

Main findings:

- ❖ The convolutional neural network (CNN) model is the top performing model with training accuracy of about 95% and a validation accuracy of about 77%.
- ❖ Using the confusion matrix 2397 images, 2946 images and 1025 images were correctly predicted for Anthracnose, Cocoa swollen shot virus (CSSV) and healthy cacao respectively.

Cacao leaf disease detection and classification

INTRO

- Ghana is the world largest producer of cocoa and generates revenue from the exports.



Figure 1 : Process of harvesting cacao pods and making chocolate is shown.

- However, the rise in disease-infected cacao plants poses a risk on cocoa harvest and ultimately the farmers' income and global supply.
- This study provides a method for the early diagnosis of diseases affecting cacao plants by utilizing deep learning techniques.

METHODOLOGY

- Comparative analysis of deep learning techniques was performed by considering custom Convolutional Neural Network (CNN), Resnet50 and EfficientnetB0 models.
- CNN model has outstanding performance and is utilized.

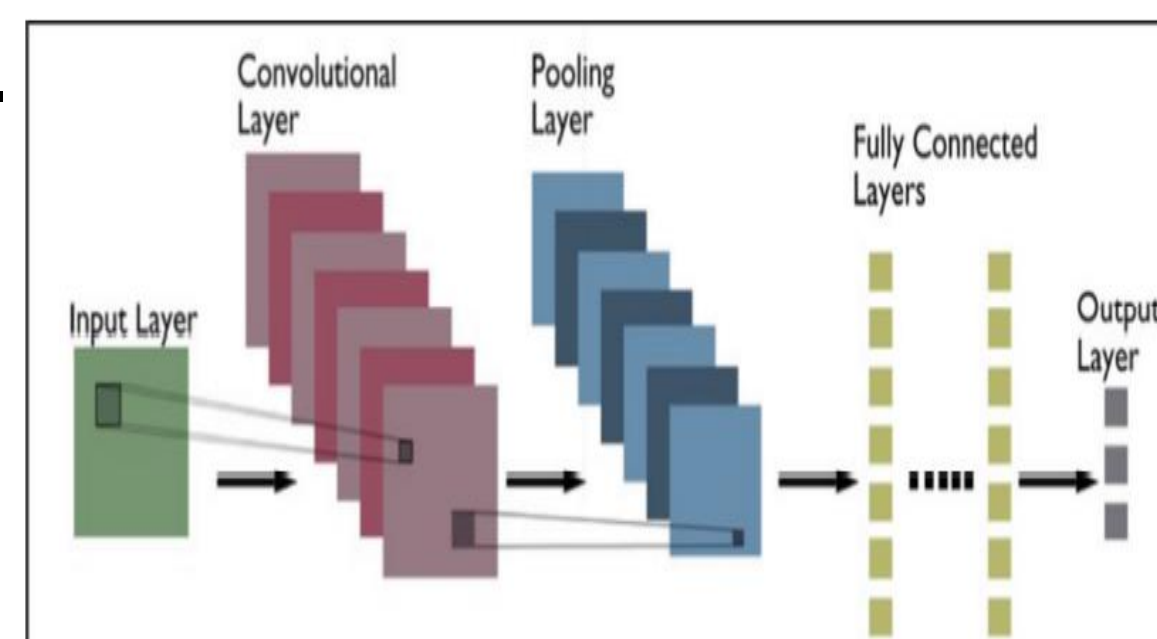


Figure 2 : Convolution Neural Network (CNN)

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DATASET

- Dataset contains images of healthy cacao and diseased leaves i.e Anthracnose and Cocoa swollen shoot virus.

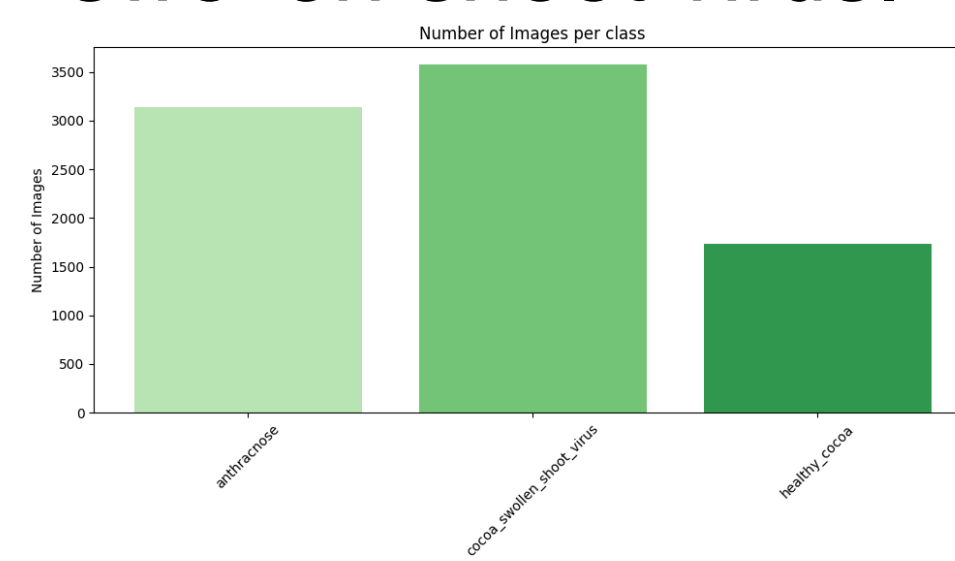


Figure 3 : Graph showing class imbalance in the dataset.

- Final model selected is the custom CNN due high validation accuracy

RESULTS

- Training and validation accuracy across all folds are 95% and 77% respectively

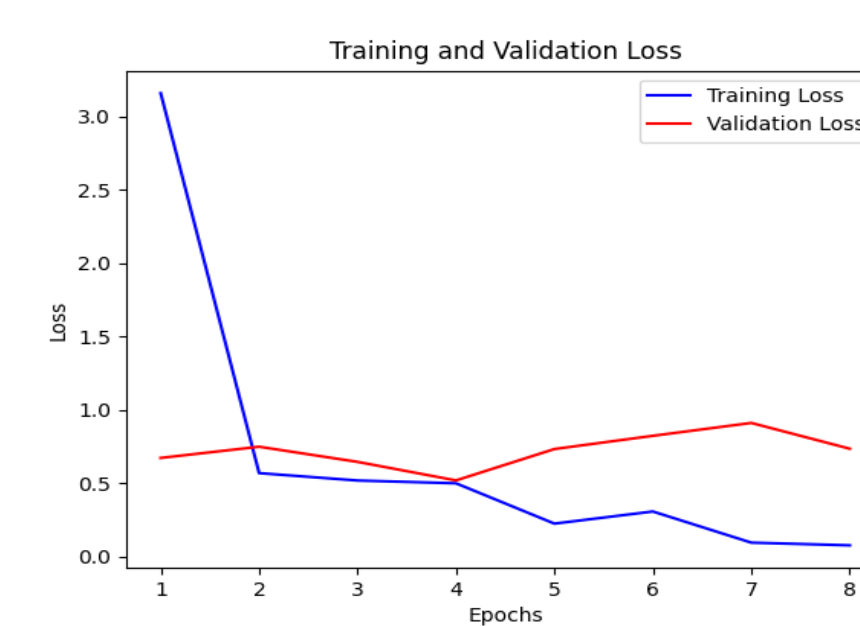
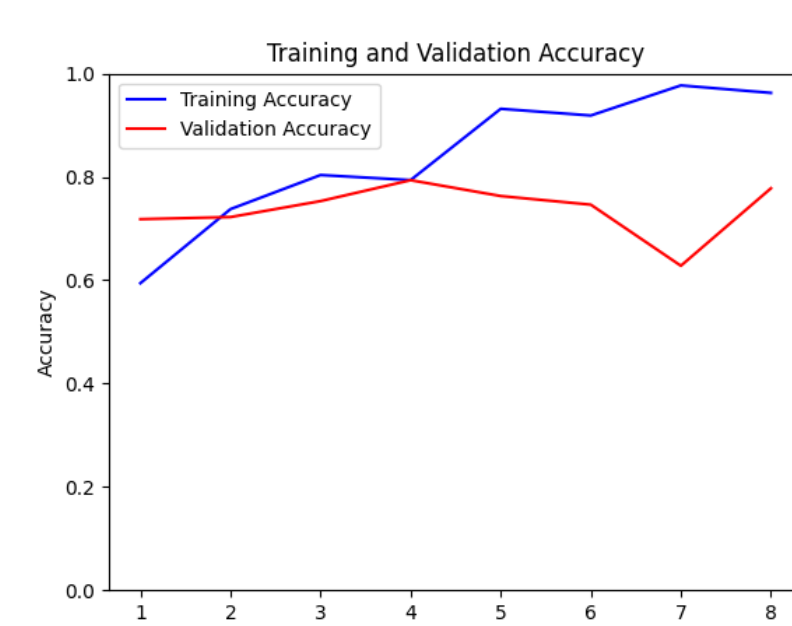


Figure 4 : Graphs showing accuracy and loss for training and validation

- Confusion matrix was used to visualise predictions made.
- Metrics are Recall, precision and F1 score used to assess model performance.
- Predictability, Compatibility Stability (PCS) Framework was a key consideration in this work

DISCUSSION

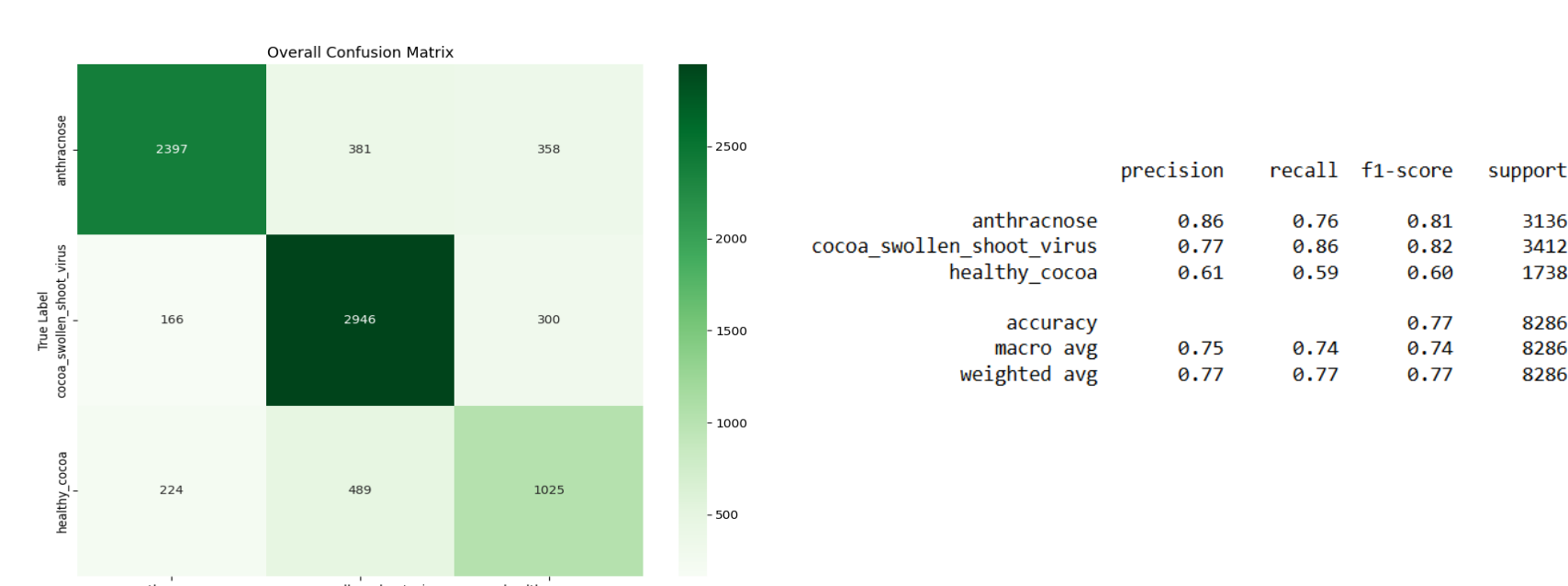


Figure 5: Confusion matrix and Classification report

- Confusion matrix show number of correctly predicted images for each class: Anthracnose – 2397, CSSV – 2946, healthy cocoa – 1025.
- Classification report gives precision, recall and f1-score per class. Despite class imbalance all classes perform well.

MODEL DEPLOYMENT

- Model was deployed in Streamlit.
- Two user types: Farmer and Model Maintainer
- Farmer uploads an image of a leaf and get a detection and pesticide recommendation .



Figure 6: Model deployment

CONCLUSION

- Revolutionized farming with DL
- Protect Ghana's Cocoa, Sustain the World's Chocolate

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