Paper ID: MISS21_31

Transfer Learning and Fine Tuning Based Early Detection of Cotton Plant Disease

Himani Bhatheja*, N. Jayanthi

Delhi Technological University, Rohini, Delhi, India

*Corresponding author

Abstract

Background: State-of-the-art pre-trained models are being popularly utilized for feature extraction along with making changes in some of the layers to obtain highly efficient classification models. VGG, Inception and ResNet architectures have been used widely for this purpose. Qiang Z. et. al. [1] proposed fine tuning based Inception V3 transfer learning method on Plant Village dataset. J. Chen et. al. [2] used VGGNet and [3] describes a comparative study on different transfer learning architectures without Data augmentation. EfficientNet is a newly developed architecture model which has been applied in this research while changing the last convolutional layers for detection of cotton plant diseases.

Objectives: Cotton is used in various industries and therefore its production should be maintained and supervised with modern techniques which can help to increase the throughput and ultimately increase the economy of our country. Cotton crops can suffer from some diseases like Cercospora, Bacterial blight, Ascochyta blight, and Target spot. Thus, identifying these diseases at an early time becomes crucial for the farmer to produce a healthy harvest.

Methodology: A number of data augmentation techniques such as horizontal shift along with height shift, width shift, zoom range and rotation have been used to prevent data scarcity for training the models and improve the classification accuracy. Inspired by performance of transfer learning technique in detection of different plant diseases [3], we have used InceptionV3 and EfficientNet models for feature extraction. Further, SoftMax layer of these models have been substituted by convolutional layers and a smaller learning rate to perform fine tuning.

Results and discussion: The metrics used for comparison are training and validation accuracy, precision, recall, f1-score and execution time. Also, we have compared accuracy of model before and after fine tuning technique was implemented. Using data augmentation, better training of data is done by increasing the quantity and diversity of data used in training.

Conclusions and future work: InceptionV3 achieved a training accuracy of 82.93%, validation accuracy of 78.12%, 0.76 precision, 0.66 recall and 0.66 f1-score. The EfficientNet model detected the cotton plant disease more efficiently than InceptionV3 with a training accuracy of 97.69%, validation accuracy of 88.93%, 0.91 precision, 0.90 recall, 0.90 f1-score and 30% faster execution. Further, a different EfficientNet model can be used, such as EfficientNet-B1 to B7 for better results.

References

[1] Qiang Z., He L., Dai F. (2019) Identification of Plant Leaf Diseases Based on Inception V3 Transfer Learning and Fine-Tuning. In: Wang G., El Saddik A., Lai X., Martinez Perez G., Choo KK. (eds) Smart City and Informatization. iSCI 2019, Communications in Computer and Information Science, vol 1122. Springer, Singapore.

[2] J. Chen, J. Chen, D. Zhang, Y. Sun, Y.A. Nanehkaran (2020) Using deep transfer learning for image-based plant disease identification. Computers and Electronics in Agriculture, Vol. 173, 105393, 0168-1699.

[3] Too, E.C., Yujian, L., Njuki, S., & Yingchun, L. (2019) A comparative study of fine-tuning deep learning models for plant disease identification. Comput. Electron. Agric., 161, 272-279.

DOI: 10.21467/abstracts.120

ISBN: 978-81-954993-2-8