**Image Classification**

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**Dataset used-Balanced\_PCB**

**1.Introduction about the model:**

It is a 1-1convolution model, the model is a stack of one convolution(filters=16,filter\_size=3,

activation=relu)followed by a maxpooling layer(stride=2) followed by one dense layer of 128 neurons and finally and sigmoid output layer.To compile i have used optimizer=Adam,loss=binary

crossentropy and metrics=accuracy.To avoid overfitting i have used Dropout at the last dense layer.

challenges faced:Because of the small datasets overfitting was the main issue,so main goal was to reduce overfitting.

**2.Experiments and Observations:**

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| NO | **MODEL** | **OBSERVATION** | **DA** | **N-DA** |
| 1 | Lenet-5  Optimizer-SGD, loss- SparseCategoricalCrossentropy  metrics=SparseCategorical accuracy. | If we plot a loss vs val\_loss graph we will see it fails to converge and seems like overfitting. | 93% | 75% |
| 2. | To reduce overfitting we reduce the no of layers as one convolution layer of 6 filters ,filter=5 and activation=relu ,follwed by max pooling ,strides=2 and 1 dense layer of 120 neurons and finally a softmax output layer. | By reducing the layers we got no overfitting but the accuracy seems to reduce. | 61% | 73% |
| 3. | Stack of one concolution layer of 16 filters ,filter =3 and activation=relu and a maxpooling layer of stride=2 followed by dense layer with 128 neurons and finally a output sigmoid layer. To compile we used optimizer=Adam,loss=binar\_crossentropy,metrics=accuracy | The model doest not converge and seems like a overfitting and validation loss seems to rise after certain point. | 79% | 75% |
| 4. | So in the above model ,small changes are made to reduce overfitting we add a dropout(0.7)after the dense 128 neurons layer. | The model doest not overfit and accuracy metrics of training and validation are near to convergence. | 80% | 81% |
| 5. | We use on another overfitting technique at the dense layer of 128 neurons,the technique is know as  regularization,we use L2 norms here. | The model seems to doing well and no overfitting is there and performs slightly better than above model. | 84% | 80% |
| 6 | Now we combine the L2 norms with dropout at the dense layer . | We get a better result and finds that model seems to have no overfitting. | 94% | 81% |
| 7. | **1-1conv model**  Here we use one convolution layer (32 filters,filter size=3,activation =relu)followed by maxpooling(strides=2)and a dropout(0.2) layer followed by 1 dense layer of 128 neurons and finally a softmax output layer.To compile we used optimizer=Adam,loss=categorical\_crossentropy,metrics=accuracy | The loss vs val\_loss graph shows that validation loss is above the training loss and has slightly less accuracy. | 81% | 77% |
| 8. | **2-2conv model**  stack of 2 convolution layer (filters=32,64 respectively,filter size=3 with activation relu )followed by maxpooling (stride=2)and 2 dense layer.(128,2 neurons),dropout(0.25)is used after every maxpooling layers. | This model does not converge and seems like overfitting and the validation accuracy got stagnant after certain point. | 89% | 70% |

**3.Final Results:**

Defective accuracy: 91%

Non-defective Accuracy: 84%

Note-In the code I have commented all the layers I have used ,and if the test dataset is big do comment out the code I have commented.