Assignment 2 Question 2

Deepayan
email deepayan.das@research.iiit.ac.in

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1 Problem 2: CNN Architecture

1. **Adding Dropout Layer**

```
_________________________________________________________________
Layer (type)                 Output Shape
Param #
=================================================================
conv2d_1 (Conv2D)            (None, 3, 32, 32)
9248
_________________________________________________________________
activation_1 (Activation)    (None, 3, 32, 32)
0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 3, 32, 32)
9248
_________________________________________________________________
activation_2 (Activation)    (None, 3, 32, 32)
0
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 1, 16, 32)
0
_________________________________________________________________
flatten_1 (Flatten)          (None, 512)
0
_________________________________________________________________
dense_1 (Dense)              (None, 512)
262656
_________________________________________________________________
activation_3 (Activation)    (None, 512)
0
_________________________________________________________________
dropout_1 (Dropout)          (None, 512)
0
```

```
_________________________________________________________________
dense_2 (Dense)              (None, 10)
5130
_________________________________________________________________
activation_4 (Activation)    (None, 10)
0
=================================================================
Total params: 286,282
Trainable params: 286,282
Non-trainable params: 0
_________________________
```

2. **Adding Batch Normalization**

```
_________________________________________________________________
Layer (type)                 Output Shape
Param #
=================================================================
conv2d_1 (Conv2D)            (None, 3, 32, 32)
9248
_________________________________________________________________
batch_normalization_1 (Batch (None, 3, 32, 32)
128
_________________________________________________________________
activation_1 (Activation)    (None, 3, 32, 32)
0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 3, 32, 32)
9248
_________________________________________________________________
batch_normalization_2 (Batch (None, 3, 32, 32)
128
_________________________________________________________________
activation_2 (Activation)    (None, 3, 32, 32)
0
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 1, 16, 32)
0
_________________________________________________________________
flatten_1 (Flatten)          (None, 512)
0
_________________________________________________________________
dense_1 (Dense)              (None, 512)
262656
_________________________________________________________________
batch_normalization_3 (Batch (None, 512)
```

```
2048
_________________________________________________________________
activation_3 (Activation)    (None, 512)
0
_________________________________________________________________
dense_2 (Dense)              (None, 10)
5130
=================================================================
Total params: 288,586
Trainable params: 287,434
Non-trainable params: 1,152
_________________________________________________________________
```

Table 1: Accuracy and time taken

Architecture	**No. of Epochs**	**Time for each epoch**	**Accuracy**
Batch Normalization	25	17s	61.77%
Drop out	25	6s	59.95

Table 2: Accuracy with different activation function

Activation	**Accuracy**
ReLu	59.95
tanh	60.44
Sigmoid	59.64
Softplus	57.34