

Roll No	21BCP094	Practical No:	6
Division	2	Date:	18/3/24

Part 1

Understand the project available on following link

Project Link: https://github.com/aharley/nn_vis

Project by: <https://adamharley.com/>

Reference in case needed: <https://www.youtube.com/watch?v=pj9-rrlwDhM>

Part 2

Populate the table below to summarize your understanding of the project mentioned in part 1

Layer	Task	Rationale
Input Layer	This layer receives the image	Accepts 28×28 pixel images of handwritten digits as input, through digital pad given on web.
Convolutional Layer 1	Feature Extraction	It extracts all the relevant features to detect edges, patterns, boundaries and etc. It applies 6 convolutional filters of 5×5 .
Down Sampling layer 1	This layer does Max Pooling, retaining maximum value of a region by reducing dimensions.	This performs 2×2 max pooling with stride 2 of size 5×5 , to reduce the spatial dimensions of the feature maps from the first convolutional layer, retaining the most important information of that region.
Convolutional Layer 2	Feature Extraction	This applies 16 convolutional filters of size 5×5 , stride 1. Which helps to extract higher level features.
Down Sampling layer 2	Max Pooling	Performs 2×2 max pooling with stride 2 to further reduce the spatial dimensions of the feature maps from the second convolutional layer, enhancing computational efficiency and preserving essential information.
Hidden Layer(fully connected) 1	Connects all neuron layers and tries to prepares for classification	It consists of 120 nodes to flattens data of classification tasks and extracts feature from the above convolutional layers.
Hidden Layer(fully connected) 2	Classification	It processes the features using 100 nodes to carry out classification of the input images into the ten digit classes given my MNIST dataset.
Output Layer	Predicts the Digit	It has 10 nodes, each of one digit. Utilises tanh to convert probabilities to predict the final output digit.

How does the following hyper-parameters affect the network performance

Hyper-Parameter	One Line Definition	Effect on the CNN
Stride	Finds the step size of filter , which helps in spatial dimensions, feature extraction	Controls the resolution of feature maps. Larger strides reduce resolution but might capture broader features.
Dilation Rate	During convolution it decides spacing between the elements in filter-kernel	Introduces gaps between filter elements, allowing for capturing features at a larger scale without increasing kernel size.
Type of pooling layer	Defines till what extent we have to reduce the features/dimensions.	Max pooling selects the maximum value, emphasizing strong activations. Average pooling considers all values, potentially capturing more subtle information.
Kernel size	It's the size of filter used during convolution.	It Controls the level of detail extracted.
padding	To not have adverse effects of boundaries, this added to boundary pixels.	It Padding alters the spatial dimensions of feature maps and the resolution of learned features in CNNs by introducing additional pixels around the input image.

References:

[An Intuitive Explanation of Convolutional Neural Networks – the data science blog \(ujjwalkarn.me\)](https://ujjwalkarn.me)

[Gentle Dive into Math Behind Convolutional Neural Networks | by Piotr Skalski | Towards Data Science](#)

[Intuitively Understanding Convolutions for Deep Learning | by Irhum Shafkat | Towards Data Science](#)

[An Introduction to different Types of Convolutions in Deep Learning | by Paul-Louis Pröve | Towards Data Science](#)

Rubrics:

Part 1 (Indirect)

Part 2 Layer Task – 5 points

Hyper Parameter Task – 5 points