

Soil Moisture Detection

CS725 : Foundations of Machine Learning

Guide: Prof. Preethi Jyothi

Team MoistureMatrix

Presenters

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Outline

- Team Contribution
- Introduction
- Dataset
- Techniques used
- Results
- Conclusion
- References

Team Contribution

□ **Hasmita Kurre**

Dataset Preparation and CNN implementation on the dataset.

□ **Rohit Kumar**

AlexNet implementation on the dataset.

□ **Chaitanya Shinge**

ResNet50 implementation on the dataset.

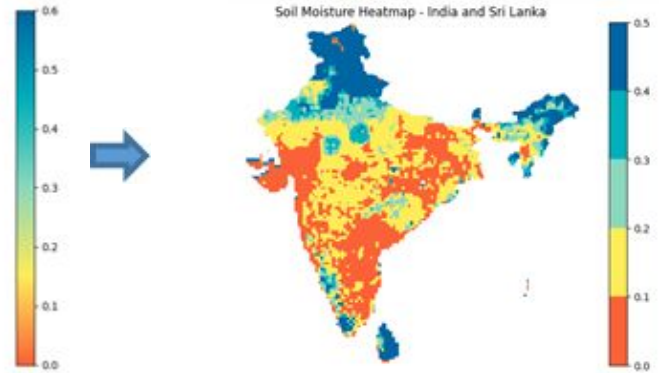
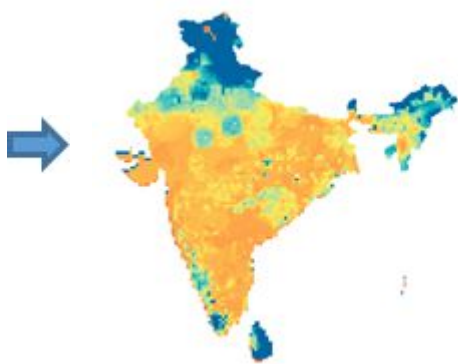
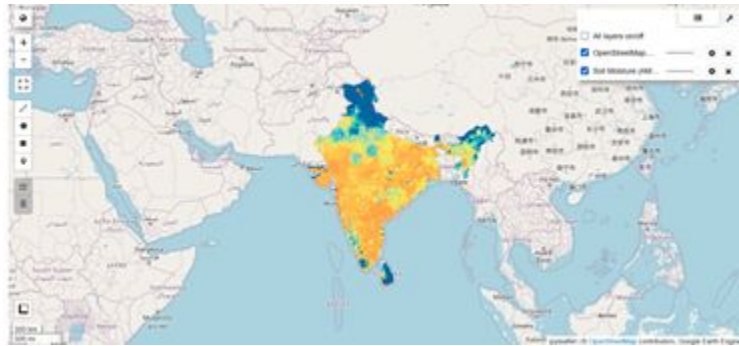
□ **Chanakya Vihar Challa**

MobileNetV2 implementation on the dataset.

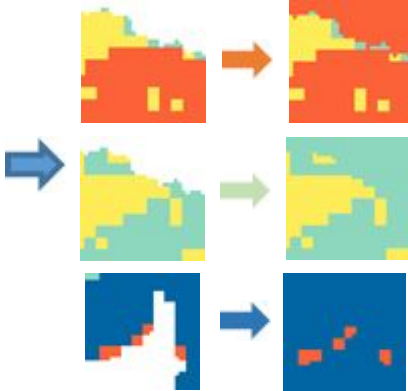
Introduction

- ❑ This project aims to develop a system for soil moisture detection to accurately predict soil moisture levels.
- ❑ We had used **NASA-USDA**, SMAP soil moisture profile satellite data from 2015 to 2020 and processed india region.
- ❑ We performed data preprocessing and sampling techniques to fine tune the data.
- ❑ For this project we had explored ML algorithms for Image Classification like CNN, ResNet, AlexNet and MobileNet to detect the moisture and compared these algorithms by calculating their accuracy and f1-score.

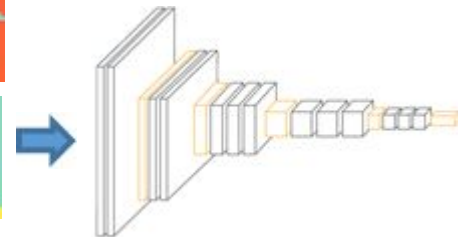
Dataset



Soil Moisture Dataset



Preprocessing



C1: Dry

C2: Moderate moisture

C3: Highest moisture

Dataset Description

- NASA-USDA SMAP soil moisture profile satellite data from 2015 - 2020
- Patch Dimensions: 396 x 396
- Training split: 70%
- Validation split: 20%

Moisture Class	#Patches
Dry	5001
Moderate_Moisture	5001
Highest_Moisture	5000

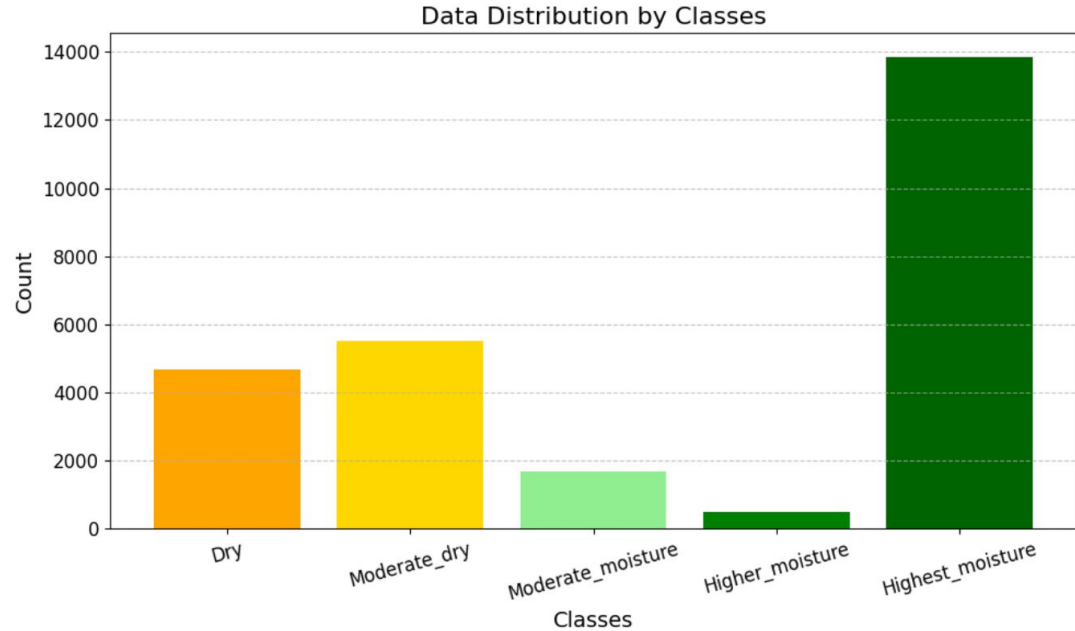


Fig: Class Distribution

Techniques Used

- Keras implementations of
 - Layers like 2D Convolution, 2D Max Pooling, Dense
 - Models like CNN, AlexNet, MobileNetV2, ResNet50
 - Optimizers like Adam, SGD
 - Loss functions like Sparse Categorical Cross Entropy
- Common Hyperparameters across Models
 - Loss functions Image Size: 96 x 96 x 3
 - Epochs: 200 (but also using **Early Stopping**)
 - Training Batch Size: 32
- Calculated Accuracy, F1-score, Recall and Precision using scikit-learn

Results

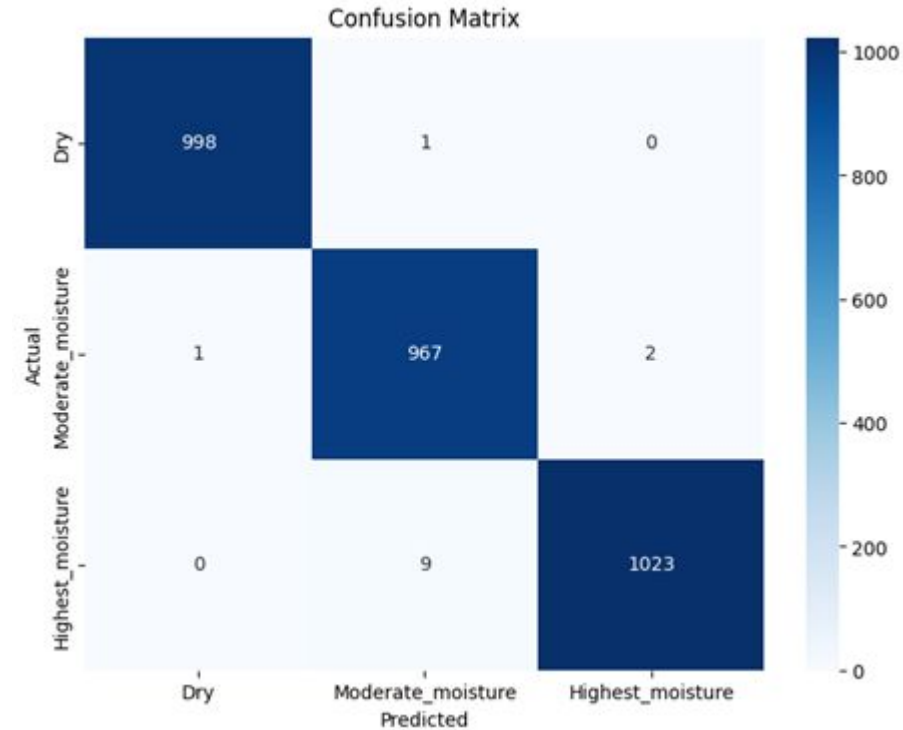


Fig: Confusion Matrix

Classification Report:

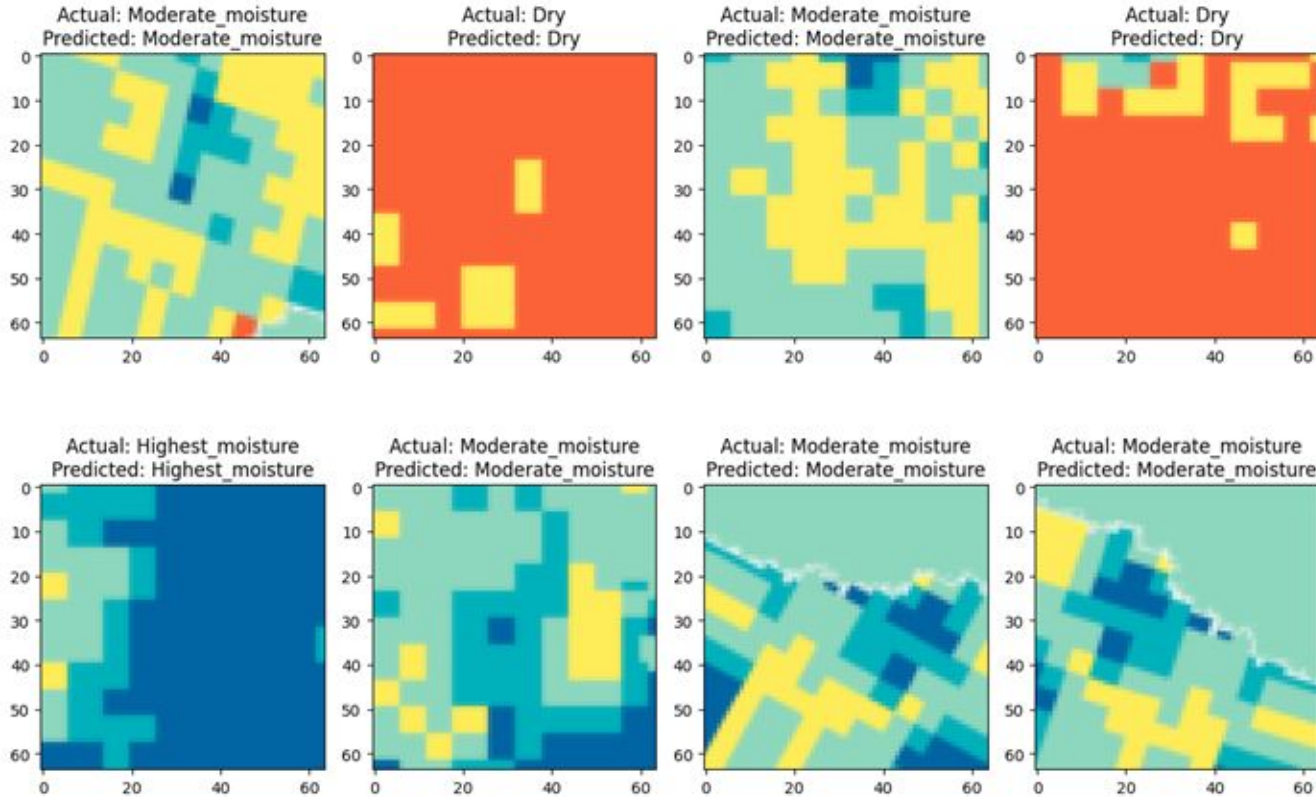
	precision	recall	f1-score	support
Dry	1.00	1.00	1.00	999
Moderate_moisture	0.99	1.00	0.99	970
Highest_moisture	1.00	0.99	0.99	1032
accuracy			1.00	3001
macro avg	1.00	1.00	1.00	3001
weighted avg	1.00	1.00	1.00	3001

Fig: Classification Report

Observation :

- ☐ All classes are classified perfectly.
- ☐ Performance is consistent across each class.

Result



Observation :

- Model performs very well in classifying images without notable errors.
- Minimal misclassifications and good predictions.

Conclusion

- Our main aim is soil moisture detection to accurately predict soil moisture levels using various machine learning algorithms and compare their accuracy to find the best algorithm for the soil moisture detection.

Models	Test Accuracy
CNN	99.57%
ResNet50	99.66%
MobileNetV2	98.71%
AlexNet	97.42%

References

□ GitHub Code:

https://github.com/HasmitaKurre/CS725_FML/tree/main/FML_Project

□ Soil Moisture Dataset:

<https://www.kaggle.com/datasets/hasmitakurre/nasa-soil-moisture-india-dataset>

THANK YOU