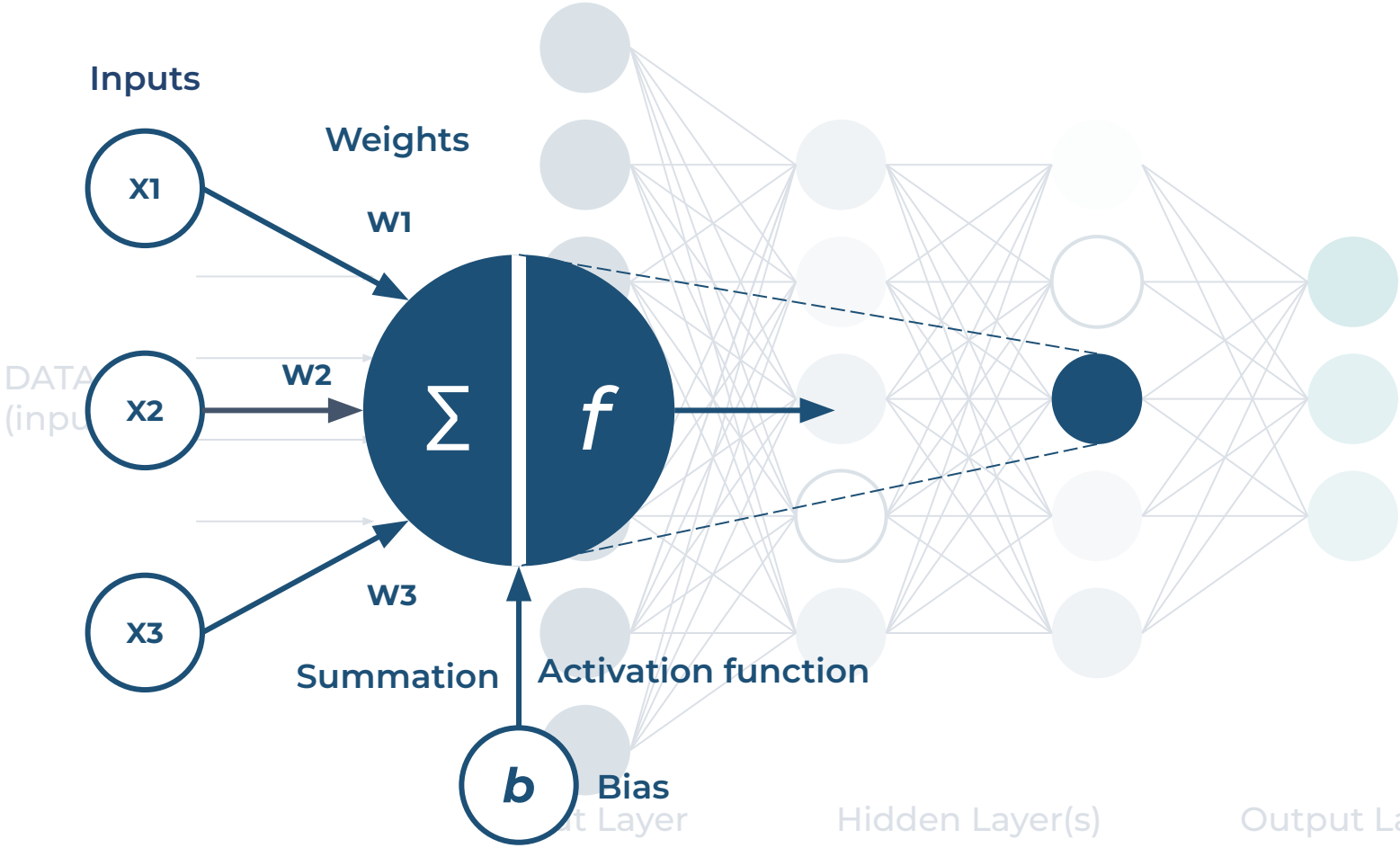
MACHINE LEARNING Algorithms which use statistical methods to enable machines to improve at tasks with experience

DEEP LEARNING Subset of machine learning in which algorithms with brain-like logical structure adapt and learn from vast amounts of data

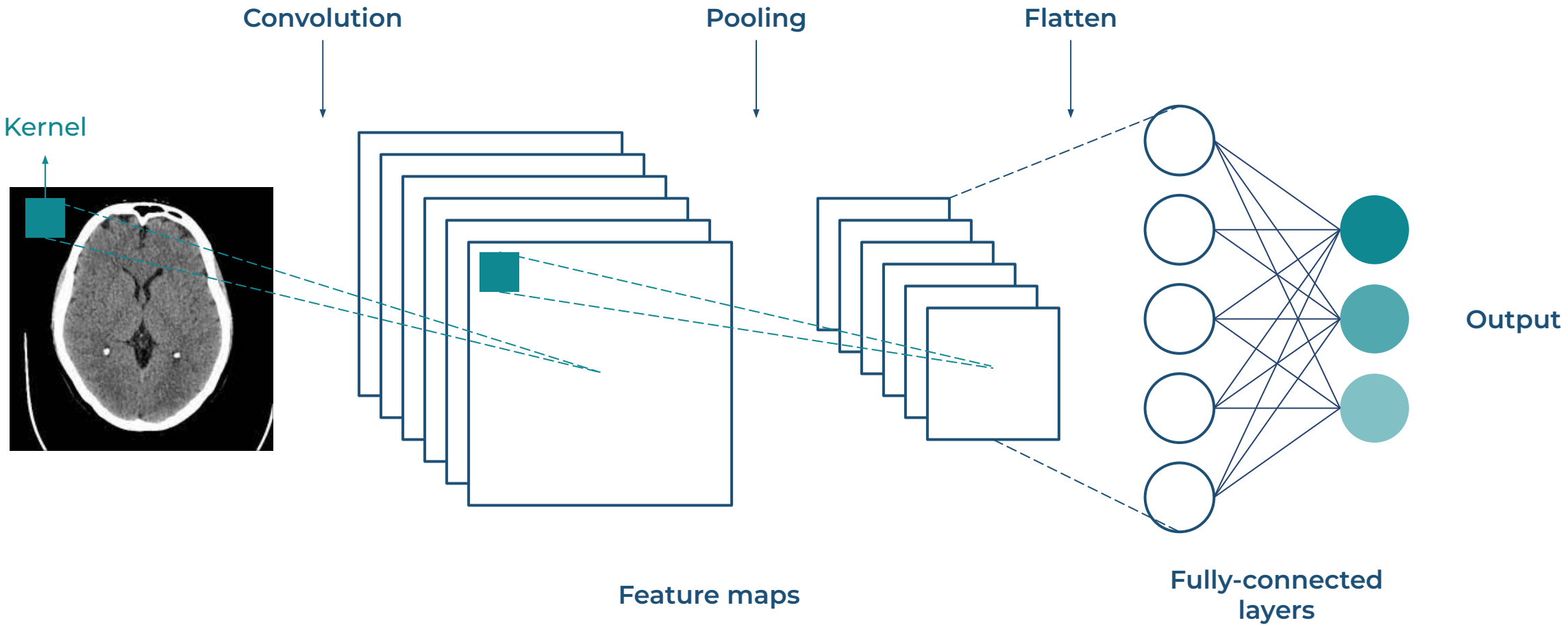
Artificial Neural Networks



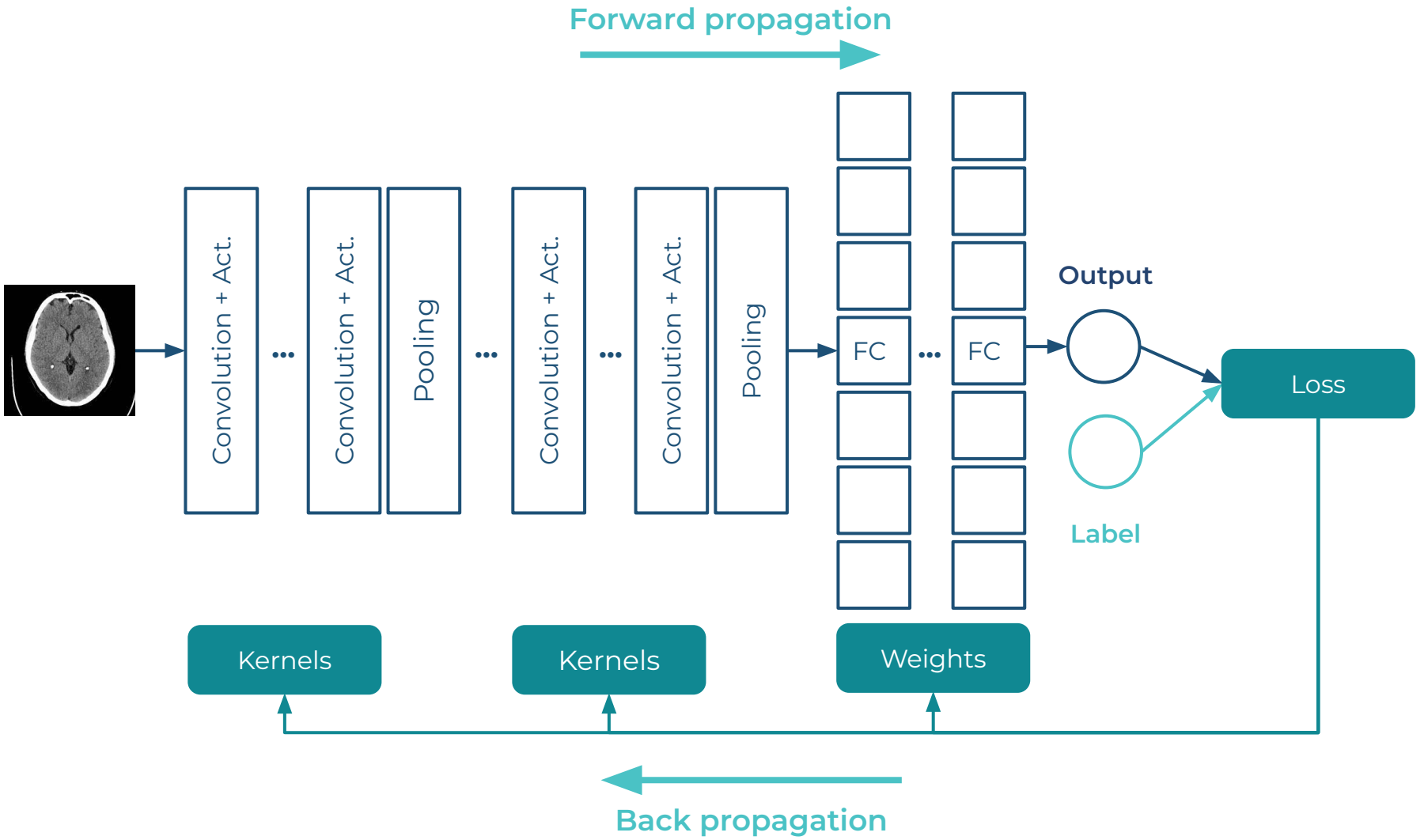
Artificial Neural Networks
Artificial Neuron



Convolutional Neural Networks



Training a network



A practical example