Convolutional Neural Networks

How does Facebook able to tag people in images automatically ( What CNN is about )

Input image -> CNN -> output label (Image class)

B/W image 2x2 pixel 🡪 2D array

Colored image 2x2 pixel 🡪 3D array BGR layer each one of those has it only intensities.

Step 1: Convolution

Step 2: Max pooling

Step 3: Flattening

Step 4: Full connection

Step 1 🡪 Convolution

(f\*g)(t) def = integrate f(t)(g(t-r) dr

Input Image 🡪 Feature detector (A matrix can be any dimension usually 3x3)

Input Image x feature detector = Feature Map. (Multiply the value corresponds to the square)

* We reduced the size of the image. Easier to process it and faster for the algorithm to run.
* We are losing some information but highlights the important features. This is how we see each feature.
* Hence, we create multiple feature detectors to highlight each respective feature to produce feature maps that form convolutional layer.

Step 1(B) -> ReLu Layer

Rectifier function is applied on feature maps 🡪 Increase non linearity in our image. Rectifier access the function to increase non linearity (Images themselves are highly non linearity that’s why we want to break the linearity. Too many elements in the picture they cannot be linear). We risked that they might construct something linear because of our convolution step, hence ReLu layer Introduce non linearity in the image.

Step 2: Pooling

Neural network to recognize the image as what it is. How does it do that if the item is located at the different corners of the image. Ensures Spatial invariance (Our algo does not care if the features are closer, further apart, at what corners) 🡪 This is what pooling is about

Max pooling 🡪

Feature Map 🡪 Only key in the maximum numbers on the feature map 🡪 Pooled feature map

We get rid the non-important features for the feature map. We are taking maximum of the values, hence we account for any spatial distortions

* Reduce the size by 75%
* Reduce the number of parameters that go into the final layer of neural network (Prevent overfitting, our model won’t be overfit into that information as this information may not be relevant. It is important to focus on the features and not the non-important information.
* Max Pooling vs Mean Pooling (We can explain why we use Max pooling rather than Mean Pooling to make our algorithm more important)

Step 3: Flattening

Pooled Featured Maps 🡪 Flattening into a column (Later we will input this in the neural network processing)

Input Image 🡪 apply convolution 🡪 Convolutional layer 🡪 Pooling 🡪 pooling layer 🡪 Flattening 🡪 Input layer of a future ANN

Step 4: Fully Connected Layer

We will be adding a huge new ANN to whatever we have produced.

Combining attributes together to produce a better prediction.

Backwards propagation is also applied/ Reassign Feature Detector/ Keep doing forwards propagation and backwards propagation to assign the weights to each neuron.