Deep Learning
Assignment 2 - Analysis Report
Syed Muzammil Ahmed - 25371

In this assignment we are doing image classification and working on five different datasets. We are analyzing the performance of CNN model after changing different parameters like layers, activation functions, optimizers, architecture etc. to observe the effect on the performance of the model. The dataset we are using in this project are taken from different online sources and some datasets built in datasets of Keras library.

Dataset 1: Fashion Dataset

The first dataset we are using is built in dataset of TensorFlow Keras. It has around 60000 images in it. Images are of different clothing and fashion items. We are classifying it using CNN model.

1- Basic CNN Model: -

At first, we are implementing basic CNN model on our dataset. The architecture with 3 convolutional and max pooling layers. It has 4 dense layers. Then we run this model with number of epochs and got the highest accuracy of 0.88.

2- Applying Different Activation Functions

We are applying four different activation functions on our model, and we can observe the performance of each activation function below. We can observe that among all the activation functions Relu is performing well, but other are good too.

Activation Functions	Performance
RELU	0.887
GELU	0.860
SELU	0.885
ELU	0.882

3- Applying Different Optimizers

Now we are checking performance of model by implementing different optimizers such as Adam, RMSprop, Adamax etc. So, we can check the performance of each optimizer on our dataset.

Optimizers	Performance
Adam	0.887
RMSProp	0.866
Adagrad	0.876
Adamax	0.899

4- ImageNet Architecture: -

For our Fashion dataset, we are using a Alex net architecture and getting accuracy of 0.75. In alexnet architecture we are using 8 convolutional layers each with batch normalization and 5 dense layers with dropout.

So, this is about our first dataset. Now we are moving towards our next dataset.

Dataset 2: Bird Classification Dataset.

The next dataset we are using is Bird images classification dataset in which we have 6 different classes.

1- Basic CNN Model: -

At first, we are implementing basic CNN model on our dataset. The architecture with 2 convolutional and max pooling layers. It has 2 dense layers. Then we run this model with number of epochs and got the highest accuracy of 0.835.

2- Implementing Different Activation Functions: -

We are applying four different activation functions on our model, and we can observe the performance of each activation function below. We can see that among all the activation functions Relu is performing well, but other are good too.

Activation Functions	Performance
RELU	0.835
GELU	0.75
SELU	0.671
ELU	0.721

3- Implementing Different Pooling Layers: -

Now we are using Average pooling layer among our architecture at first, we were using Max Pooling layer in CNN architecture. So, after adding layer of average pooling, we implement CNN model on all 4 activation functions and check out model performance which is mentioned below.

Activation Functions	Performance
RELU	0.71
GELU	0.65
SELU	0.55
ELU	0.57

4- Using Different Architecture: -

We are using two different architectures for this dataset which are Alex net and Le Net architecture. The accuracy with Le Net architecture is 0.834 and with Alex net is 0.674.

Dataset 3: CIFER 10

The Dataset we are using next is another built in dataset by TensorFlow known as CIFER 10. It has around 50,000 images in it and famous dataset for image classification.

1- Basic CNN Architecture: -

So, first thing we are implementing is basic CNN architecture with 2 convolutional and 2 dense layer along with max pooling. We run 5 epochs, but we are getting constant accuracy of 0.100 throughout each epoch. Value of accuracy is not improving apochs.

2- Checking Different Activation Functions: -

Now, we are checking performance of model on different activation functions such as gelu, selu, relu, and elu. But the performance is constant for every activation function that is 0.10

Activation Functions	Performance
RELU	0.100
GELU	0.100
SELU	0.100
ELU	0.101

3- Checking Different Optimizers: -

Now, we are checking performance of model on different activation functions such as Adam, Adagrad, Adamax, and RMSProp. But the performance is constant for every activation function that is 0.10

Optimizers	Performance
Adam	0.100
RMSProp	0.100
Adagrad	0.100
Adamax	0.100

4- Average Pooling: -

Now we are trying average pooling with pool size 2 instead of Max pooling. We are adding average pooling with every conv2d layer. We are first implementing it on all activation functions.

Activation Functions	Performance
RELU	0.100
GELU	0.100
SELU	0.100
ELU	0.101

5- Image net Architectures: -

Now we are trying different architectures such as Alex net and VVG16 and applying CNN on this architecture, but result is not changing much.

Dataset 4: Plant Disease Classification

The next dataset we are using is Plant disease images classification dataset in which we have 900 images and six classes.

1- Basic CNN Model: -

At first, we are implementing basic CNN model on our dataset. The architecture with 2 convolutional and max pooling layers. It has 2 dense layers. Then we run this model with number of epochs and got the highest accuracy of 0.98.

2- Implementing Different Activation Functions: -

We are applying four different activation functions on our model, and we can observe the performance of each activation function below. We can see that among all the activation functions Relu is performing well, but other are good too.

Activation Functions	Performance
RELU	0.835
GELU	0.82
SELU	0.72
ELU	0.97

3- Implementing Different Pooling Layers: -

Now we are using Average pooling layer among our architecture at first, we were using Max Pooling layer in CNN architecture. So, after adding layer of average pooling, we implement CNN model on all 4 activation functions and check out model performance which is mentioned below.

Activation Functions	Performance
RELU	0.98
GELU	0.85
SELU	0.75
ELU	0.98

4- Using Different Architecture: -

We are using two different architectures for this dataset which are Alex net and Le Net architecture. The accuracy with Le Net architecture is 0.98 and with Alex net is 0.65.

Conclusion and Results: -

So, after applying CNN with different parameters and architectures I have concluded that:

1- RELU is best performing activation function among all, followed by ELU.

2- CNN with max pooling perform better than average pooling for my datasets.

3- In some cases, Adamax perform better than Adam optimizer.

4- VVG16 architecture is more computationally high as compared to LENET and Alex net architecture.

5- Lenet performs better than Alex net architecture in term of accuracy.