# CNN using NumPy

Pseudocode

## Pre-Requisites:

Import and Load the Python Libraries required for Code Execution

Sci-Kit Learn image data

NumPy (NumPy) is used as is. Alternatively, import numpy as np can be used.

matplotlib

## Function Definition:

### Convolution Function: (Convolution Layer)

Function `conv_` (image, convolution_filter):

Perform 2D convolution of the image with the filter

Return the convolved result

Function `conv` (image, convolution_filter):

Check image and filter dimensions for compatibility

If incompatible, print error and exit

Create empty feature maps

For each filter in the convolution_filter:

If the filter has multiple channels:

Convolve each image channel with the corresponding filter channel using `conv_` and sum the results

Else (single channel filter):

Convolve the image with the filter using `conv_`

Store the result in the feature maps

Return the feature maps

## Pooling Function (Max Pooling Layer)

Function `pooling` (feature_map, size, stride):

Perform pooling (e.g., max pooling) on the feature_map with the given size and stride

Return the pooled result

## ReLU Function (ReLU Layer)

Function `relu` (feature_map):

Apply the ReLU activation function (max(0, x)) to each element in the feature_map

Return the activated feature map

# Main Execution:

Load an image

Convert the image to grayscale

Apply the first convolutional layer:

Define filters for layer 1

Apply `conv` to the image and layer 1 filters

Apply `relu` to the result

Apply `pooling` to the result

Apply the second convolutional layer:

Define filters for layer 2 (randomly)

Apply `conv` to the output of layer 1 pooling and layer 2 filters

Apply `relu` to the result

Apply `pooling` to the result

Apply the third convolutional layer:

Define filters for layer 3 (randomly)

Apply `conv` to the output of layer 2 pooling and layer 3 filters

Apply `relu` to the result

Apply `pooling` to the result

Graph the results:

Display the original image

Display the feature maps, ReLU outputs, and pooled outputs for each layer

Save the plotted figures