

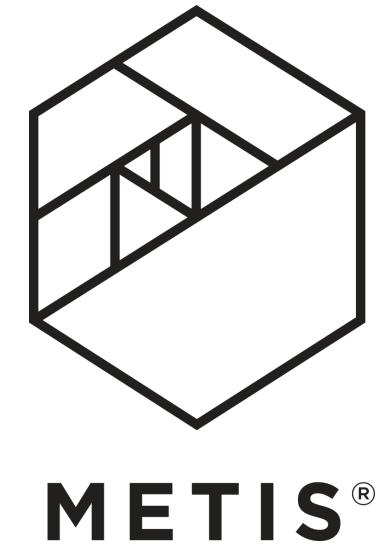
Plastic or Glass?

Image Classification with Deep Learning

METIS Data Science and Machine Learning Bootcamp

by Krystian Krystkowiak, 2022

Introduction

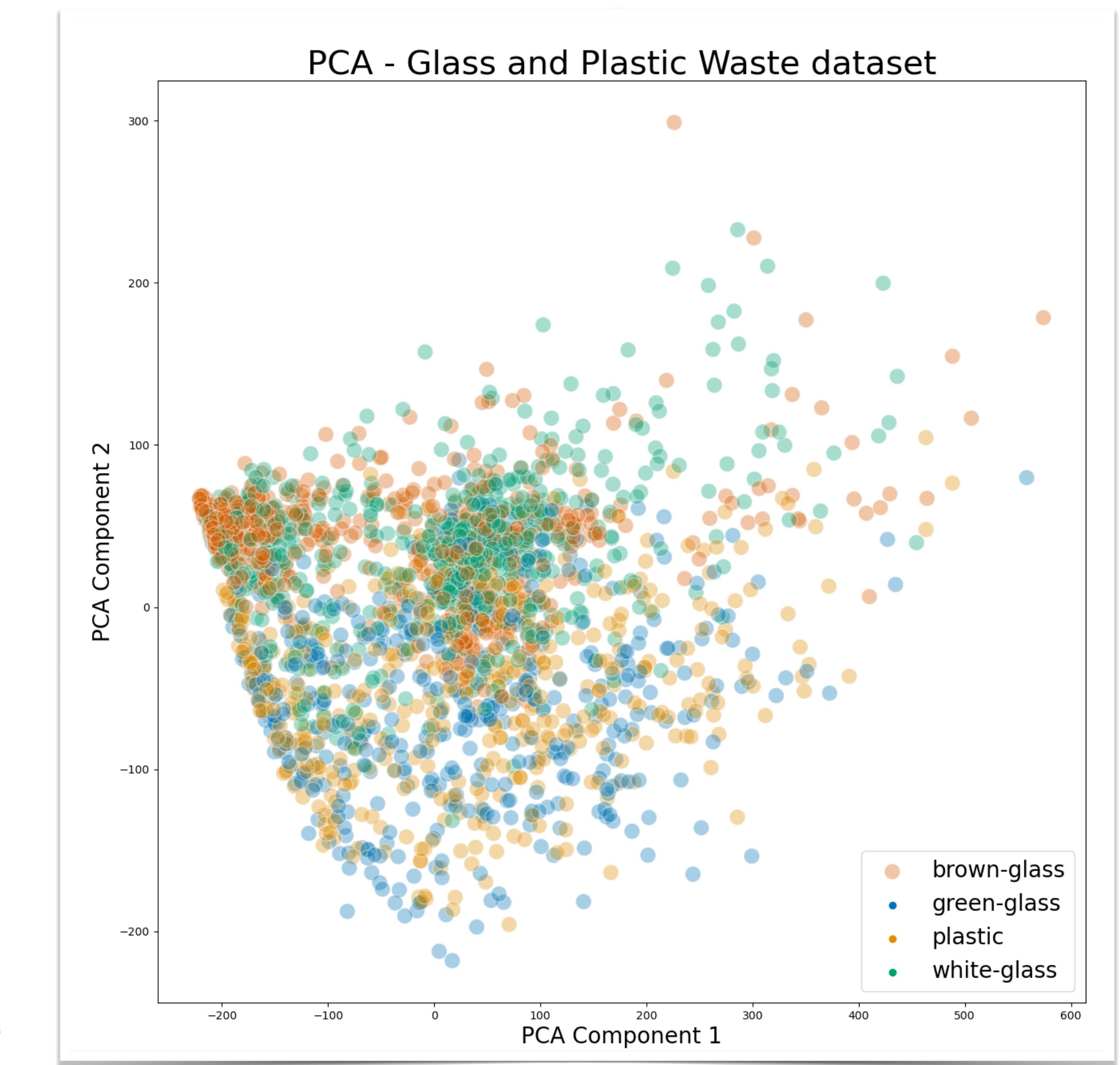
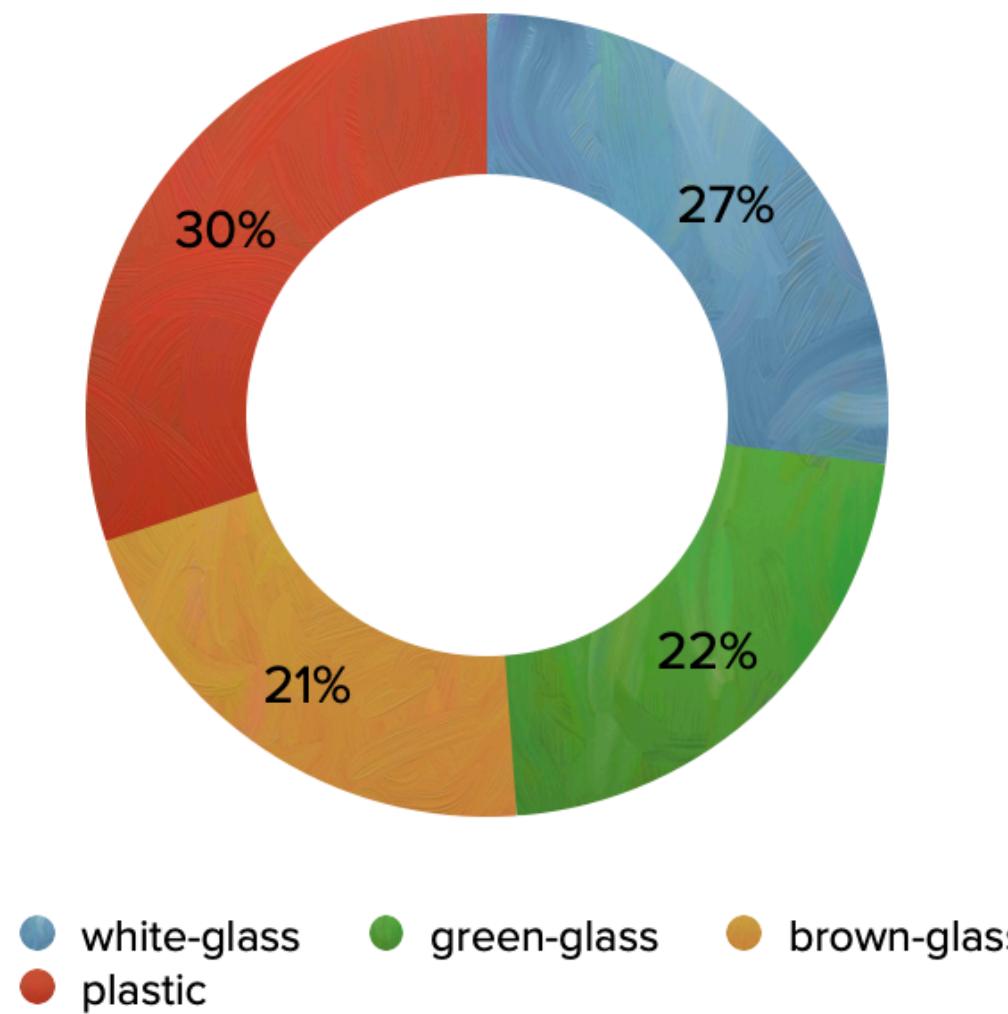


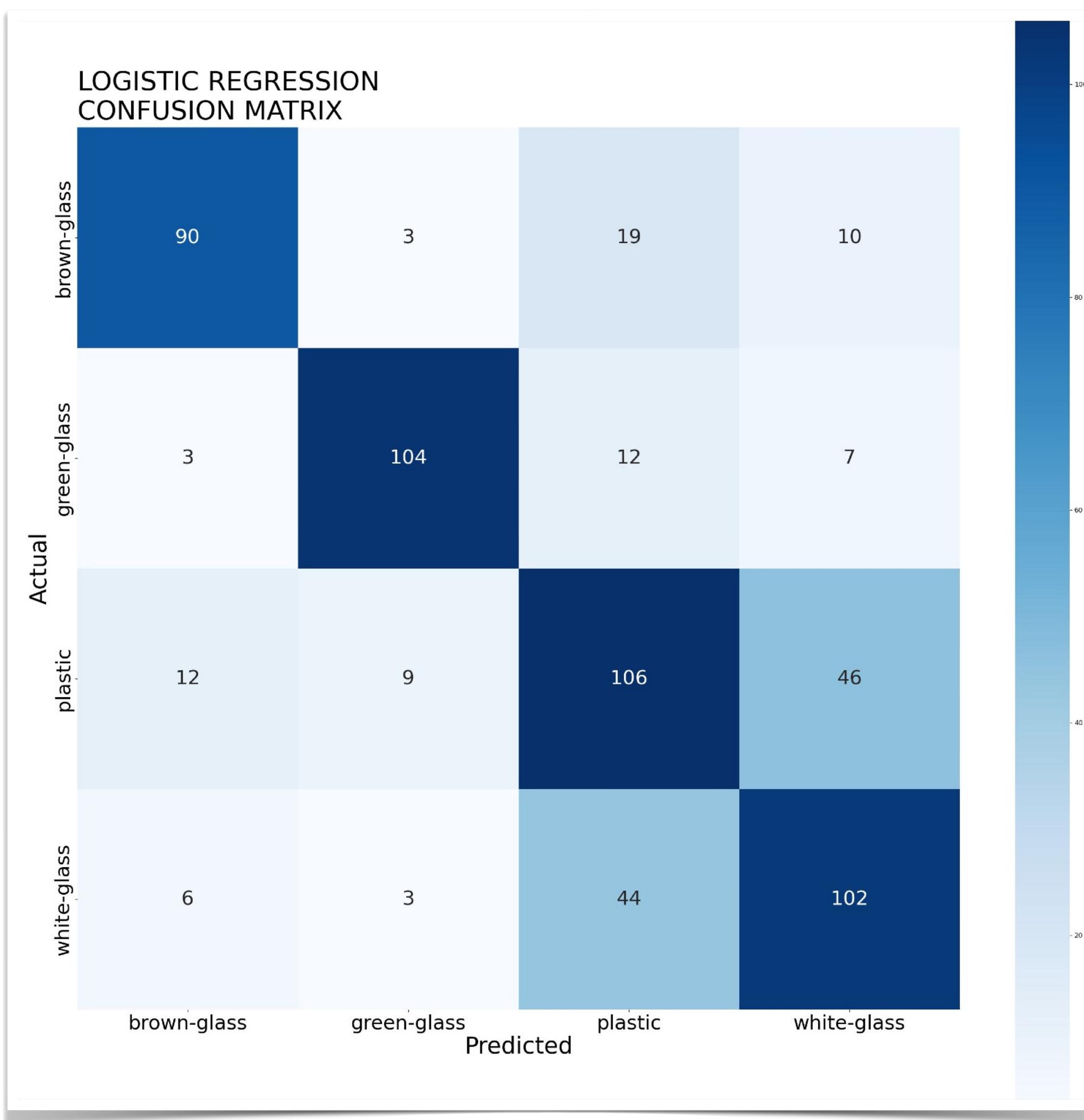
- **Garbage** in ecosystem leads to environmental pollution and health problems
- Challenge: Efficient **waste management**
- **Innovations**: Smart waste containers and self-learning sorting technologies
- GOAL: Deep learning model to help **classify plastic and glass waste**

Methodology

- “Images dataset for classifying household garbage” from Kaggle
- **2876 images of 4 types of waste**

- 128x128 RGB

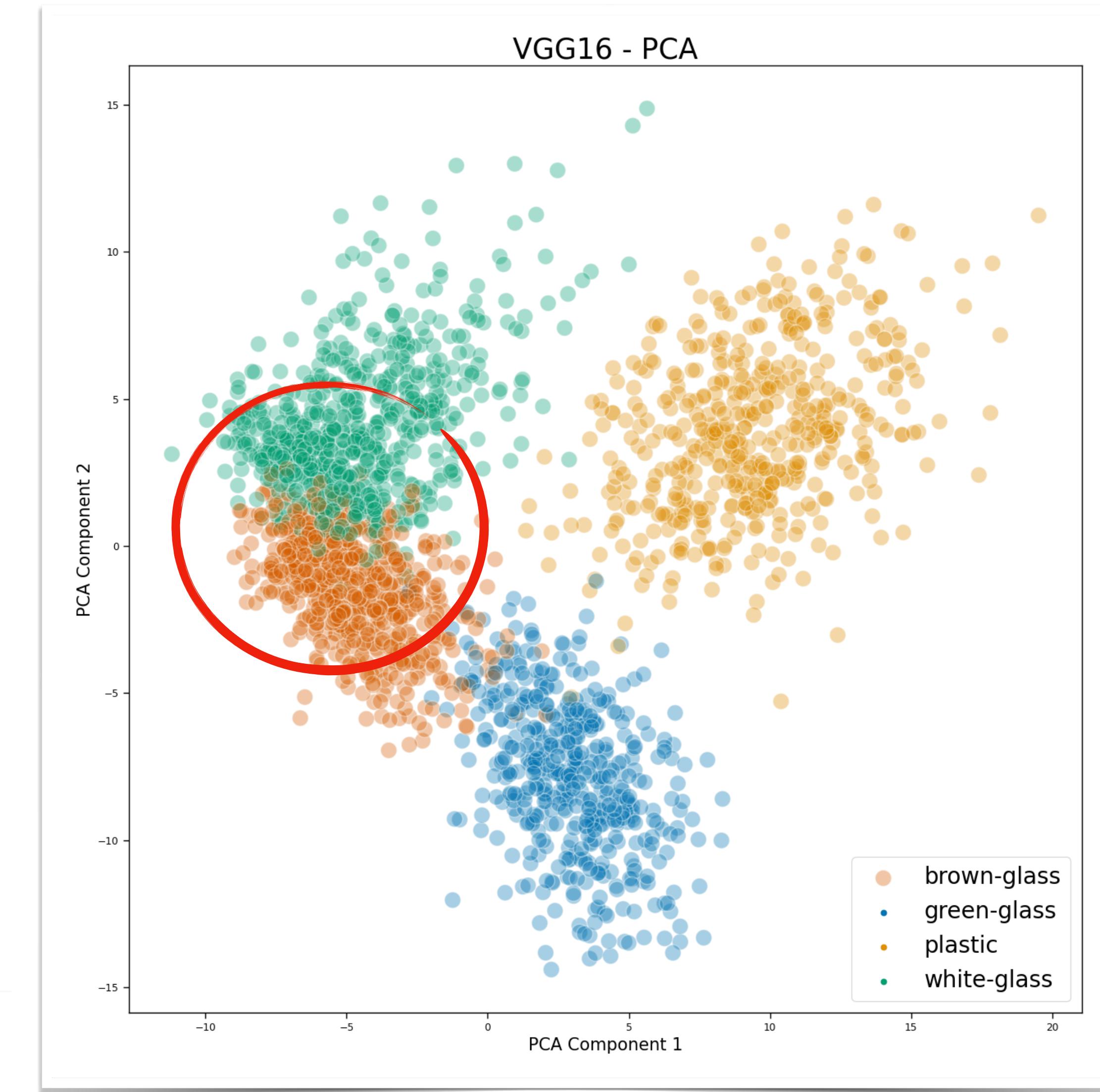
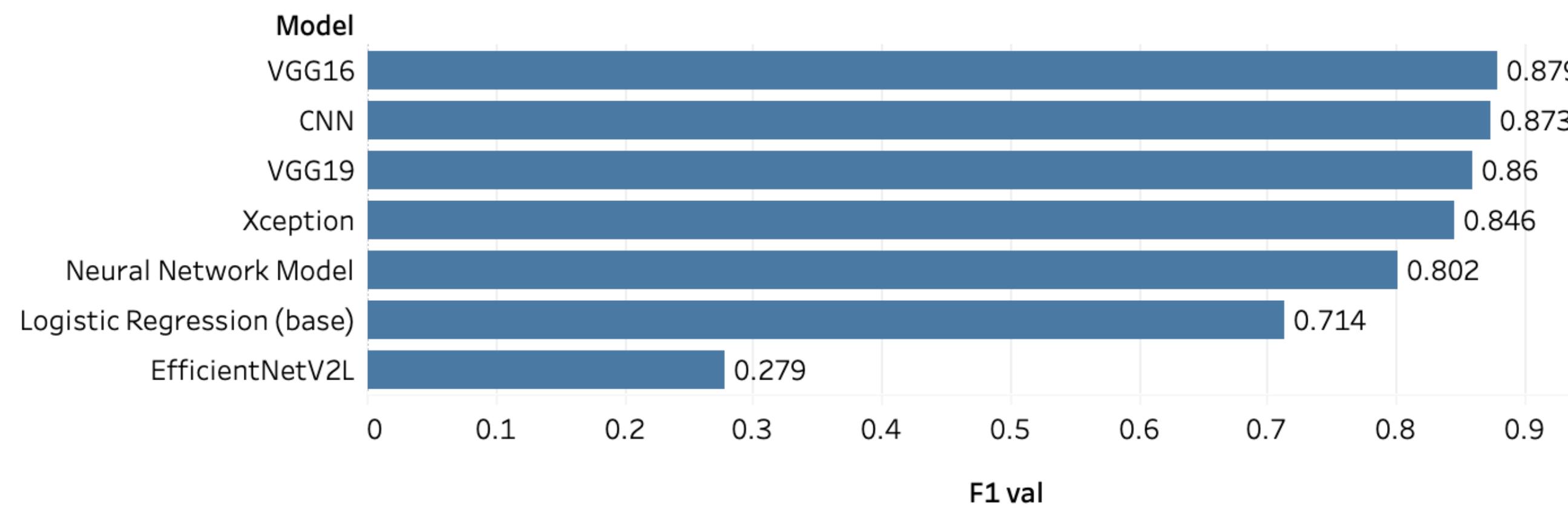
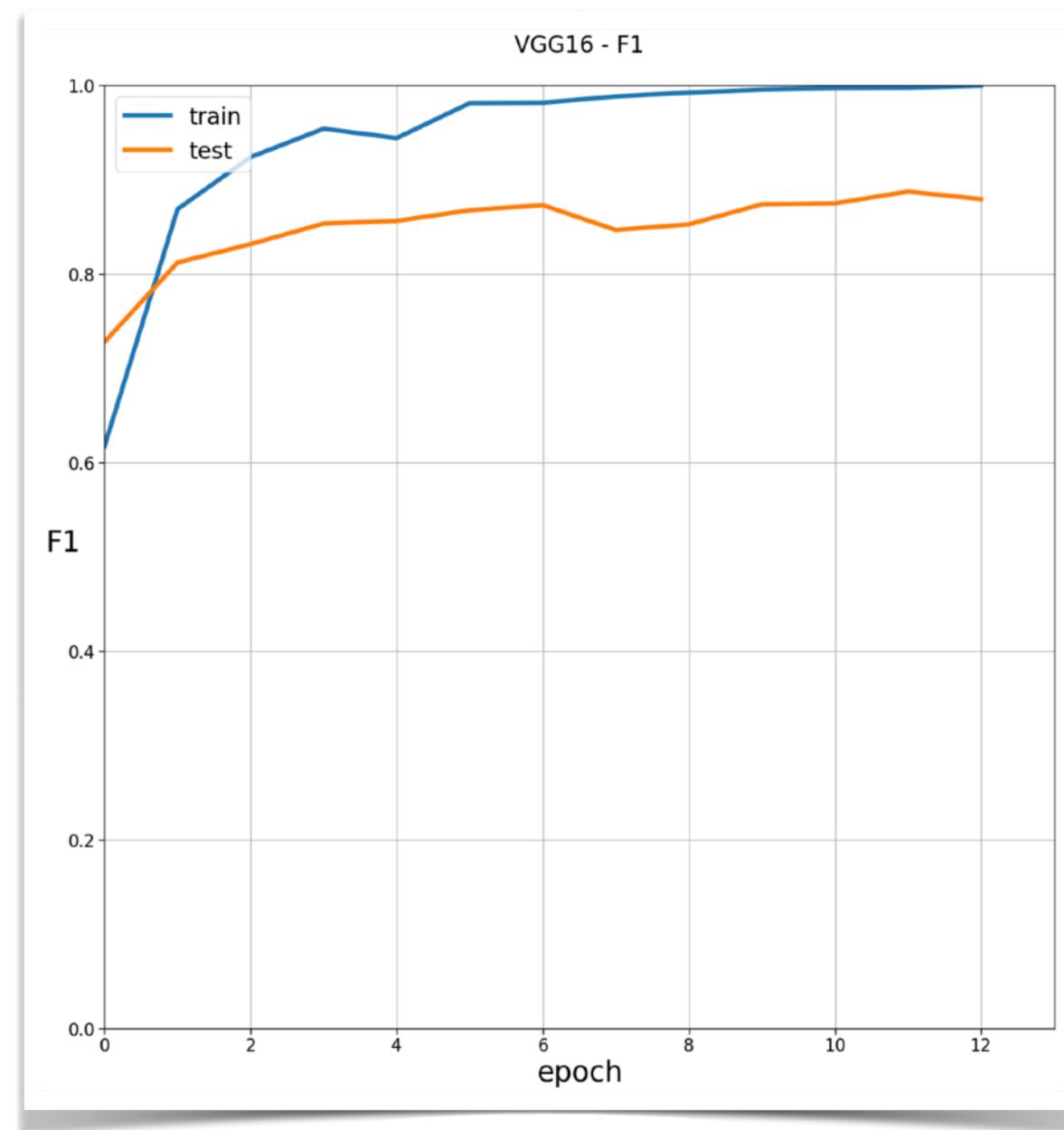


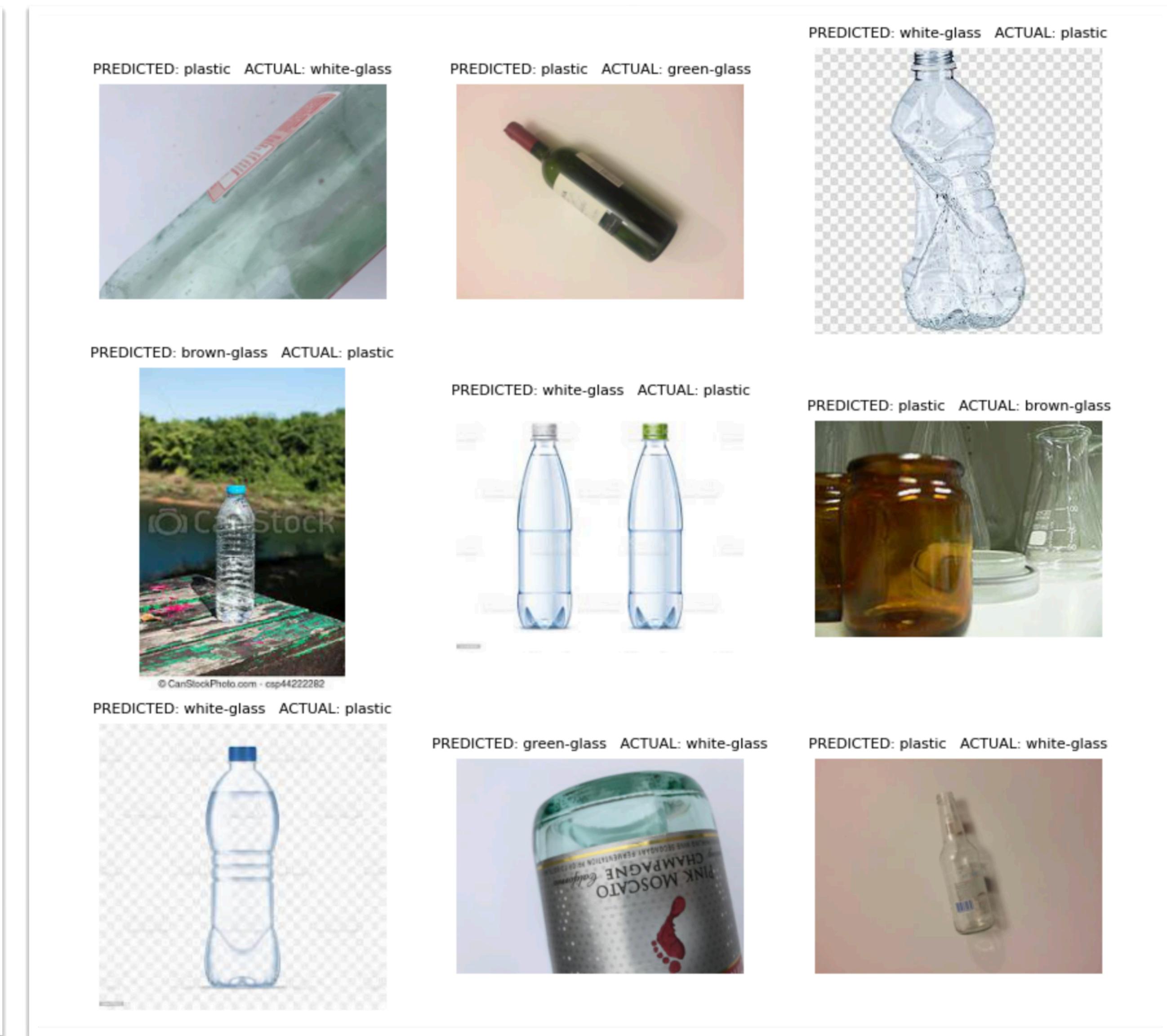
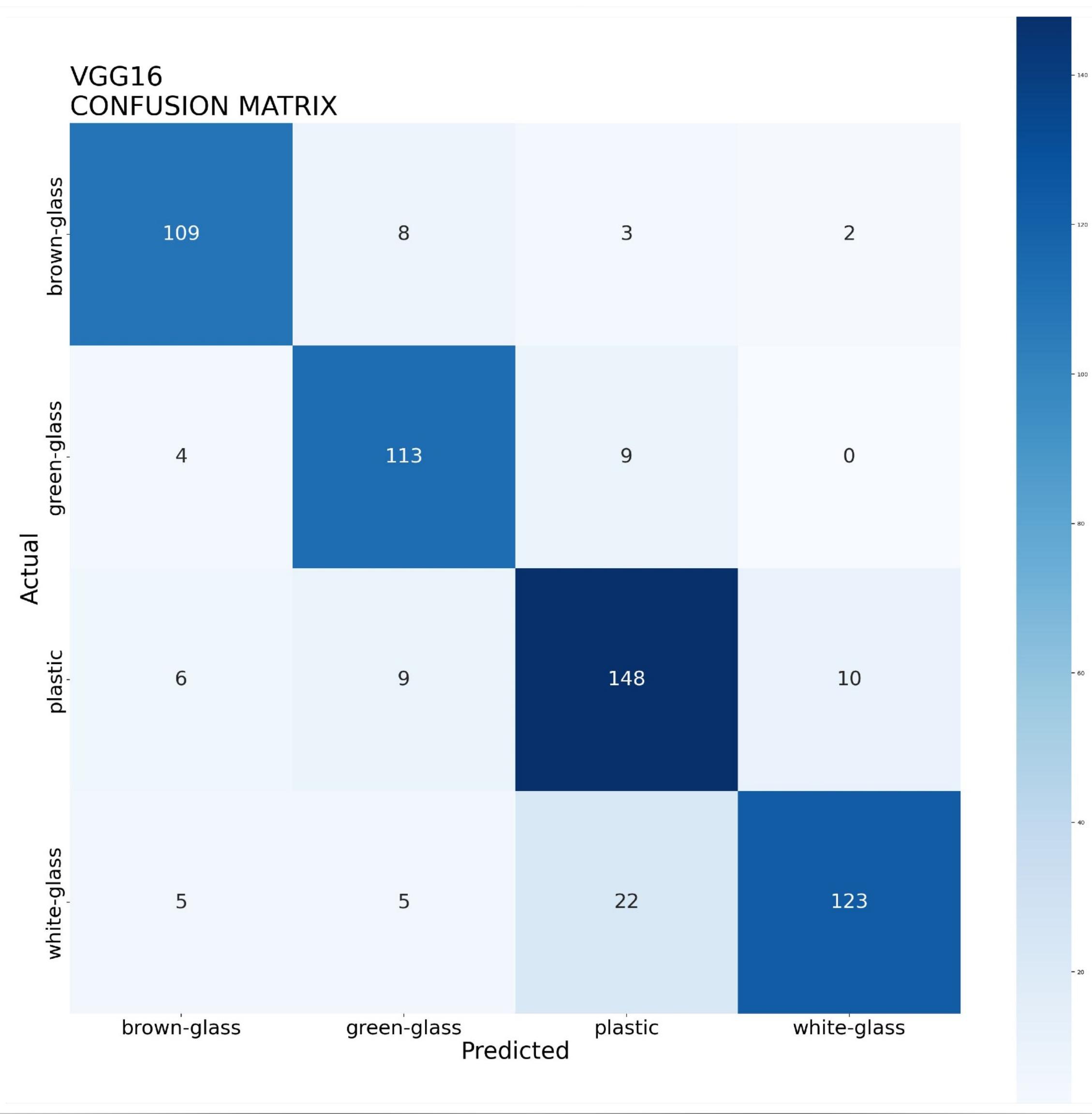


- Training/Validation: 80% (2300 images) / 20% (576 images)
- **BASELINE: Logistic Regression**
- **METRICS: F1: 0.714 (Val)**

Results

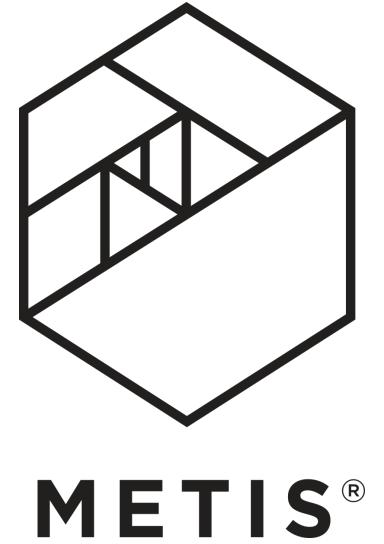
- VGG16
- F1 0.879





- Challenges: plastic/white-glass

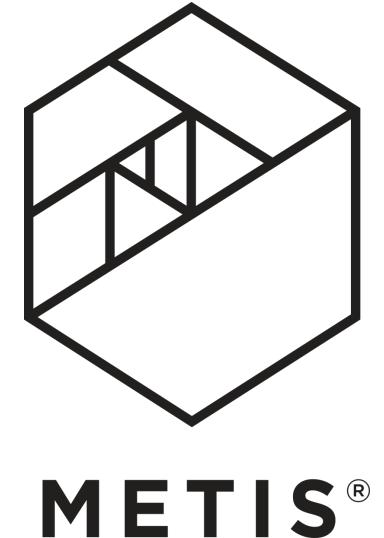
Conclusions/Recommendations



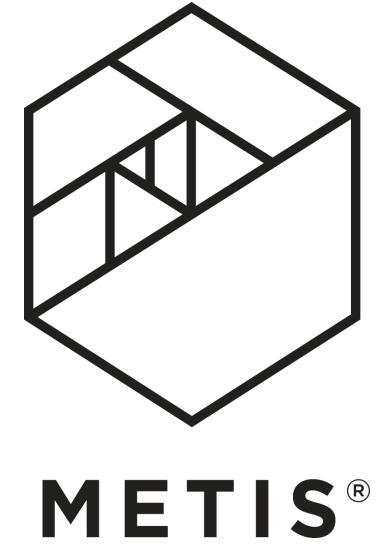
- **CNN, VGG16 and VGG19** presented similar performance and may be the model of choice depending on fine-tuning
- **VGG16** presented slightly better F1
- **Proper data labelling and preprocessing are crucial** for improving performance
- Transfer learning is effective, but **the way the model is trained matters** (EfficientNetV2L)



Future Work



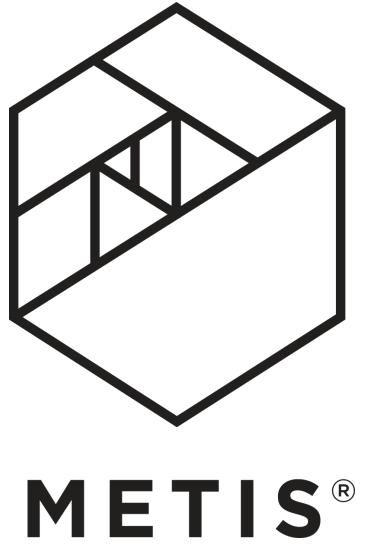
- **Fine-tuning and analyze difficult cases** for model optimization
- **More data**, add waste types and use data augmentation
- Development of **end-to-end model** with object detection
- Exploration of **other transfer learning models** like ResNet and InceptionV3
- **Integration** with smart container and **sorting technologies**



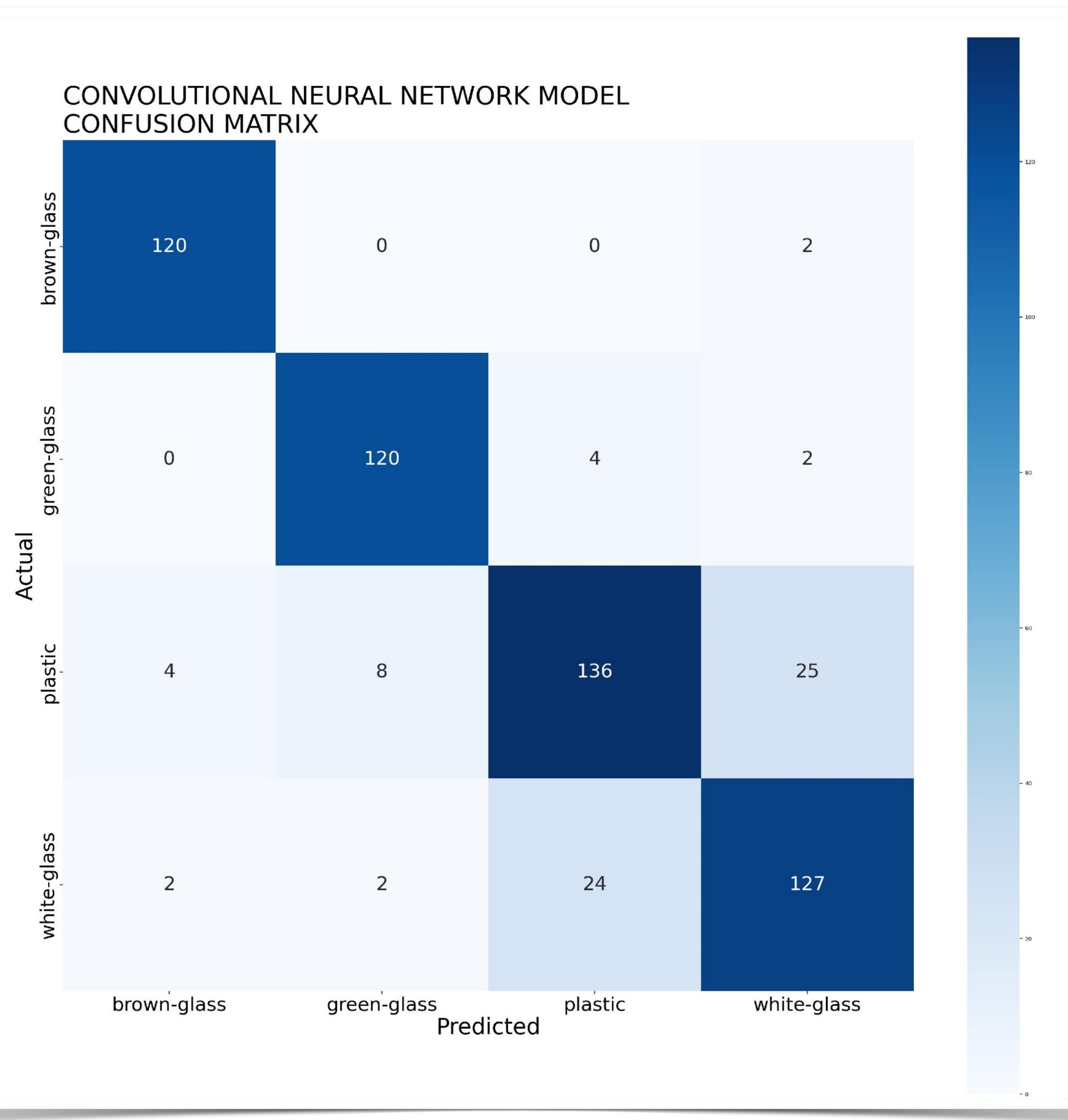
Thank you!

Questions?

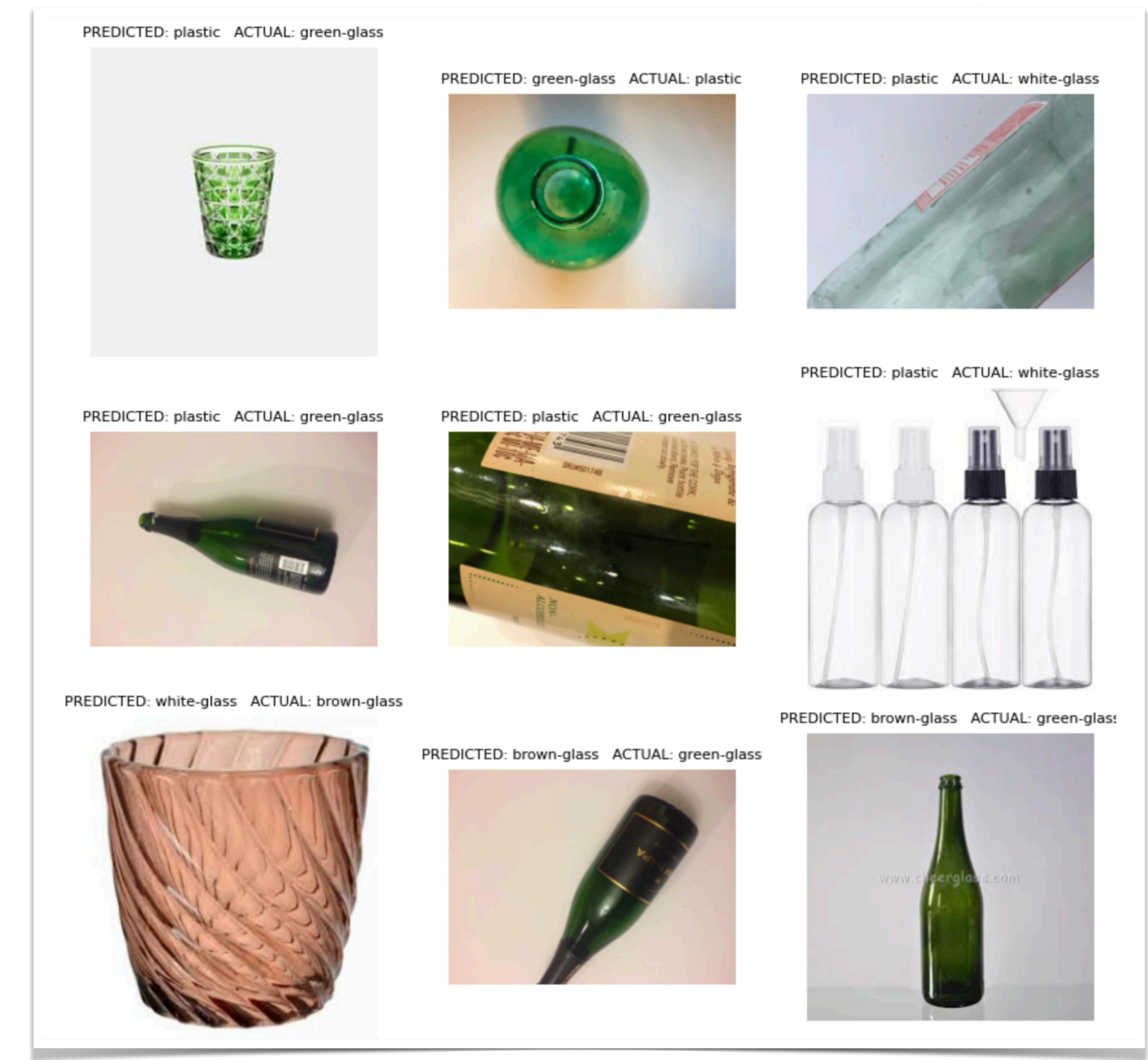
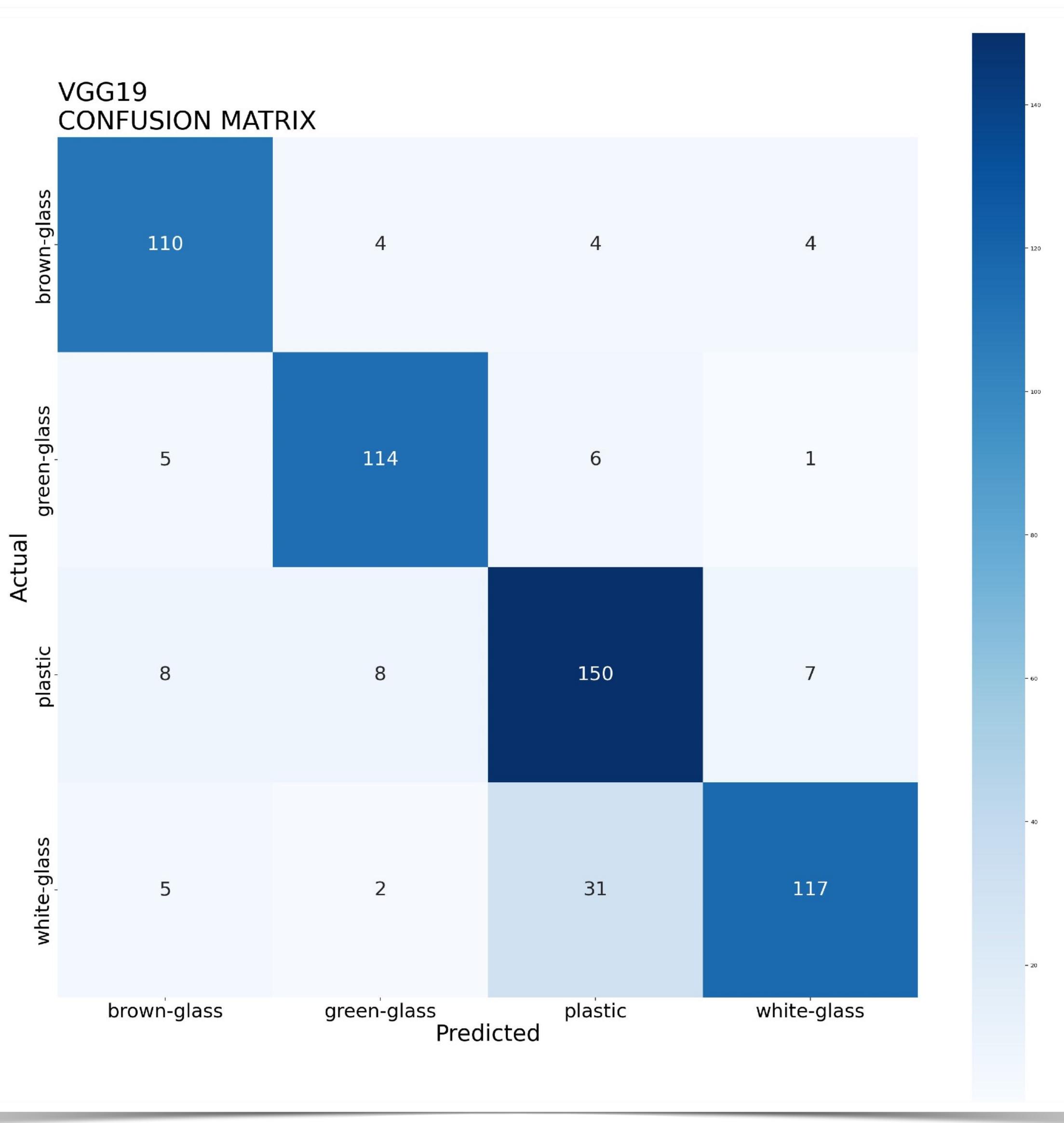
Appendix



- Data link: www.kaggle.com/datasets/mostafaabla/garbage-classification



- **CNN, F1 0.879**



- **VGG19, F1 0.860**