Fruits classification

ANN&DL Project Report

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The Report

1. Data Preprocessing & augmentation:
    - We make one hot encoding for each class to make a list of labels.
    - After reading data we resize all images
    - Apply rotate 90 deg clockwise.
    - Apply flipping vertically and horizontally.
    - Apply zooming,
    - Apply brightness and contrast.
    - Last thing we shuffle the data to ensures that the data is presented in a random order during training and improving generalization and to preventing patterns.

    ➢ We apply different types of data augmentation to get the best results to increase the accuracy of the models. By applying the above methods in each image and save it that make a large data but this increase the time of training too.so we try to put all the techniques together, we apply the brightness to all data and apply the flipping by 0.2, and apply zooming and cropping by 0.3 We use a random selection from images.

2. hyperparameter tunning:

   Hyperparameter tuning plays a crucial role in optimizing the performance of neural network models. tuning specific hyperparameters such as epochs and learning rate can have a significant impact on the models' performance.

   - Learning rate: when use large lr the model training done fast but over shot global minimum can occurs so we choose to apply small lr to increase model performance.
     (lr = 0.0001)
   - Num of epochs: num of epochs play a significant role in model training process If num of epochs is large the model training time increases and the accuracy increases too.
     When we make num of epochs to high (40) the model over fit and doesn't do well in testing so we try different number to achieve best accuracy in training and testing.
     In VGG16 model lr = 25

   L2 regularization: we apply l2 to generalize the model to increase the accuracy in test and avoid over fitting in training.
   L2 = 0.01

3. Models:
   1. VGG16 model:
      - We use VGG16 architecture butt we edit number of filter used in layers to avoid over fitting and decrease training time.
      - L2 = 0.01
      - First Dropout = 0.5, second = 0.2
      - Num of epochs = 25
      - Validation split = 0.3

In epoch 22 the validation accuracy got decreased so the early stopping Is run and return to the best validate accuracy in epoch 17
Training accuracy = 72 %
Test accuracy = 68 %

2. Improved VGG16 model:
    - We apply fine tuning on the vgg16 model that implemented before. That increase the training accuracy from 72% to 80% and increases the test to 80% also.
    - L2 = 0.0001
    - Num of epochs = 20
    - Validation split = 0.3
    - accuracy in epoch 17
    - Training accuracy = 80 %
    - Test accuracy = 80 %

- From the results in model 2 we noticed that regularization techniques works well and with this hyperparameters we avoid over fitting.

3. Custom CNN model:
    - We used a pretrained parameters that trained on a imgnet dataset and unfreeze some layers and enter the model layer to a custom cnn model this makes the model learn faster and perform good performance.
    - L2 = 0.01
    - Num of epochs = 25
    - Validation split = 0.3
    - Lr 1= 0.0001

    Training accuracy = 98 %

    Test accuracy = 95 %

6: Conclusion

- In our project, we apply several NN models for image classification. We started by prepping the data, using tricks like resizing and flipping images. Hyperparameter tuning was key choosing the right settings for learning rate, epochs, and regularization helped a lot.

- Our first VGG16 model hit 72% training and 68% test accuracy. We improved it by tweaking parameters, reaching 80% on both training and test data. This showed that careful tuning and regularization techniques can prevent overfitting.

- We also built a custom CNN model using pre-trained parameters. It learned faster and scored big with a 98% training and 95% test accuracy. Leveraging existing knowledge made a big difference.

- In a nutshell, our project highlights the importance of smart data handling and tuning in neural networks. These findings pave the way for better image classification models in the future.