

# Artificial Neural Network

Homework 2  
(CNN)

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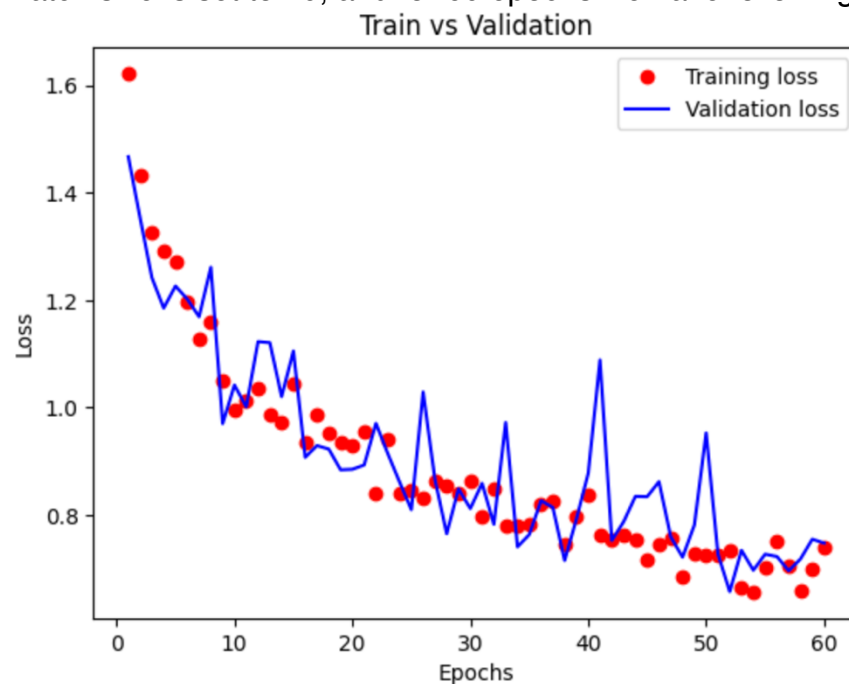
### Q.1) model summary:

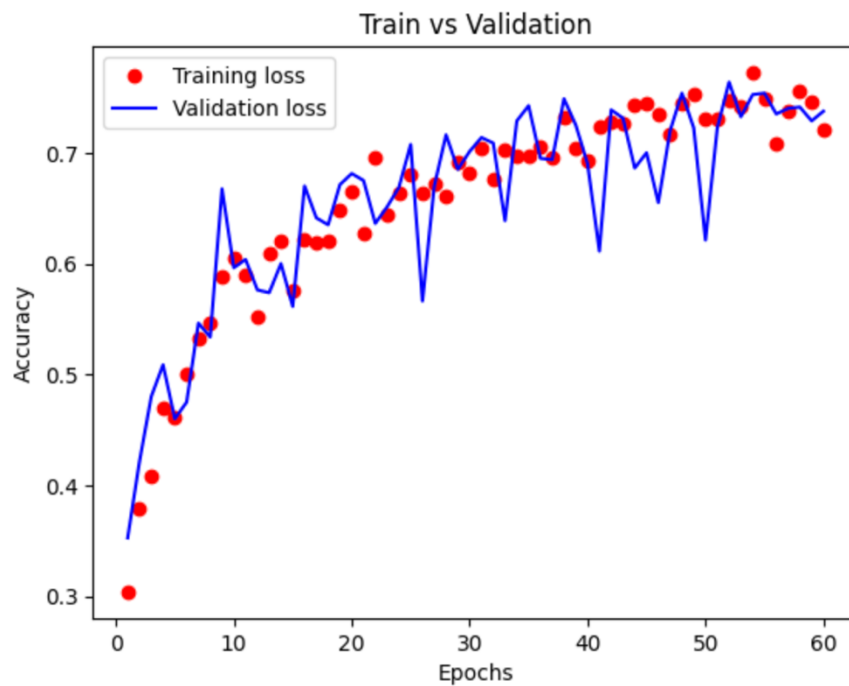
Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 58, 58, 20)	560
max_pooling2d (MaxPooling2D)	(None, 29, 29, 20)	0
conv2d_1 (Conv2D)	(None, 27, 27, 40)	7240
max_pooling2d_1 (MaxPooling2D)	(None, 13, 13, 40)	0
conv2d_2 (Conv2D)	(None, 11, 11, 80)	28880
max_pooling2d_2 (MaxPooling2D)	(None, 5, 5, 80)	0
conv2d_3 (Conv2D)	(None, 3, 3, 120)	86520
max_pooling2d_3 (MaxPooling2D)	(None, 1, 1, 120)	0
flatten (Flatten)	(None, 120)	0
dense (Dense)	(None, 360)	43560
dropout (Dropout)	(None, 360)	0
dense_1 (Dense)	(None, 6)	2166

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Total params: 168,926  
Trainable params: 168,926  
Non-trainable params: 0  
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Batch size is set to 20, and for 60 epochs we have following results:

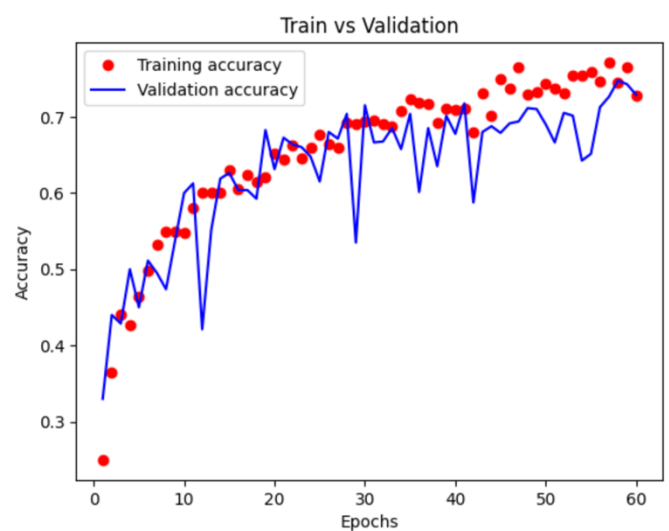
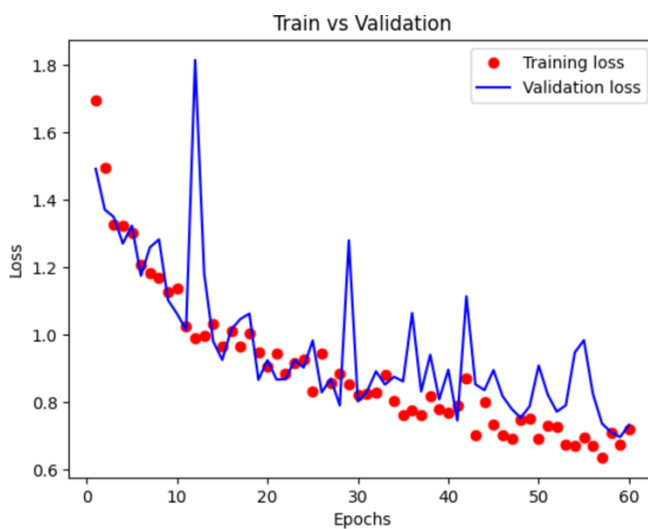




as can be seen, epoch 35 is probably the optimal number of epochs for the batch size chosen. So we set the number of epochs to 53 and train our data again.

MSE = 0.7289703488349915, MAE: 0.7386666536331177

## Results for augmented data



MSE = 0.7326207756996155, MAE: 0.7296666502952576

**Q.2)**

Layer (type)	Output Shape	Param #
conv2d_19 (Conv2D)	(None, 216, 216, 32)	7808
max_pooling2d_19 (MaxPooling2D)	(None, 108, 108, 32)	0
conv2d_20 (Conv2D)	(None, 104, 104, 64)	51264
max_pooling2d_20 (MaxPooling2D)	(None, 52, 52, 64)	0
conv2d_21 (Conv2D)	(None, 48, 48, 64)	102464
max_pooling2d_21 (MaxPooling2D)	(None, 24, 24, 64)	0
flatten_5 (Flatten)	(None, 36864)	0
dense_10 (Dense)	(None, 3)	110595
dense_11 (Dense)	(None, 6)	24

Total params: 272,155

Trainable params: 272,155

Non-trainable params: 0

**Number of params for conv layer:**

Weights count = filter count \* filter size \* filter size

Bias count = filter count

**Number of params for dense layer:**

Weights count = neurons count \* last layer neurons count (3 \* 36864 for dense\_10)

Bias count = neurons count (3 for dense\_10)