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Cocadoctor: deep learning-based cocoa disease detection system

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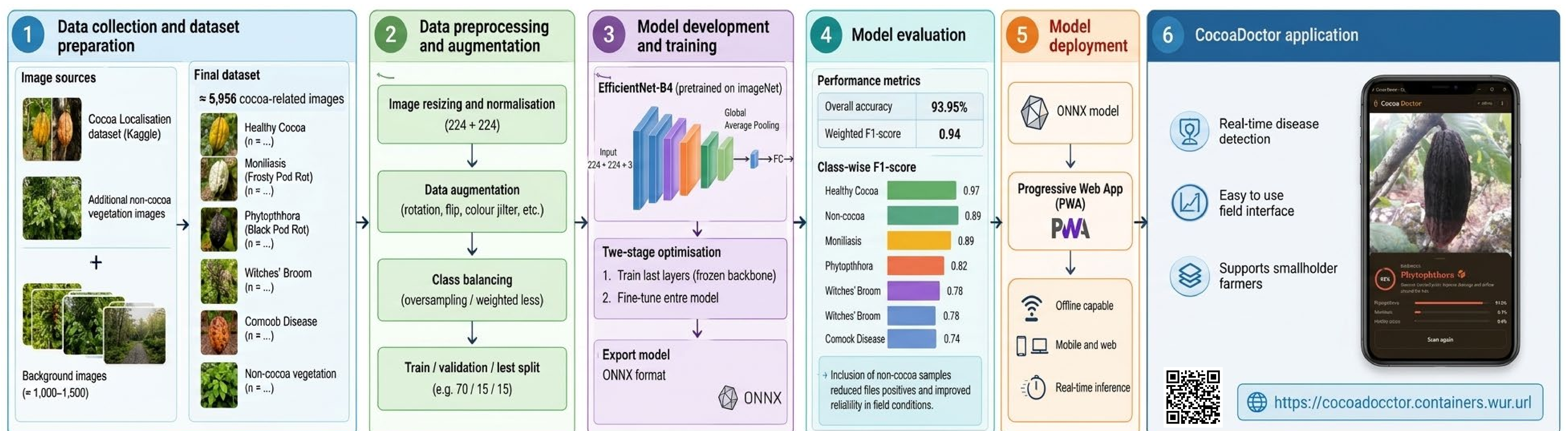
Background

Cocoa production in smallholder systems is increasingly affected by climate variability and the spread of fungal and bacterial diseases, leading to yield losses. Early and accurate disease detection is important for better crop management and more resilient cocoa systems. Recent progress in deep learning makes automated image-based diagnosis possible in field conditions.

Objective

- To develop a deep-learning model for image-based classification of cocoa pod conditions;
- To assess its classification performance and robustness across cocoa disease and non-cocoa classes; and
- To operationalise the model in an offline mobile application for field-based cocoa disease screening.

Methodological workflow



Results

Model Prediction Overview — EfficientNet-B4 (94.2% test accuracy)



Conclusion

- ~6,000 field images used for model training
- ~94% overall accuracy achieved for cocoa pod condition classification
- Strong performance for healthy pods and cocoa/non-cocoa discrimination.
- Disease classification remains challenging due to similar visual symptoms.
- On-device inference (CocoaDoctor mobile application) enables offline field-level assessment

Future outlook

- 20+ agronomists and disease-detection experts engaged in Brazil
- 20,000+ additional images recently reviewed and quality-checked
- Expert-validated images will be used to retrain the model
- Additional disease classes will be incorporated
- Continued expert-supported data collection will improve model robustness and field applicability

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