Aalen University

Interpretable Machine Learning: Image Classification and Explanation

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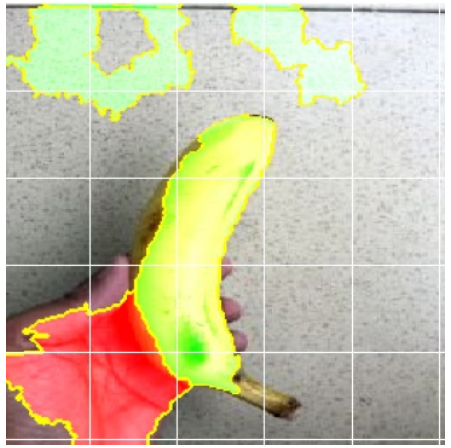
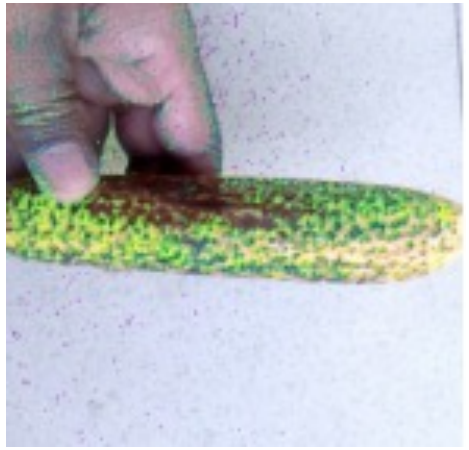




Agenda

Dataset

Methods

Related work

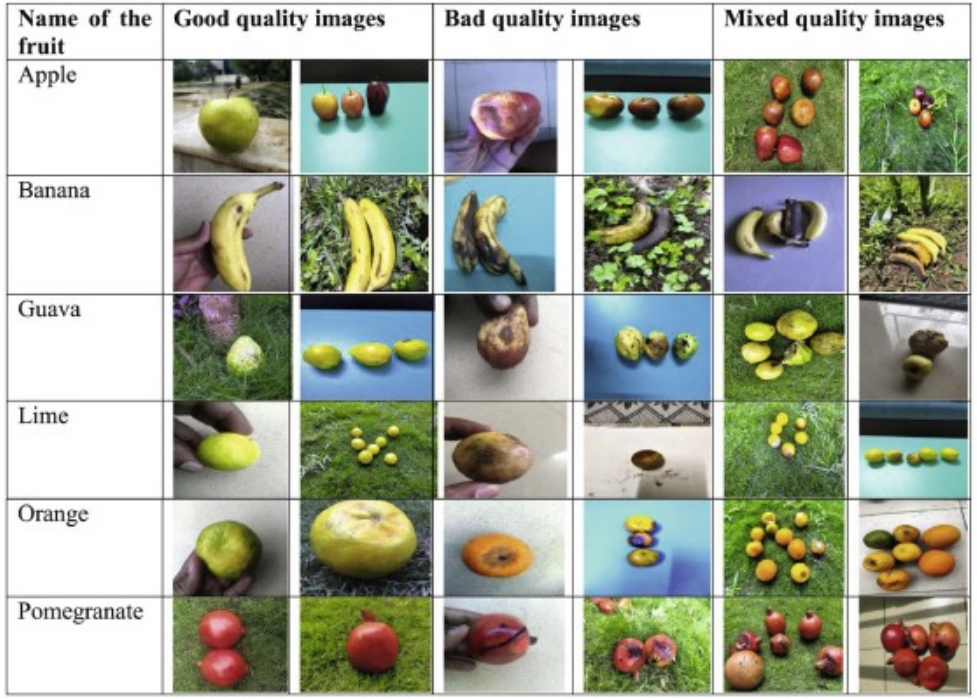
Dataset

FruitNet: Indian fruits images - 6 fruits (bad, good, mixed)

https://www.sciencedirect.com/science/article/pii/S2352340921009616

Project:

- Subset **FruitNet**
- **2 fruit types:** (bad, good)
  - Apple_bad: 1141
  - Apple_good: 1134
  - Banana_bad: 1113
  - Banana_bad: 1087
- **Dimension:** 3024x3024



https://ars.els-cdn.com/content/image/1-s2.0-S2352340921009616-gr1.jpg

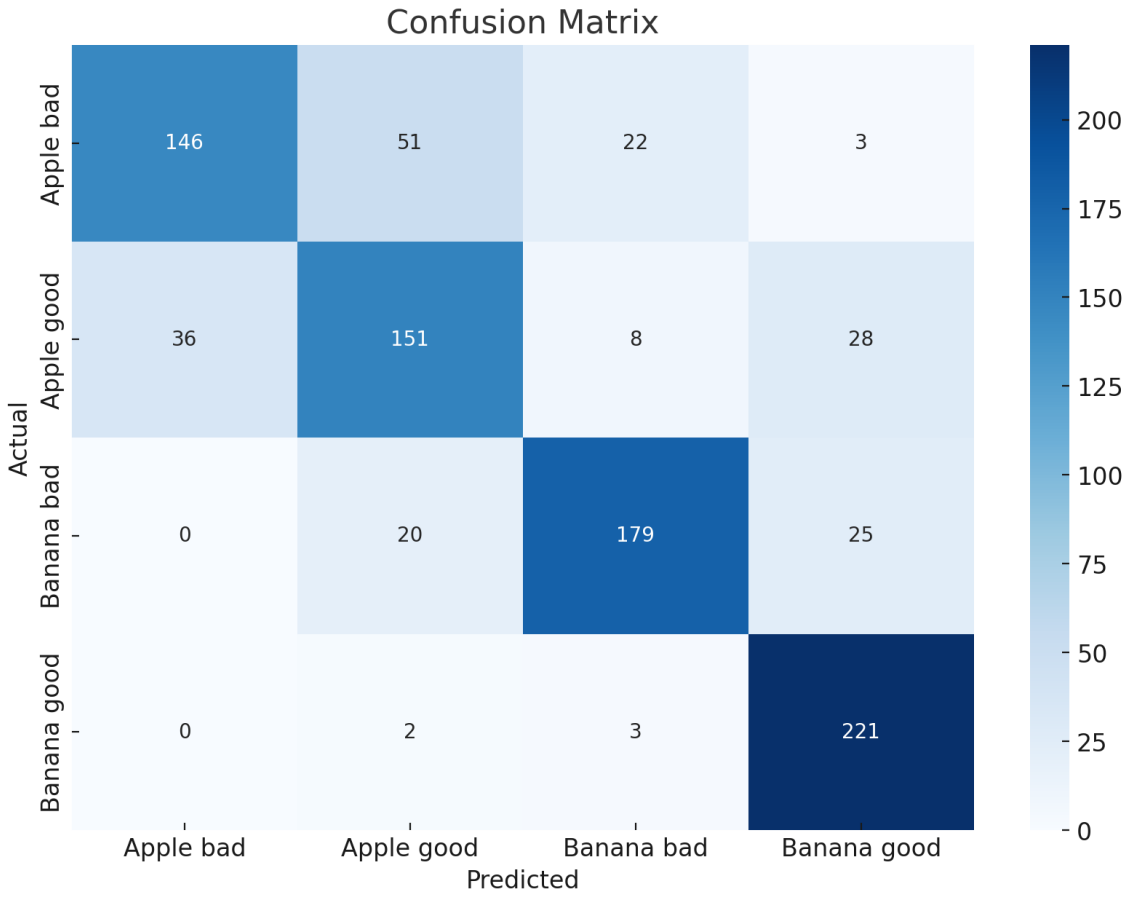
Methods

Data Preprocessing	Machine Learning Method	Validation Procedure
- Observe pictures - Categorize data into four target classes - Data Augmentation	- Train 2D-CNN	- Early stopping - Train / Test / Val split

2D-CNN model architecutre

- Three consecutive Conv2D layers, each with ReLU as activation function followed by a MaxPooling2D layer
- A GlobalAveragePooling2D layer to reduce the feature maps
- A sequence of two Dense layers, each paired with a Dropout layer to reduce overfitting
- A Dense layer with a softmax activation function for classification

Perfomance – Machine Learning Model

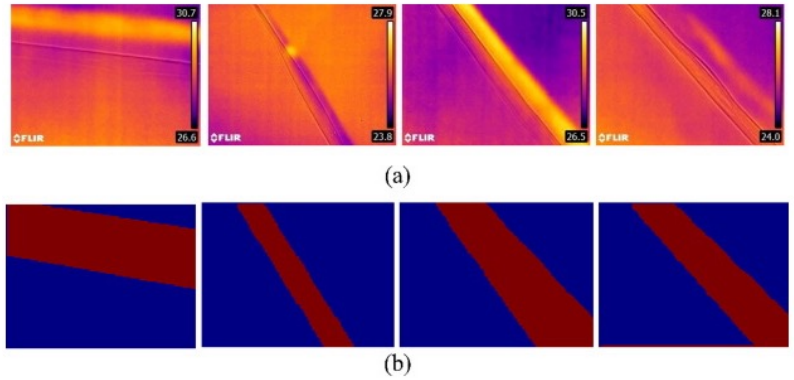


Class	Precision	Recall	F1-Score
Apple bad	80%	66%	70%
Apple good	67%	68%	68%
Banana bad	84%	80%	82%
Banana good	80%	98%	88%

Related work

Deep learning-based plant classification and crop disease classification by thermal camera (Batchuluun et. al.) https://www.sciencedirect.com/science/article/pii/S1319157822004013

- Classification of plants and plant diseases based on thermal images
- Use of a Convolutional Neural Network (CNN) combined with Explainable Artificial Intelligence (XAI).
- Improvement of classification accuracy despite blurred thermal images and demonstration of the usefulness of thermal images at night



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Related work

Understanding How CNNs Recognize Facial Expressions: A Case Study with LIME and CEM (Torres et. al.) https://www.mdpi.com/1424-8220/23/1/131

- Recognition of facial expressions
- Use of Convolutional Neural Networks (CNN)
- Explainable Artificial Intelligence (XAI) for interpreting the results of machine learning models
- Analysis of LIME and CEM as XAI techniques to explain classifications

https://www.mdpi.com/1424-8220/23/1/131

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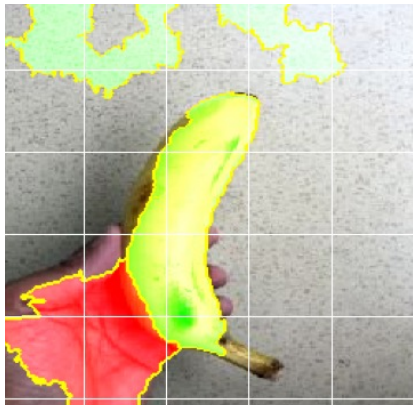
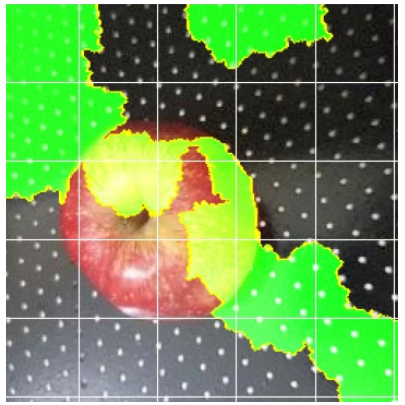
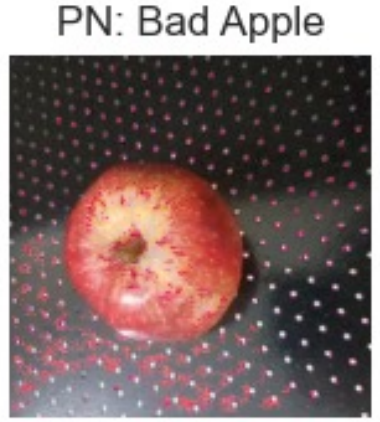
Explainations

Banana good

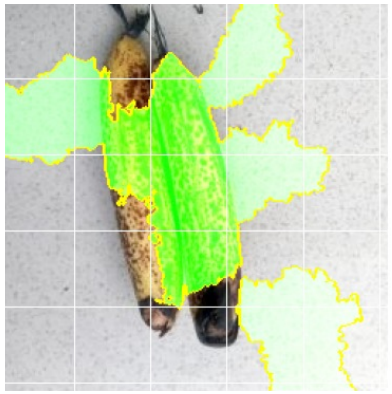


Apple good

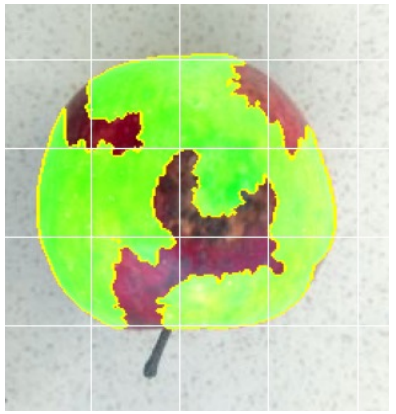




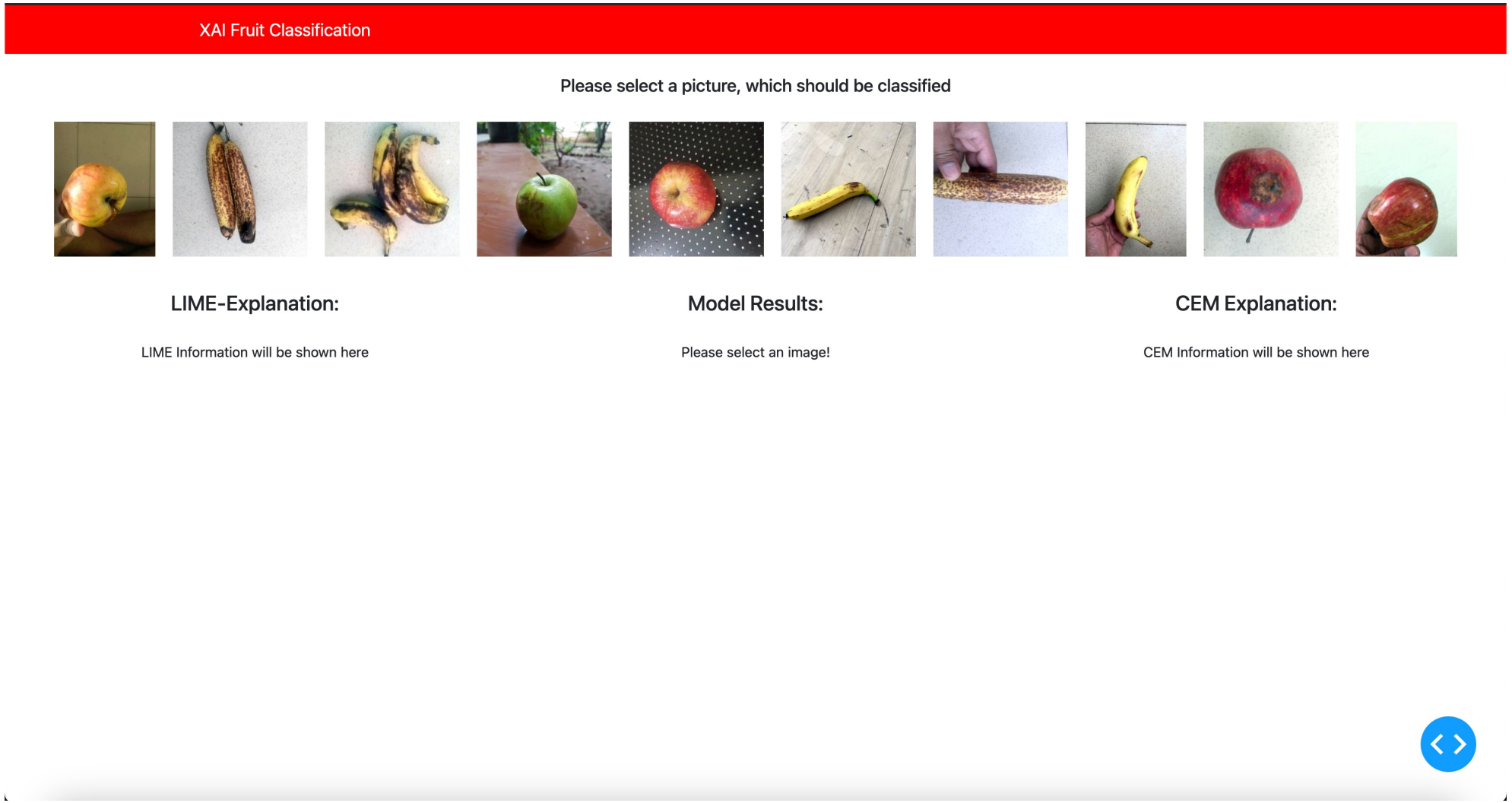
Banana bad



Apple bad



Demo


XAI Fruit Classification
Please select a picture, which should be classified
LIME-Explanation:
LIME Information will be shown here
Model Results:
Please select an image!
CEM Explanation:
CEM Information will be shown here


Thank you for your attention!
AI