Data Science and Machine Learning for Engineering Applications

Introduction to Image Processing with Deep Learning

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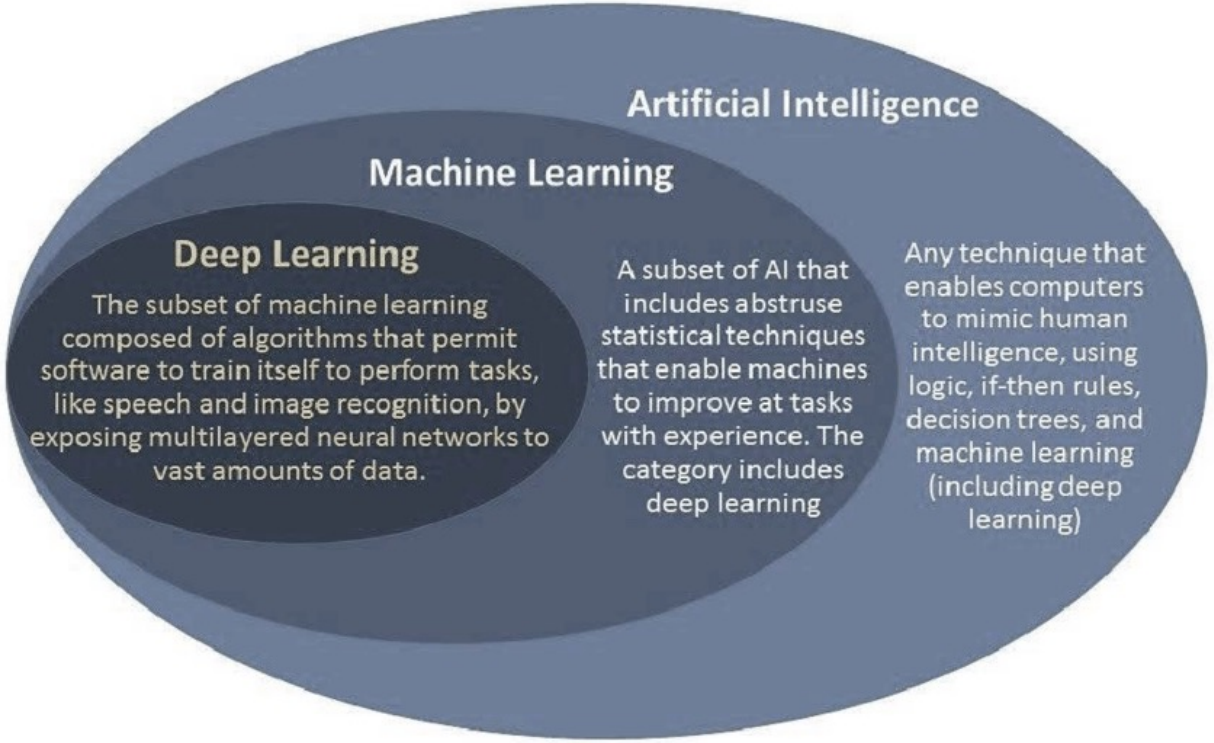
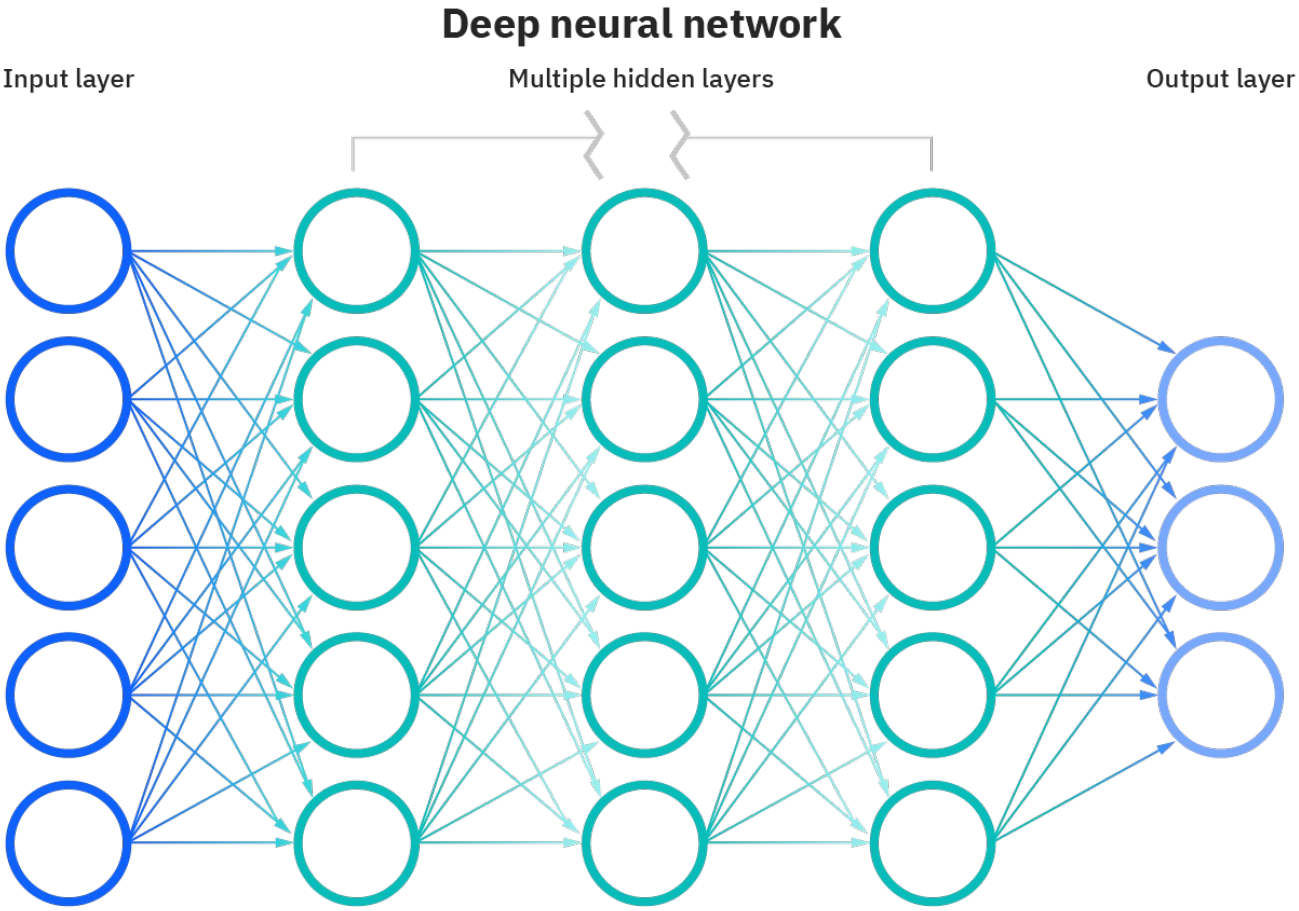
DataBase and Data Mining Group

What is Deep Learning?



[Refaee, Ali & Koucheryavy, Andrey. (2020). SURVEY ON ARTIFICIAL INTELLIGENCE TECHNIQUES IN 5G NETWORKS. Telecom IT. 8. 1-10. 10.31854/2307-1303-2020-8-1-1-10.]

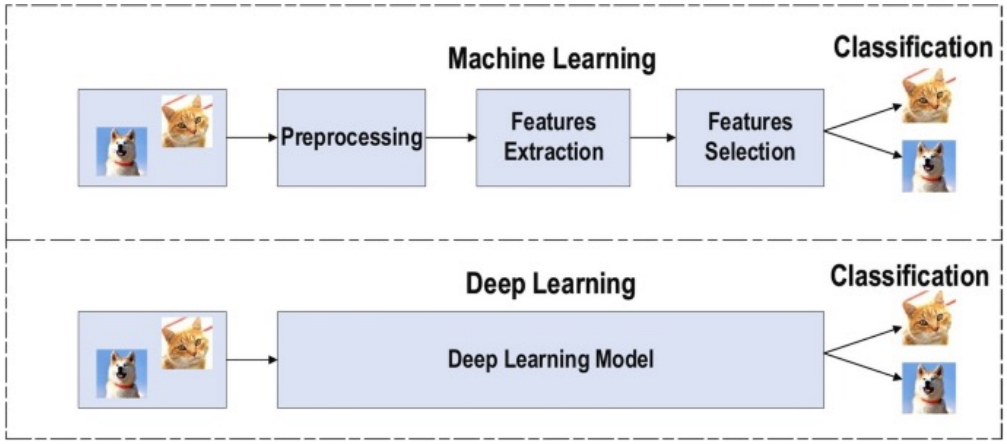
What is Deep Learning?



[https://www.ibm.com/cloud/blog/ai-vs-machine-learning-vs-deep-learning-vs-neural-networks]

Deep Learning vs Machine Learning

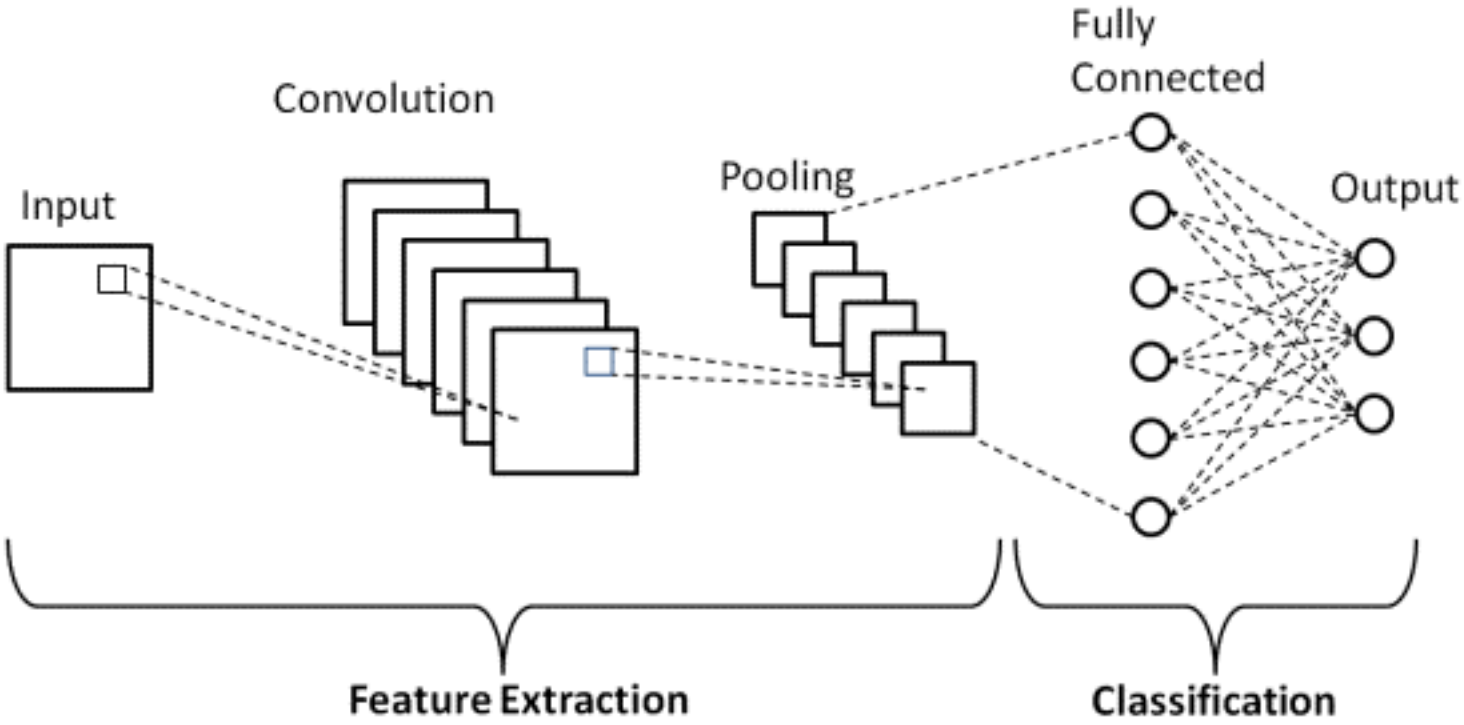
- It usually works with **large datasets**
- It is more suitable to process **unstructured data** (e.g., images, texts, audio)
- Deep learning automates much of the **feature extraction** process, eliminating some of the manual human intervention required



*[Alzubaidi, L., Zhang, J., Humaidi, A.J. et al. Review of deep learning: concepts, CNN architectures, challenges, applications, future directions. J Big Data **8**, 53 (2021). https://doi.org/10.1186/s40537-021-00444-8]*

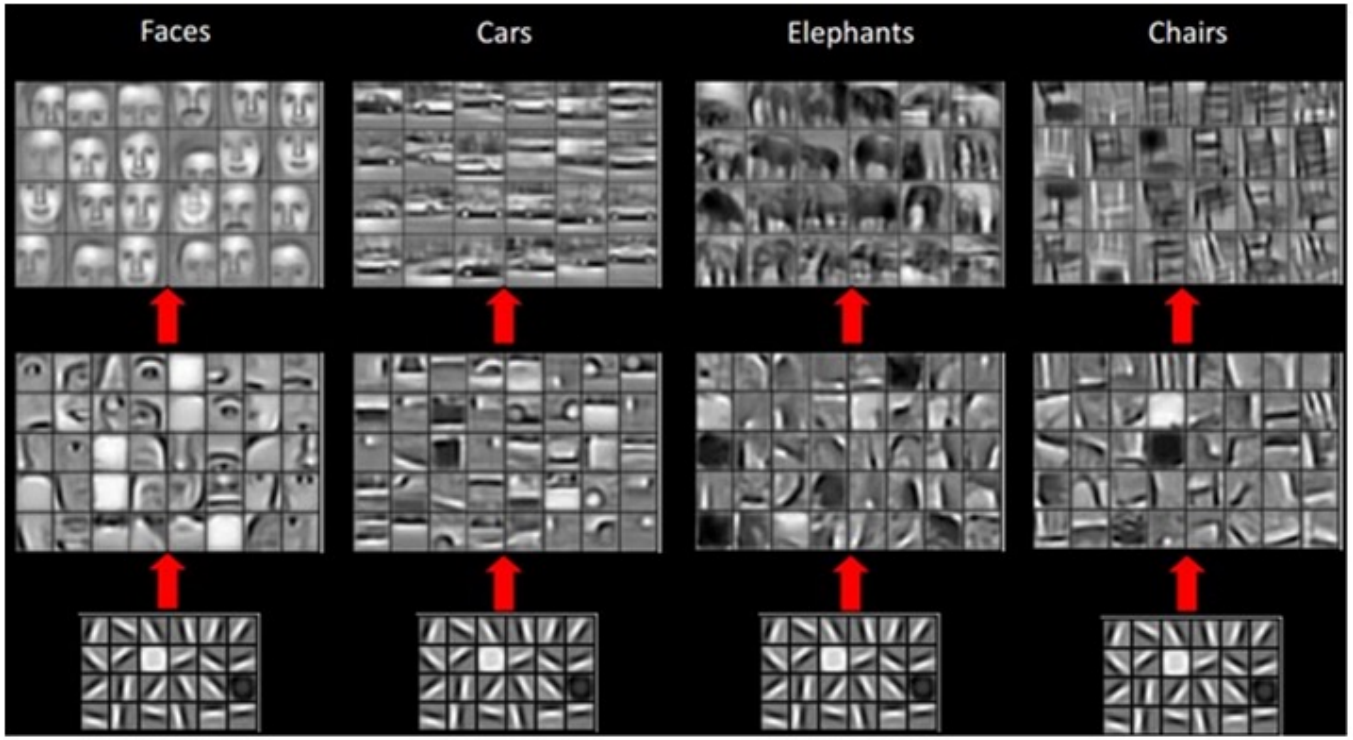
Convolutional Neural Networks

CNN



[https://www.analyticsvidhya.com/blog/2022/03/basic-introduction-to-convolutional-neural-network-in-deep-learning/]

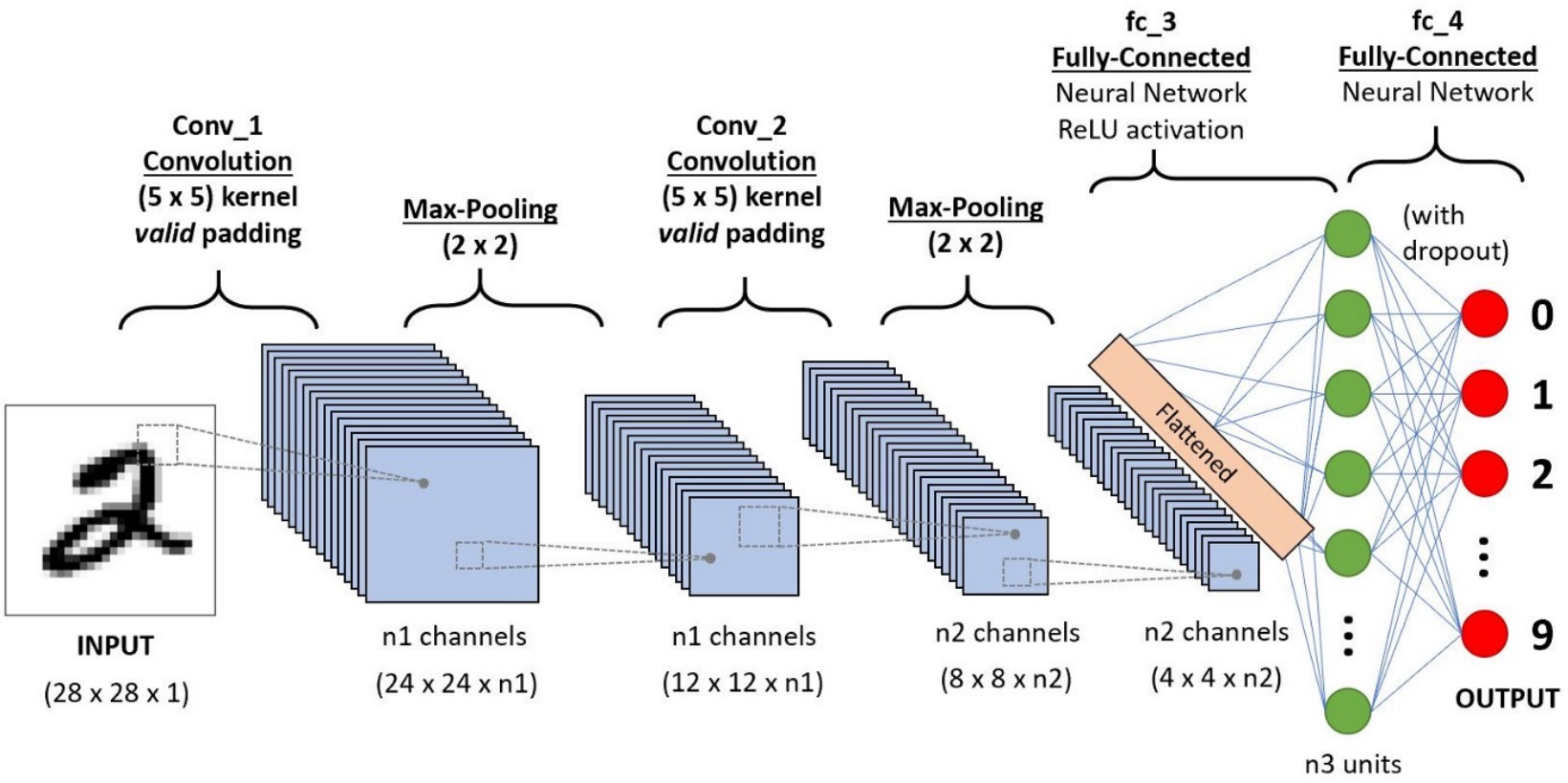
Convolutional Neural Networks
Features



[https://tung2389.github.io/coding-note/CNNneuralnetwork]

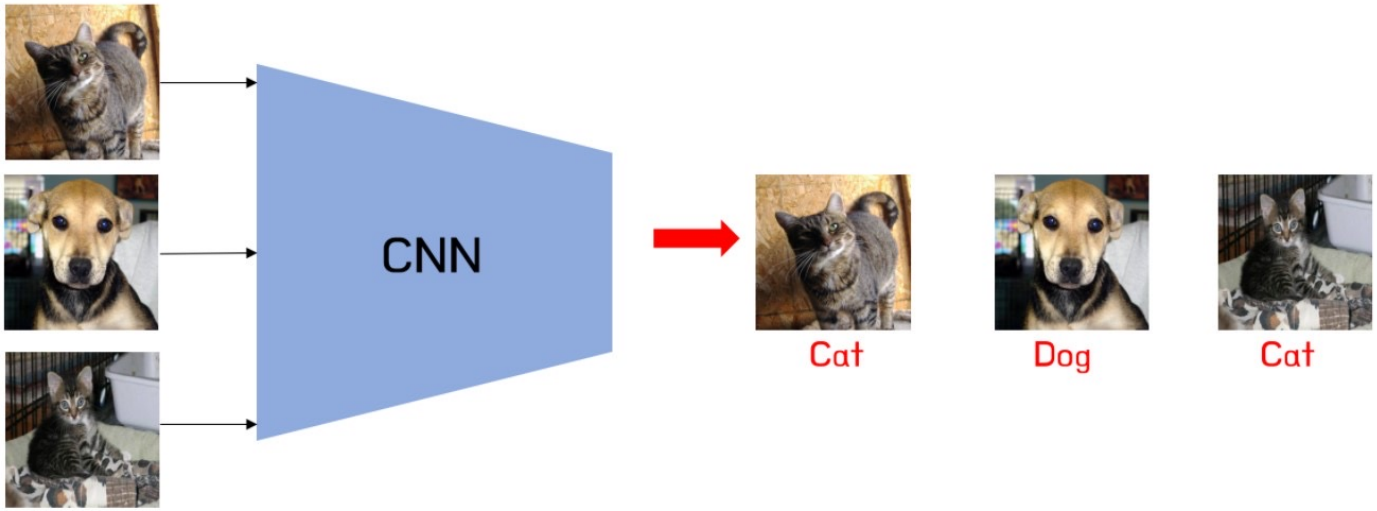
Convolutional Neural Networks

CNN



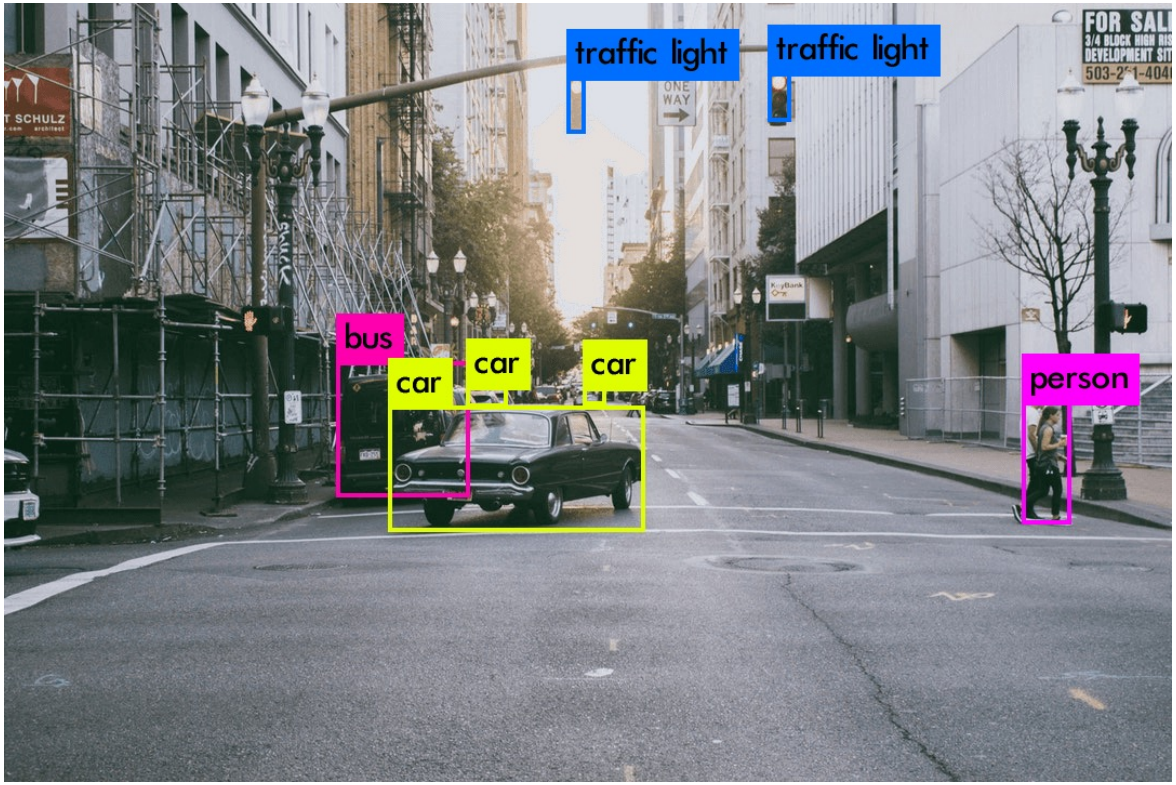
[https://www.analyticsvidhya.com/blog/2022/03/basic-introduction-to-convolutional-neural-network-in-deep-learning/]

Deep Learning Applications
Image Classification



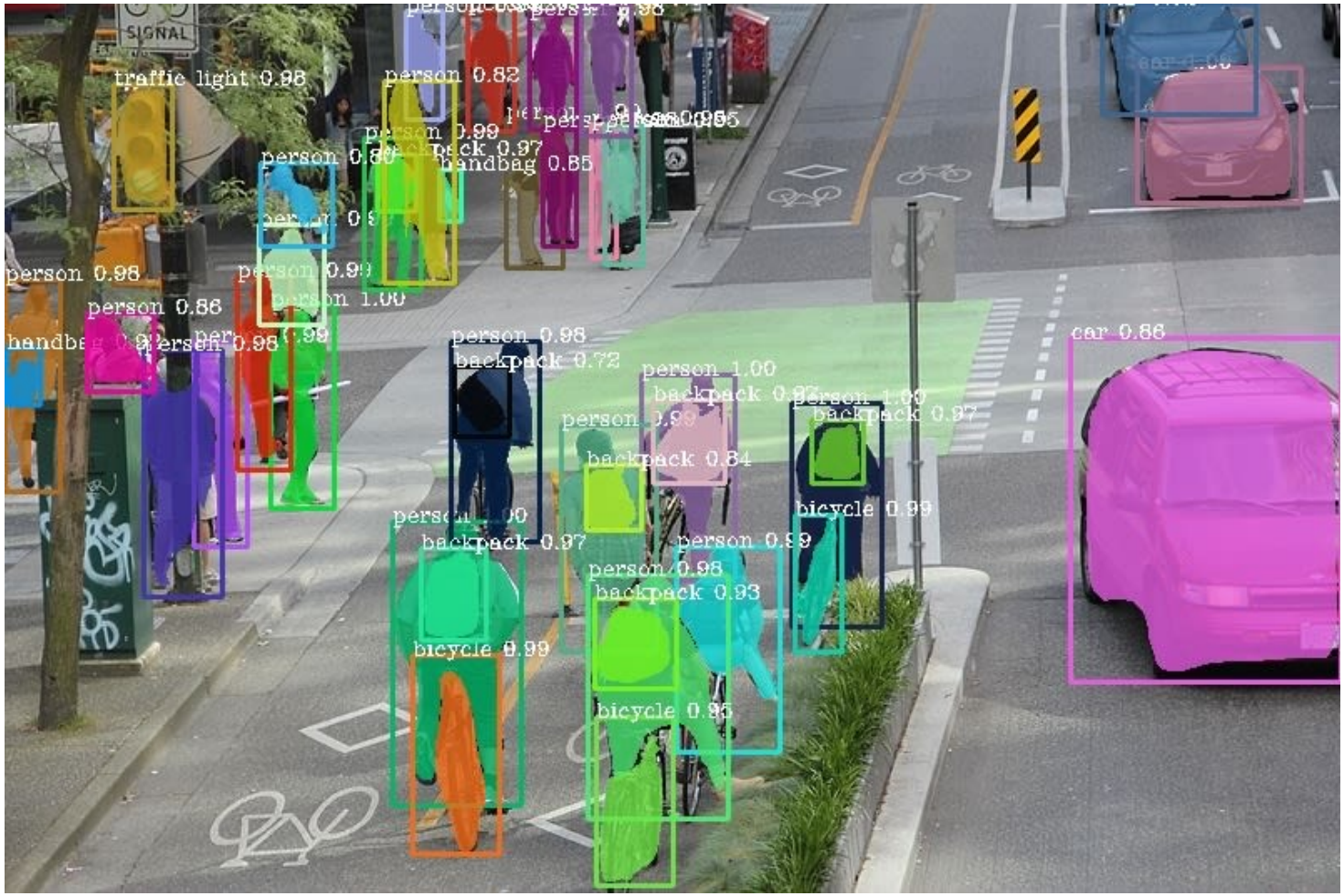
[https://vitalflux.com/classification-problems-real-world-examples/]

Deep Learning Applications
Object Detection



[https://appsilon.com/object-detection-yolo-algorithm/]

Deep Learning Applications
Image Segmentation



Deep Learning Applications
Image Generation

[Karras, Tero & Aila, Timo & Laine, Samuli & Lehtinen, Jaakko. (2017). Progressive Growing of GANs for Improved Quality, Stability, and Variation.]

Computer Vision in Python

PoliTo

DBMG

TensorFlow

PyTorch

Notebooks

PoliTo

DBMG

- Image Classification from scratch link
  - https://colab.research.google.com/github/keras-team/keras-io/blob/master/examples/vision/ipynb/image_classification_from_scratch.ipynb#scrollTo=nbe82lPlRgL3

- Image Classification with transfer learning link
  - https://colab.research.google.com/github/tensorflow/docs/blob/master/site/en/tutorials/images/transfer_learning.ipynb?hl=it#scrollTo=RpR8HdyMhukJ