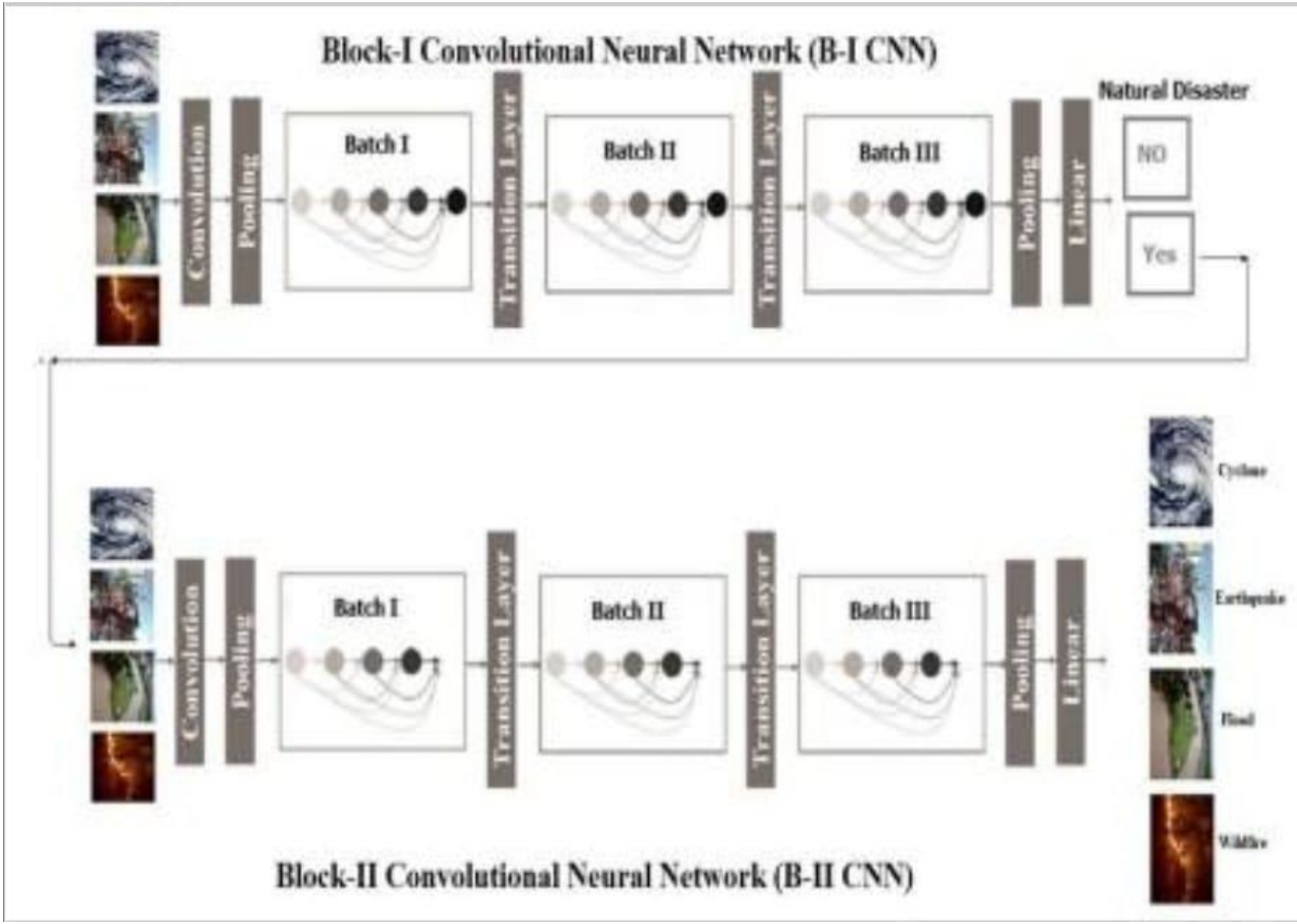
Prior Knowledge

Date	20 November 2022
Team ID	PNT2022TMID51308
Project Name	Natural Disasters Intensity Analysis and Classification using Artificial Intelligence
Maximum Marks	4 Marks

- Natural disasters not only disturb the human ecological system but also destroy the properties and critical infrastructures of human societies and even lead to permanent change in the ecosystem. Disaster can be caused by naturally occurring events such as earthquakes, cyclones, floods, and wildfires.
- Many deep learning techniques have been applied by various researchers to detect and classify natural disasters to overcome losses in ecosystems, but detection of natural disasters still faces issues due to the complex and imbalanced structures of images.
- To tackle this problem, we propose a multilayered deep convolutional neural network. The proposed model works in two blocks: Block-I convolutional neural network (B-I CNN), for detection and occurrence of disasters, and Block-II convolutional neural network (B-II CNN), for classification of natural disaster intensity types with different filters and parameters. The model is tested on 4428 natural images and performance is calculated and expressed as different statistical values: sensitivity (SE), 97.54%; specificity (SP), 98.22%; accuracy rate (AR), 99.92%; precision (PRE), 97.79%; and F1-score (F1), 97.97%. The overall accuracy for the whole model is 99.92%, which is competitive and comparable with state-of-the-art algorithms.


Block-I Convolutional Neural Network (B-I CNN)
Convolution
Pooling
Batch I
Transition Layer
Batch II
Transition Layer
Batch III
Pooling
Linear
Natural Disaster
NO
Yes
Convolution
Pooling
Batch I
Transition Layer
Batch II
Transition Layer
Batch III
Pooling
Linear
Cyclone
Earthquake
Flood
Wildfire
Block-II Convolutional Neural Network (B-II CNN)

Block-I Convolution Neural Network(B-I CNN)

According to block-I of the convolutional neural network, only a detection process occurred in this phase. However, this block also consists of three small batches having four layers each. Moreover, an image input layer and fully connected layers are present. Additionally, some parameters are also defined with learning rate 0.001 and epoch size 40. On the other hand, the convolutional layers use a filter size of 3 × 3, stride 1 and eight filters that increase in number from 16 to 32 for the second and third minibatches of convolutional neural networks

Block-I Convolutional Neural Network (B-I CNN) with Learning Rate = 0.001 and Epochs = 40		
Layer Name and Batches		**Parameters**
	Image Input Layer	Height: 100, Width: 120, Channel: 3
Batch I:	Convolution Layer Batch Normalization Layer Relu Layer Max Pooling Layer	Filter size: 3 × 3, No. of filters = 8, stride = 1
Batch II:	Convolution Layer Batch Normalization Layer Relu Layer Max Pooling Layer	Filter size: 3 × 3, No. of filters = 16, stride = 1
Batch III:	Convolution Layer Batch Normalization Layer Relu Layer Max Pooling Layer	Filter size: 3 × 3, No. of filters = 32, stride = 1
	Fully Connected Layer	4 Classes

Block-II Convolution Neural Network(B-II CNN)

The block-II convolutional neural network takes the output from the first block and finds the types of natural disaster with intensity. Moreover, this block also consists of three minibatches having three layers each with two extra layers such as image input and fully connected layers. Additionally, the same parameters as block-I have been defined for this block also.

Block-II Convolutional Neural Network (B-II CNN) with Learning Rate = 0.001 and Epochs = 30		
Layer Name and Batches		**Parameters**
	Image Input Layer	Height: 100, Width: 120, Channel: 3
Batch I:	Convolution Layer Batch Normalization Layer Max Pooling Layer	Filter size: 3 × 3, No. of filters = 8, stride = 1
Batch II:	Convolution Layer Batch Normalization Layer Max Pooling Layer	Filter size: 3 × 3, No. of filters = 16, stride = 1
Batch III:	Convolution Layer Batch Normalization Layer Max Pooling Layer	Filter size: 3 × 3, No. of filters = 32, stride = 1
	Fully Connected Layer	4 Classes