SMIT SIKKIM MANIPAL UNIVERSITY
SIKKIM MANIPAL INSTITUTE OF TECHNOLOGY

Artificial Intelligence (CS301A1) Assignment Project

Land Use Classification on EUROSAT dataset

Presented by:
Shinjini Dey(202300268)
Roland Singh(202300279)
Priyajit Chakraborty(202300398)
Diwakar Chettri(202300348)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SIKKIM MANIPAL INSTITUTE OF TECHNOLOGY
(A constituent college of Sikkim Manipal University)
MAJITAR, RANGPO, EAST SIKKIM – 737136

PROBLEM STATEMENT AND OBJECTIVE

- Satellite images are complex and visually similar, making manual land-use classification slow and error-prone.

- Traditional mapping methods lack scalability and accuracy when handling large volumes of satellite data.

- Reliable automated land-use identification is needed for agriculture, urban planning, and environmental related monitoring.
- Develop a deep-learning-based model capable of accurately classifying EuroSAT images into 10 land-use categories.

- Evaluate and interpret the model using accuracy metrics, confusion matrix, and explainable AI (XAI), ensuring transparency and real-world usability.

DATASET

The EuroSAT dataset contains 27,000 labeled satellite images across 10 land cover classes:

- **Annual Crop** - Agricultural fields with seasonal crops
- **Forest** - Dense wooded areas
- **Herbaceous Vegetation** - Grasslands and meadows
- **Highway** - Major roads and highways
- **Industrial** - Factories and industrial zones
- **Pasture** - Grazing lands for animals
- **Permanent Crop** - Orchards and vineyards
- **Residential** - Housing areas and neighborhoods
- **River** - Water bodies and streams
- **SeaLake** - Oceans, seas, and large lakes

DATASET

Total Images: 27,000

Training Samples: 21,600 (80%)

Validation Samples: 5,400 (20%)

Image Size: 64×64 pixels (resized to 224×224 for training) with a Ground Sampling distance of 10m.

Balanced Distribution: Equal samples per class

RESULTS

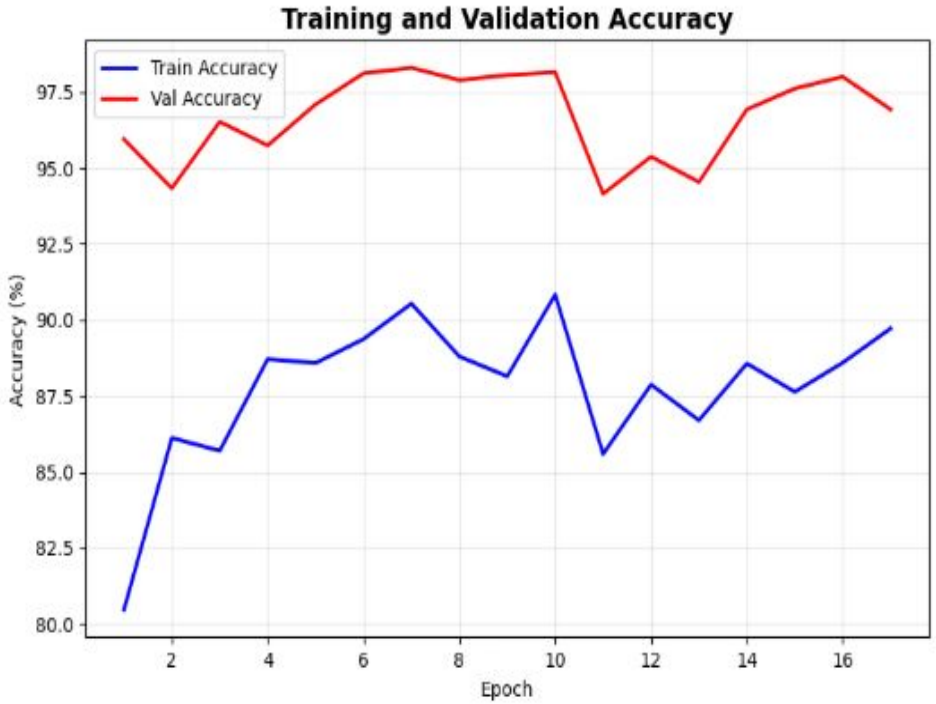


Fig 1. Training report: (i) Final Training Accuracy: 89.72% (ii) Final Validation Accuracy: 96.93%

(iii) Best Validation Accuracy: 98.30% (iv) Final Training Loss: 0.7155 (v) Final Validation Loss: 0.5730

RESULTS

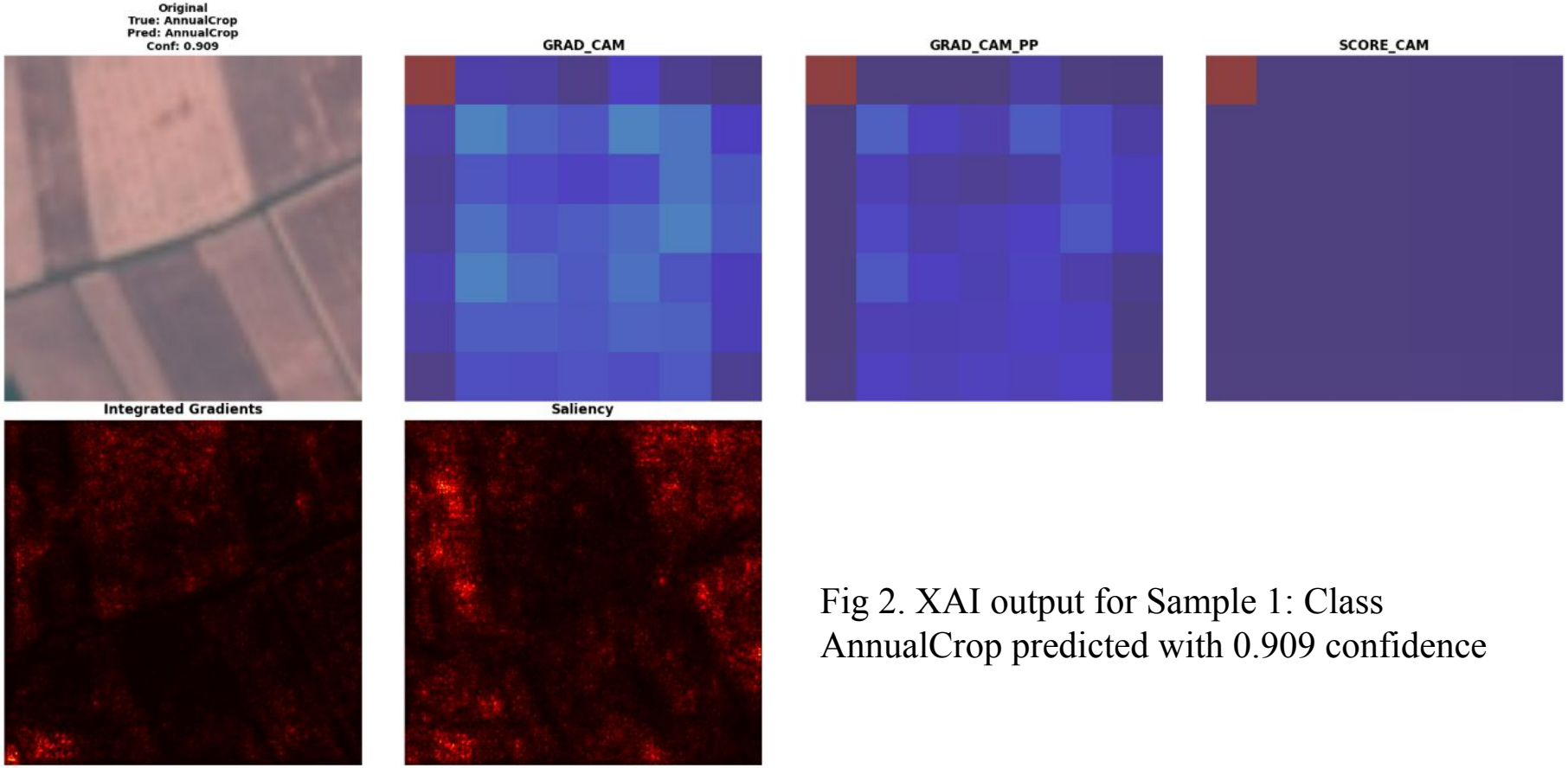


Fig 2. XAI output for Sample 1: Class AnnualCrop predicted with 0.909 confidence

RESULTS

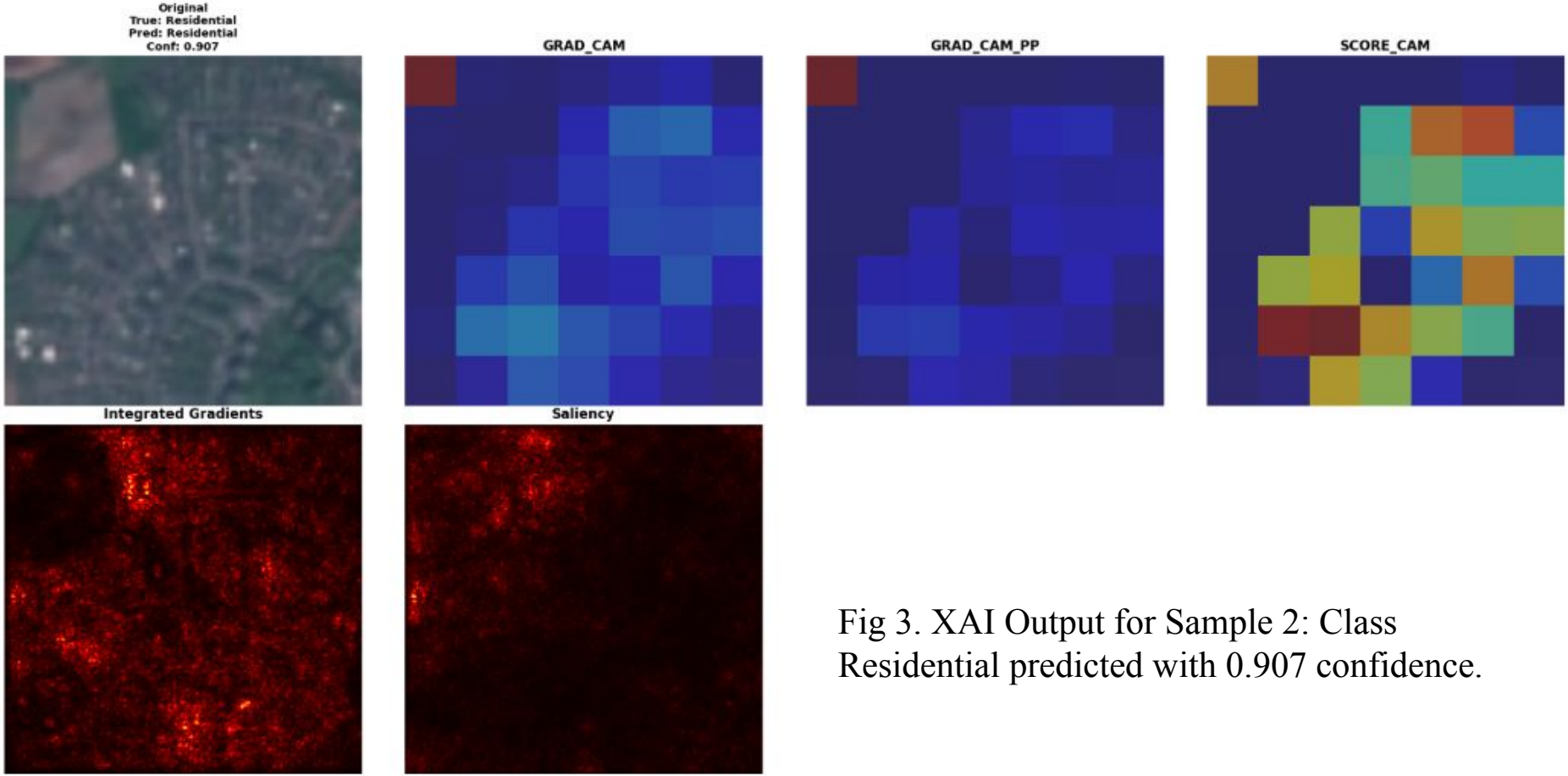


Fig 3. XAI Output for Sample 2: Class Residential predicted with 0.907 confidence.

RESULTS

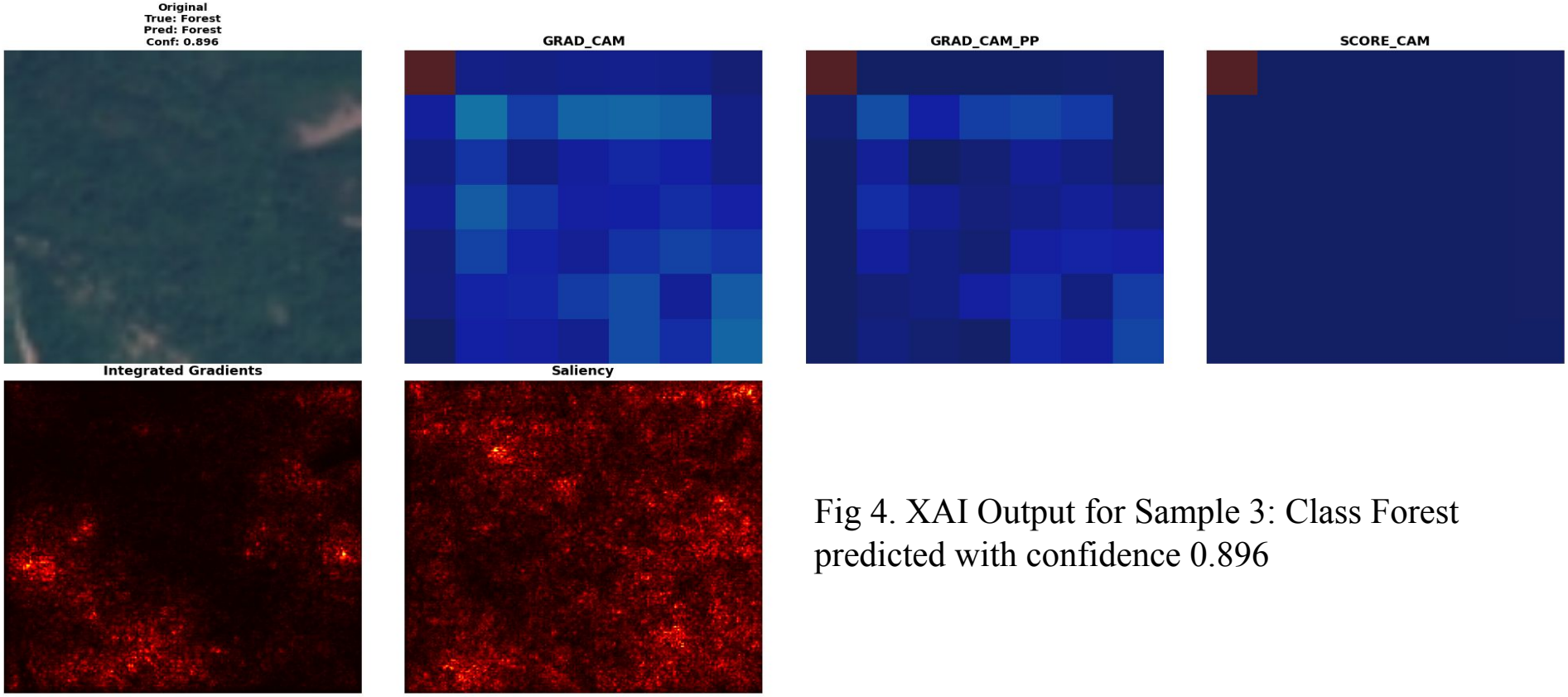
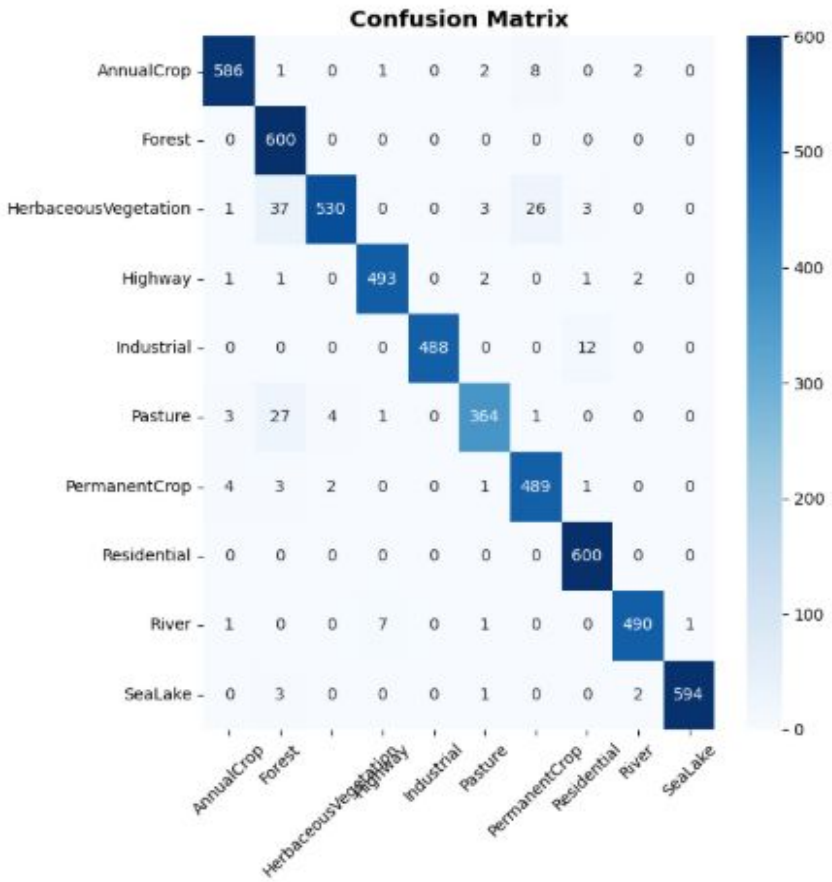


Fig 4. XAI Output for Sample 3: Class Forest predicted with confidence 0.896

RESULTS



FINAL PROJECT REPORT

Best Validation Accuracy: 98.30%
Final Validation Accuracy: 96.93%
Training Epochs: 17
Test Accuracy: 0.9693
Macro F1-Score: 0.9688
Calibration ECE: 0.0940
Model Architecture: Ensemble
Batch Size: 64

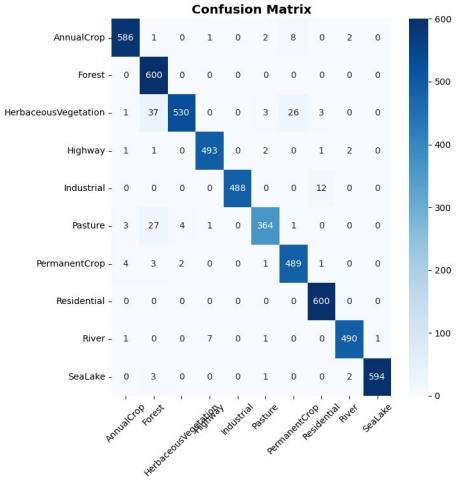
TOP 3 PERFORMING CLASSES:

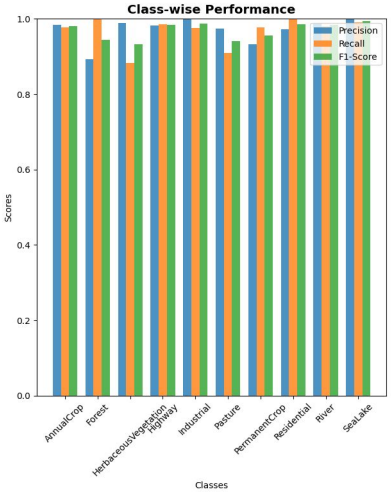
SeaLake	F1: 0.994
Industrial	F1: 0.988
Residential	F1: 0.986

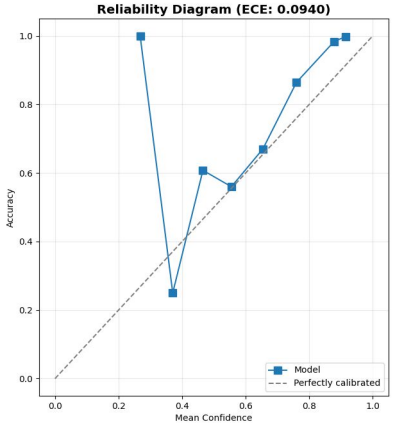
BOTTOM 3 PERFORMING CLASSES:

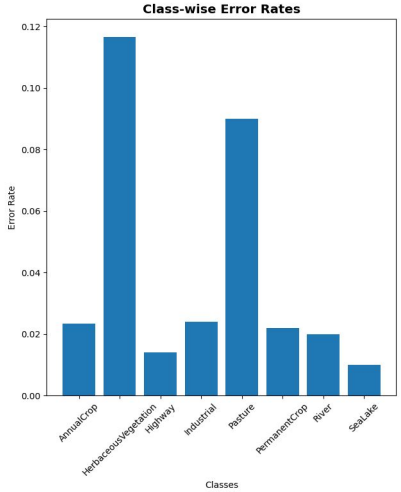
HerbaceousVegetation	F1: 0.933
Pasture	F1: 0.941
Forest	F1: 0.943

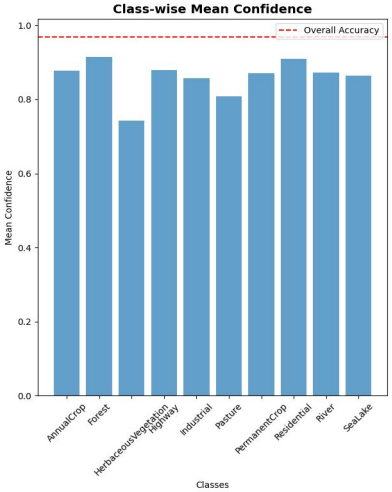
CONCLUSION

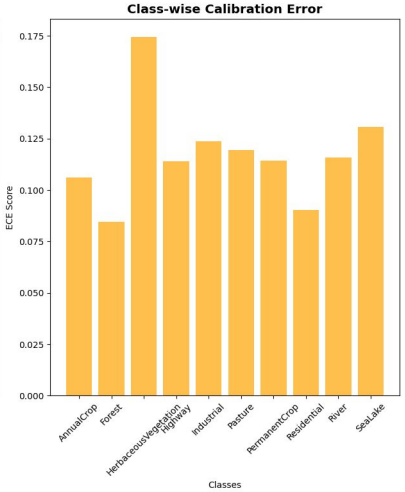












- A deep learning model was successfully trained on the EuroSAT dataset to classify 10 different land-use categories.
- Preprocessing, augmentation, and transfer learning significantly improved accuracy.
- Model results show strong capability for satellite image understanding.
- This study highlights the potential of AI in environment monitoring, agriculture, and urban planning.