CONVOLUTIONAL NEURAL NETWORK 101.

↳ a regularized type of feed-forward Network (moves in only 1 direction. ↑ does not effect backprop.)
that learns features by itself via filter.

↳ It is a deep learning model designed to process grid-like data.

CNN Architecture & Components.

↳ a convolutional Neural Network consists of several layers each serving a specific role.

① Convolutional layer

→ detects patterns (edges, texture, shape) in image.

Working → Uses filters (kernels) that slide over the input image and perform element-wise multiplication, producing feature map.

e.g
a filter may detect vertical edges in 1 layer and more complex shapes in deep layers.

Feature Map = Input * Filter.

② Activation Function (Non linearity)

→ introduces non-linearity to help model learn complex patterns; helps remove negative values & speeds up learning.

↳ RELU (Rectified Linear Unit)

$$f(x) = \max(0, x).$$

③ Pooling Layer (Downsampling).

⇒ reduces the spatial size of feature maps while keeping important features by selecting key values.

↳ Types:

(i) Max pooling — Takes max value from a small region
(ii) Avg pooling. — Takes avg value from a region.

e.g if you have a 4x4 feature map and apply 2x2 Max pooling you get a 2x2 output.

④ Fully Connected (FC) Layer

⇒ Uses the extracted features to make final predictions.

↳ flattens the feature map into a 1D vector then passes it through a fully connected network. (FNN).

e.g if recognizing handwritten digit (0-9), the last layer might have 10 neuron (one per digit) with a softmax activation.

⑤ Softmax Layers:

⇒ Converts the FC layer output into probabilities.