

Convolutional Neural Networks (CNNs) - Summary

How it works:

Convolutional Neural Networks (CNNs) are a type of deep learning model designed specifically for processing data that has a grid-like structure, such as images. Instead of processing all input pixels at once (like fully connected networks), CNNs use *convolutional layers* to scan small regions of the image and detect patterns like edges, corners, or textures. These local patterns are then combined and processed through deeper layers to identify higher-level features (like eyes, faces, or objects). CNNs also use *pooling layers* to reduce the dimensionality and computation, and *fully connected layers* at the end for classification.

How it's used:

CNNs are widely used in:

- Image classification (e.g., recognizing handwritten digits or animals)
- Object detection (e.g., identifying people or cars in an image)
- Medical imaging (e.g., detecting tumors in scans)
- Facial recognition, self-driving cars, and even art generation

Gotchas in using it:

- **Overfitting:** CNNs can memorize training data if the dataset is too small or not diverse.
- **Computational cost:** Training CNNs, especially large ones, requires a lot of GPU power and memory.
- **Need for preprocessing:** Input images often need to be resized, normalized, and augmented to improve performance.
- **Architecture tuning:** Choosing the right number of layers, filters, and kernel sizes requires experimentation and domain knowledge.

Link to IPython notebook:

<https://colab.research.google.com/drive/13kzO457l4lj5M9VO5ud8JBdVHLVLEWJz?usp=sharing>