Satellite Image Classification.

Salford & Co.

Team Members

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Slides Content

- Introduction.
- Week1.
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Introduction

he project idea is to make a high-resolution classification of four categories of images taken by satellites. These images are green areas, desert, water and cloudy. This helps in making decisions in various fields, including:

1.*Environmental Monitoring:* Tracks changes such as desertification, deforestation, and climate patterns.

2. *Agriculture Management:* Monitors crop health, estimates production, and assists in water resource management.

3. *Urban Planning:* Assesses urban expansion and infrastructure development.

4. *Natural Resources:* Aids in locating resources and monitoring mining activities.

5. *Disaster Management:* Evaluates damage from natural disasters and supports emergency response.

6. *Marine Surveying:* Monitors sea level changes and coastal conditions.

7. *Security and Defense:* Used for military surveillance and border monitoring.

8. *Biodiversity Conservation:* Monitors habitats and assesses the impact of human activities on wildlife.

Week 1

1-Data Collection:

Collecting The Data Set From Kaggle.

2-Data Preprocessing:

- Data resize
- Data Normalization
- Label encoding
- One Hot encoding
- Data Augmentation

Week 1

Data Preprocessing

Create an Empty DataFrame

Define Images and Classes

Initialize a List for Data Storage

Loop Through Each Label Directory

Convert the List to a DataFrame

resize images 28*28

convert images into array

Week 1

Data Preprocessing

normalizing the pixels

Label Encoding

One-Hot Encoding

Validation Split & Test Split

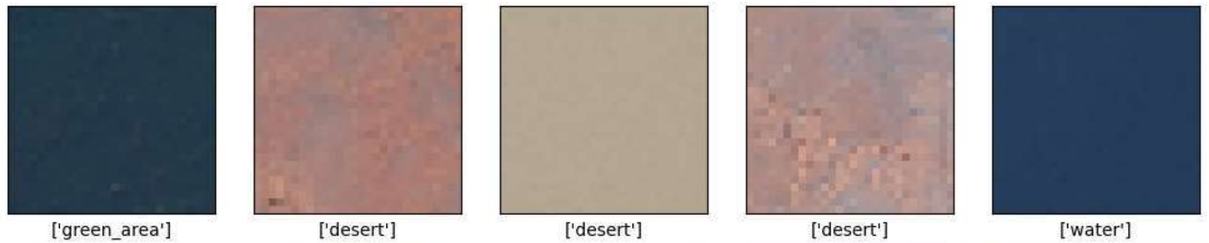
data augmentation

display data to ensure that all this ok after spliting

week 1

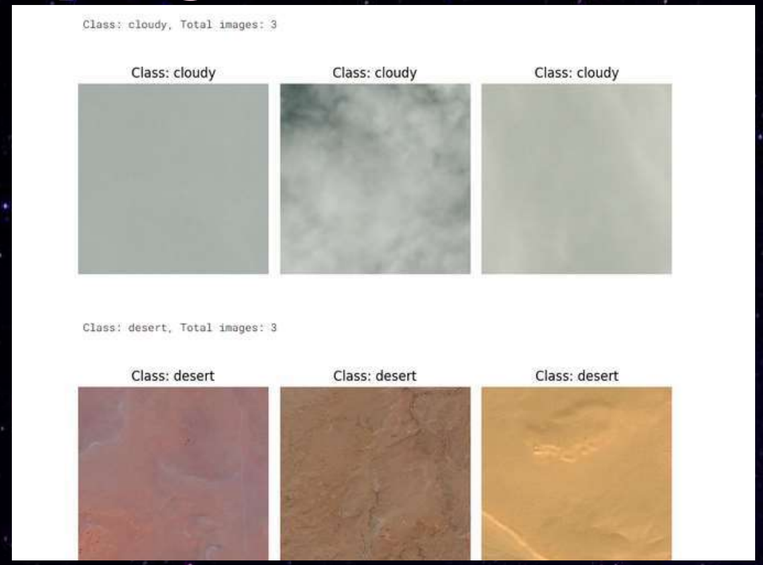
display data to ensure that all this ok after spliting

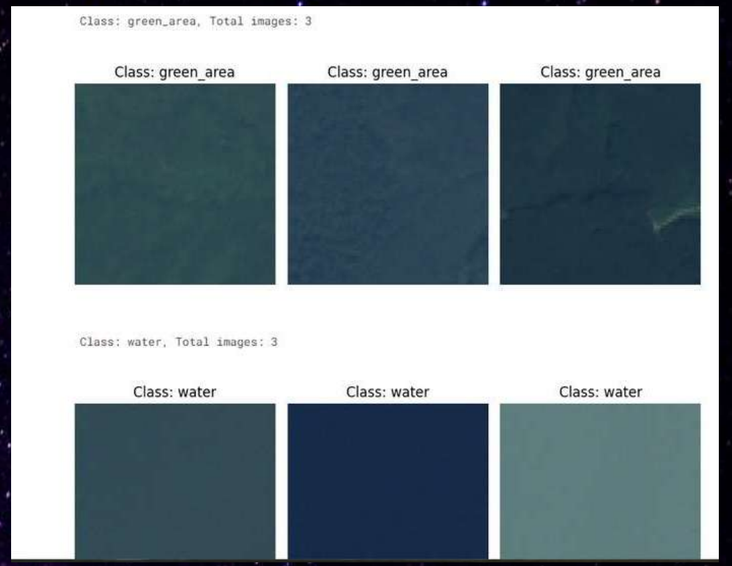
```
Classes found by label encoder: ['cloudy' 'desert' 'green_area' 'water']
X_train shape: (4504, 28, 28, 3), X_val shape: (1127, 28, 28, 3), y_train shape: (4504, 4), y_val shape: (1127, 4)
```

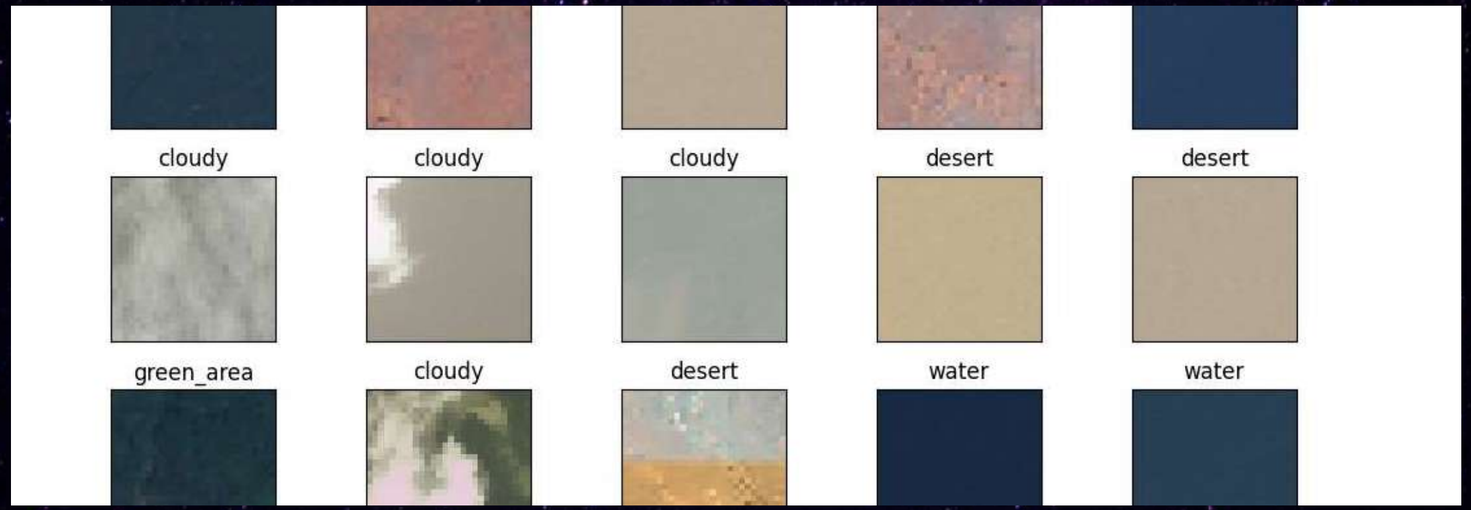


week 1

display data to ensure that all this ok after spliting

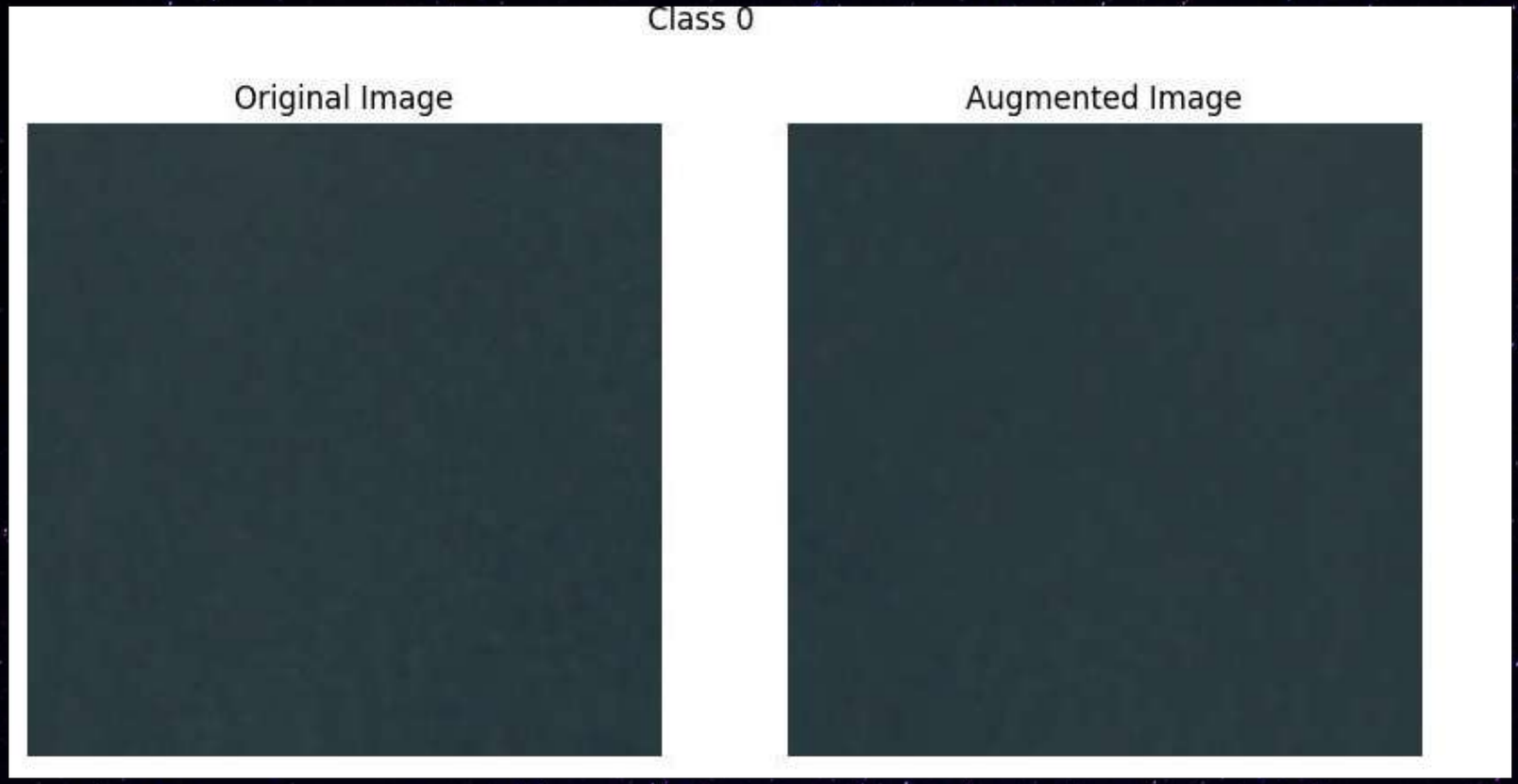






week 1

Augmentation



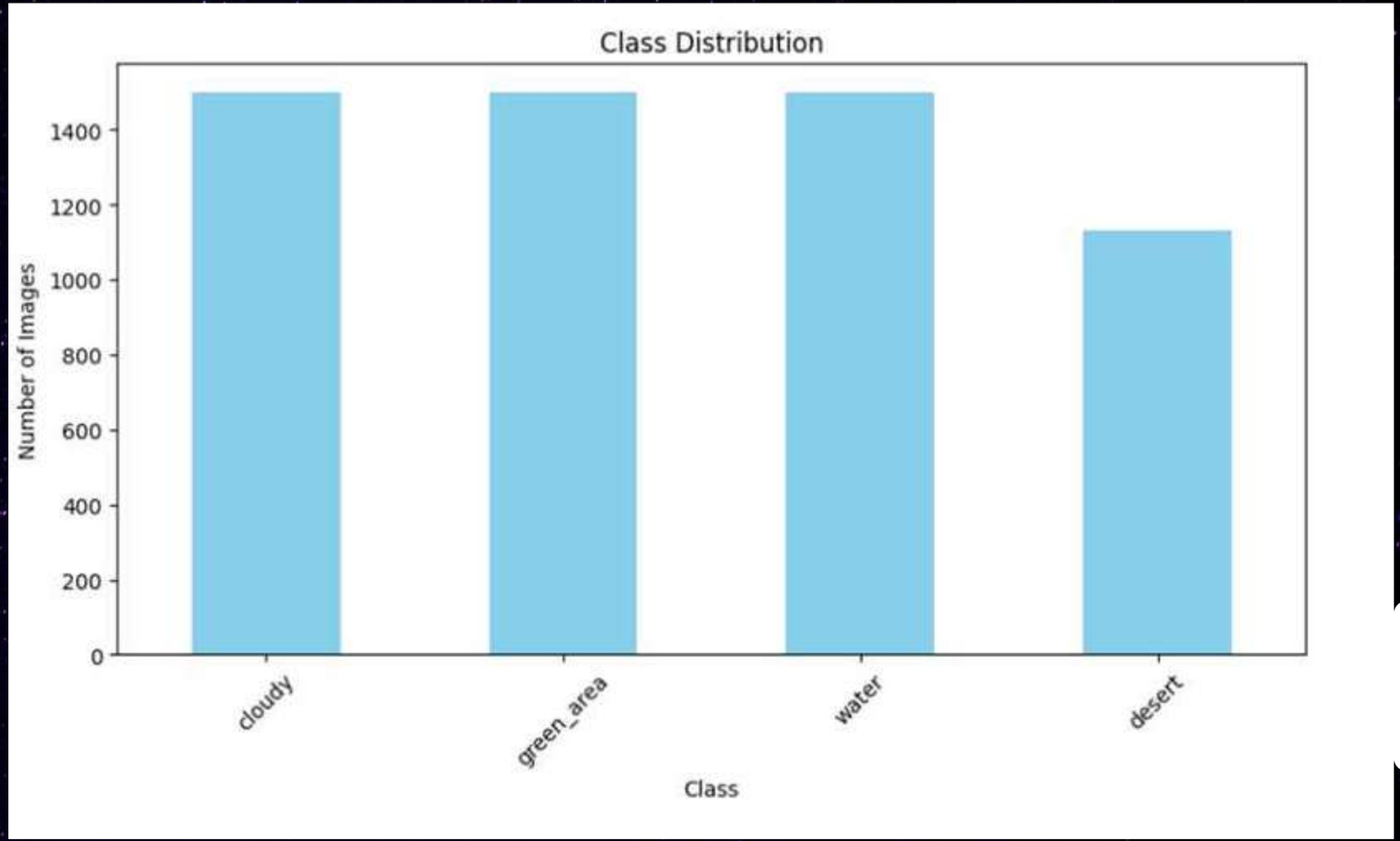
week 2

Data Science and Machine Learning

Week 2

Exploratory Data Analysis”EDA”

Highest number of images: **cloudy** and **green_area** .

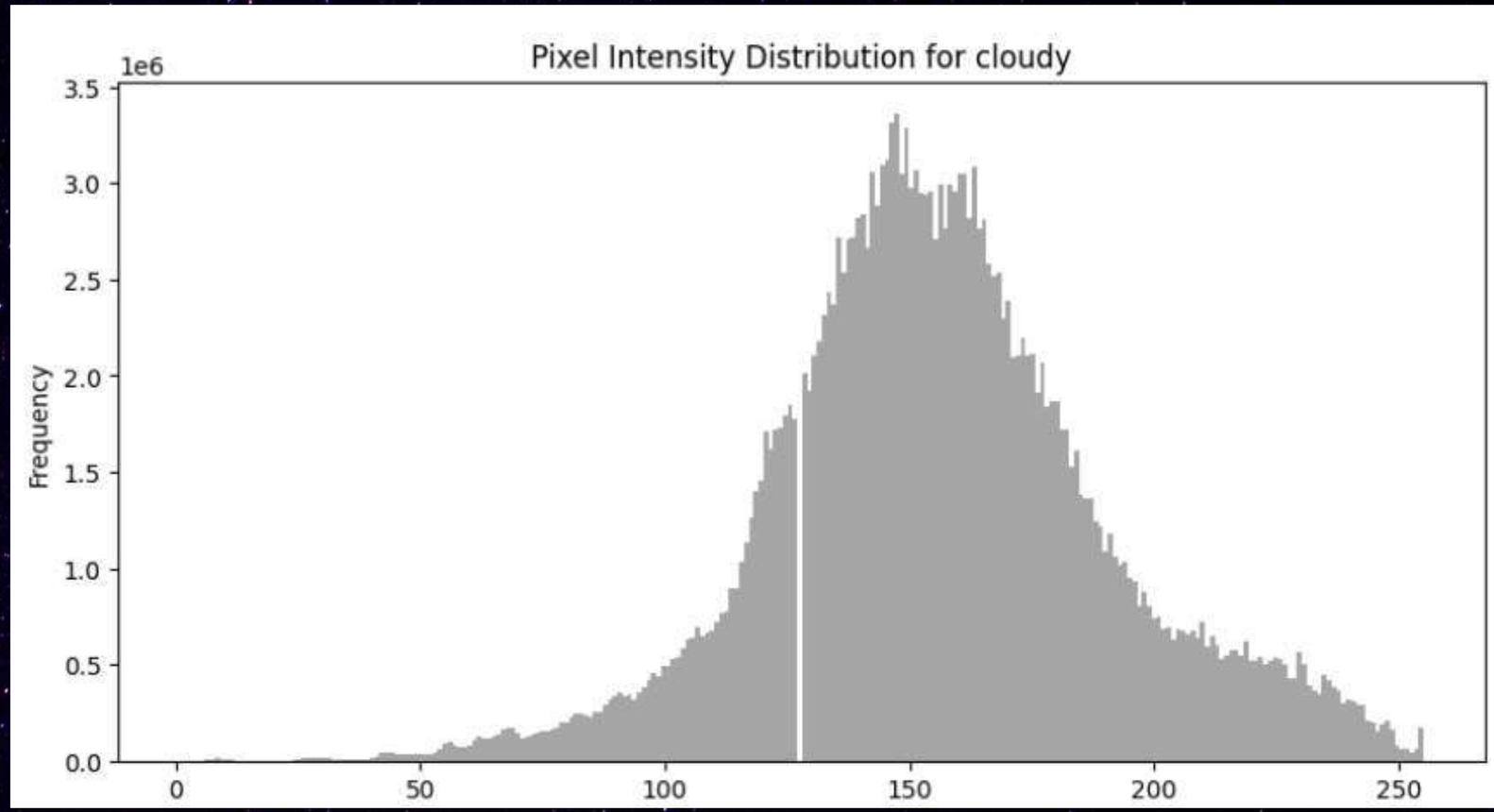


Exploratory Data Analysis”EDA”

Symmetrical Distribution

The **Cloudy** class has a **balanced** range of pixel intensities.

Peak at Mid-range Pixel Values

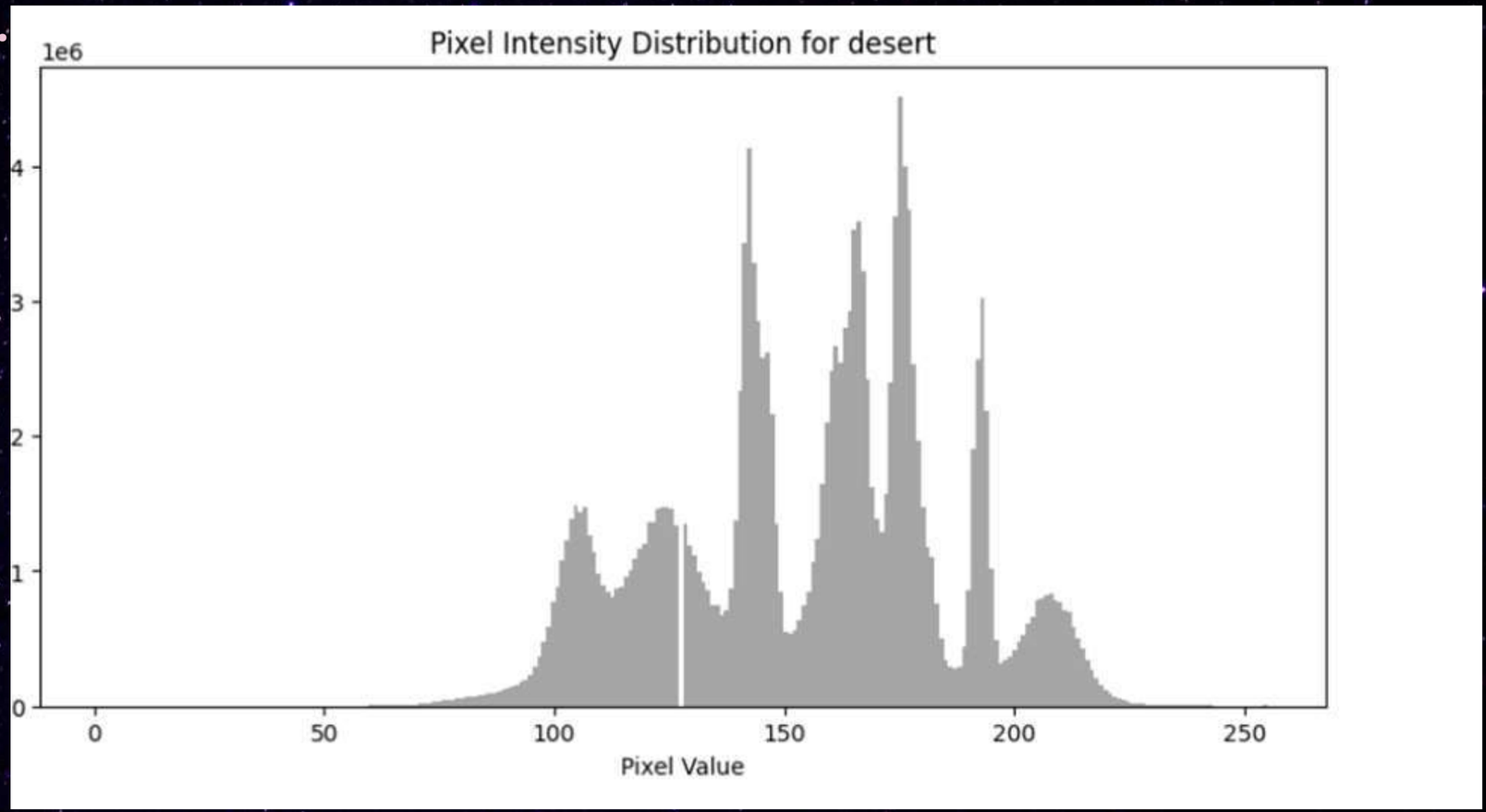


Exploratory Data Analysis”EDA”

Multimodal Distribution.

The **Desert** class covers a **wider range** of pixel intensities.

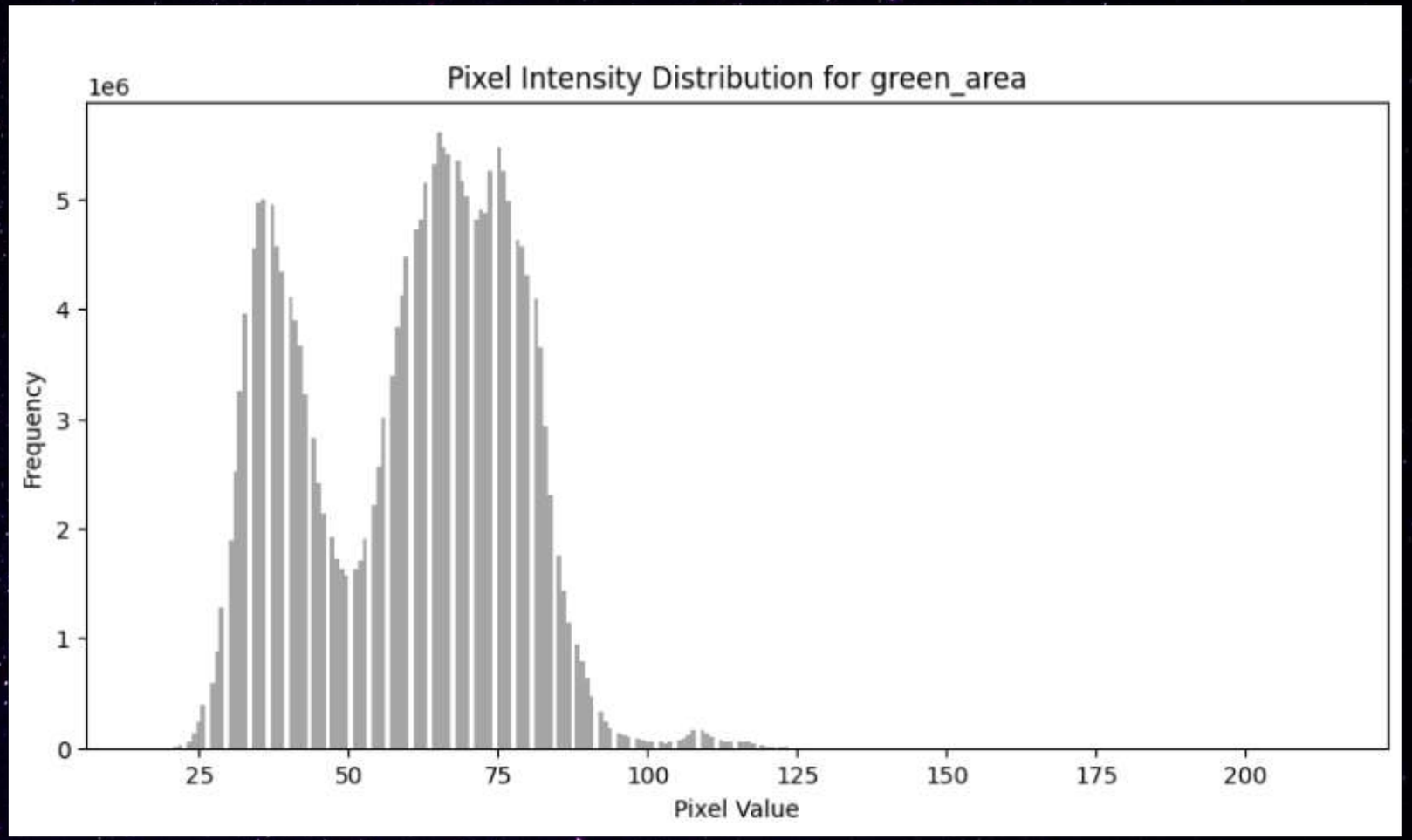
Peaks at Various Intensities.



Exploratory Data Analysis”EDA”

Bimodal Distribution

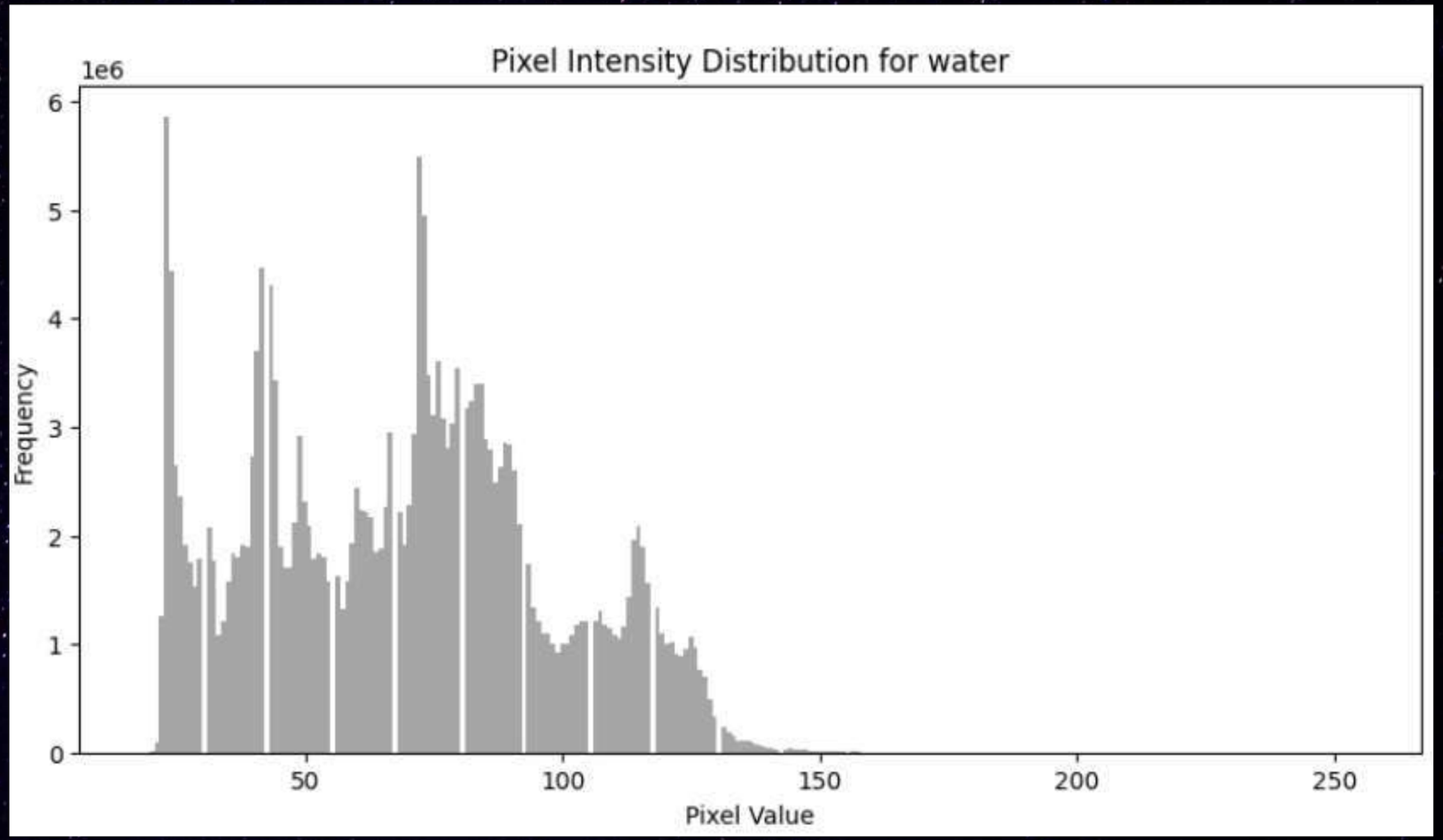
Absence of
High Intensity Values



Exploratory Data Analysis”EDA”

LEFT-SKEWED

skewed heavily toward the lower pixel values



The Model

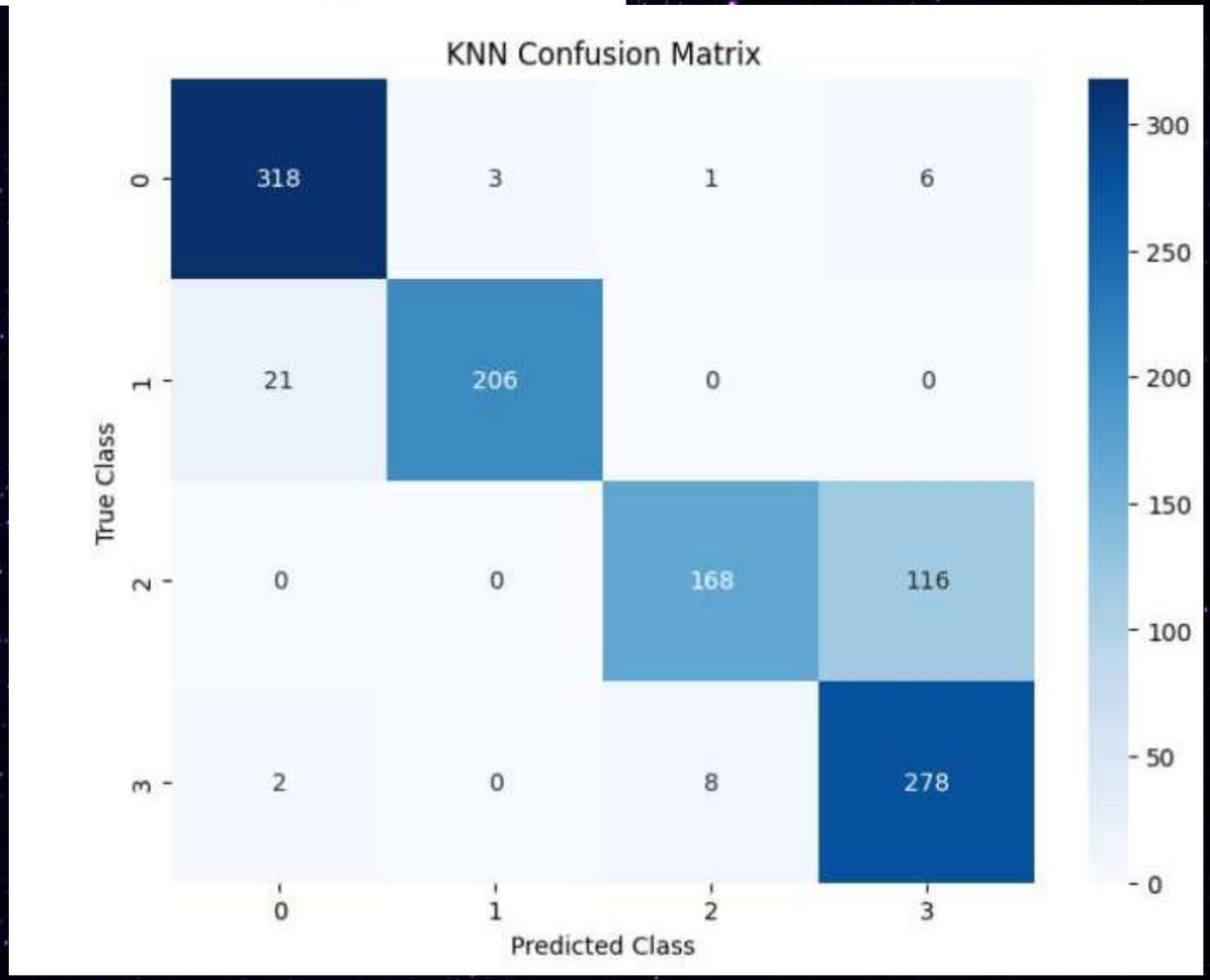
Traning -Test split.

Model Building

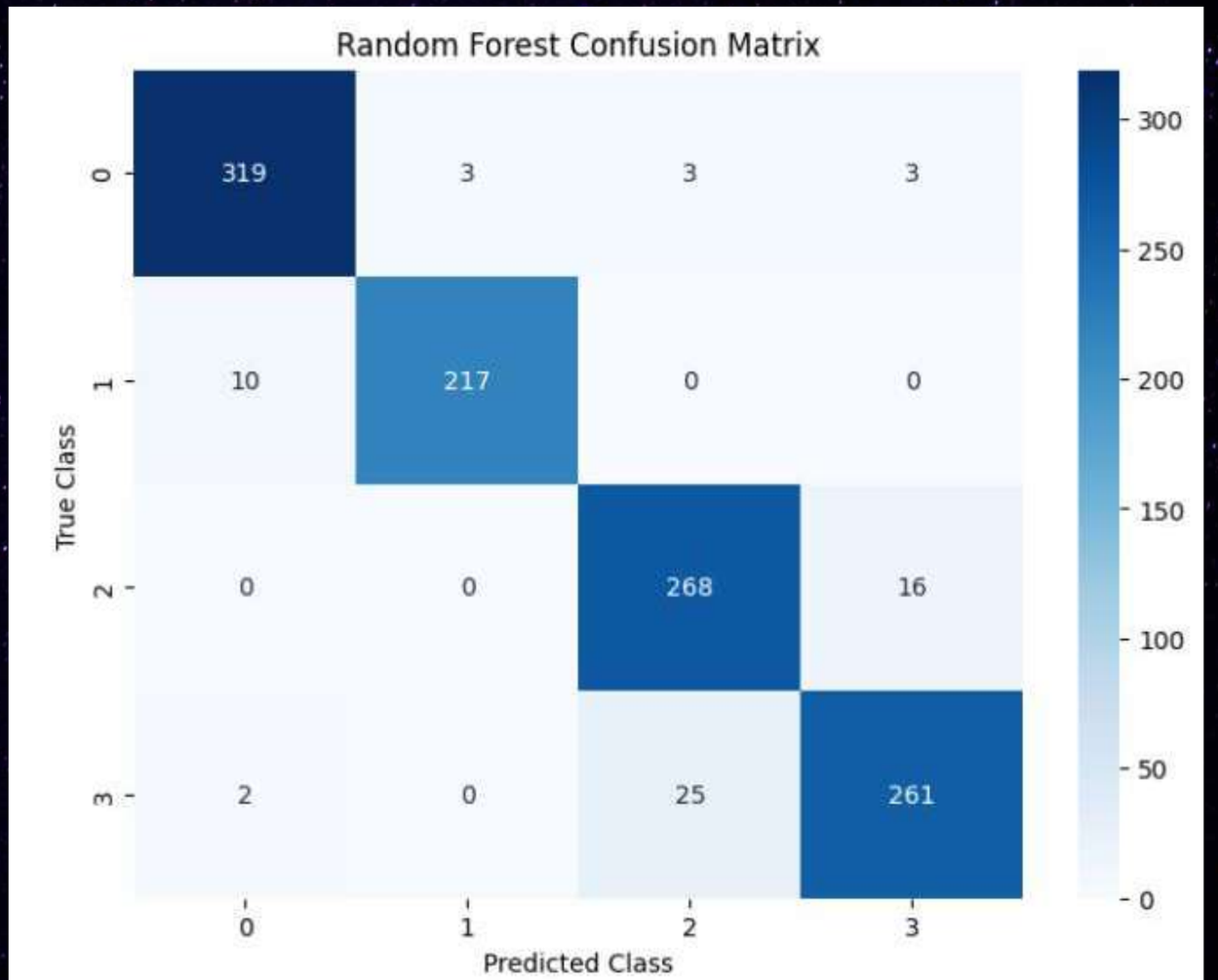
Traning The Model

COMPARE ALGORITHMS

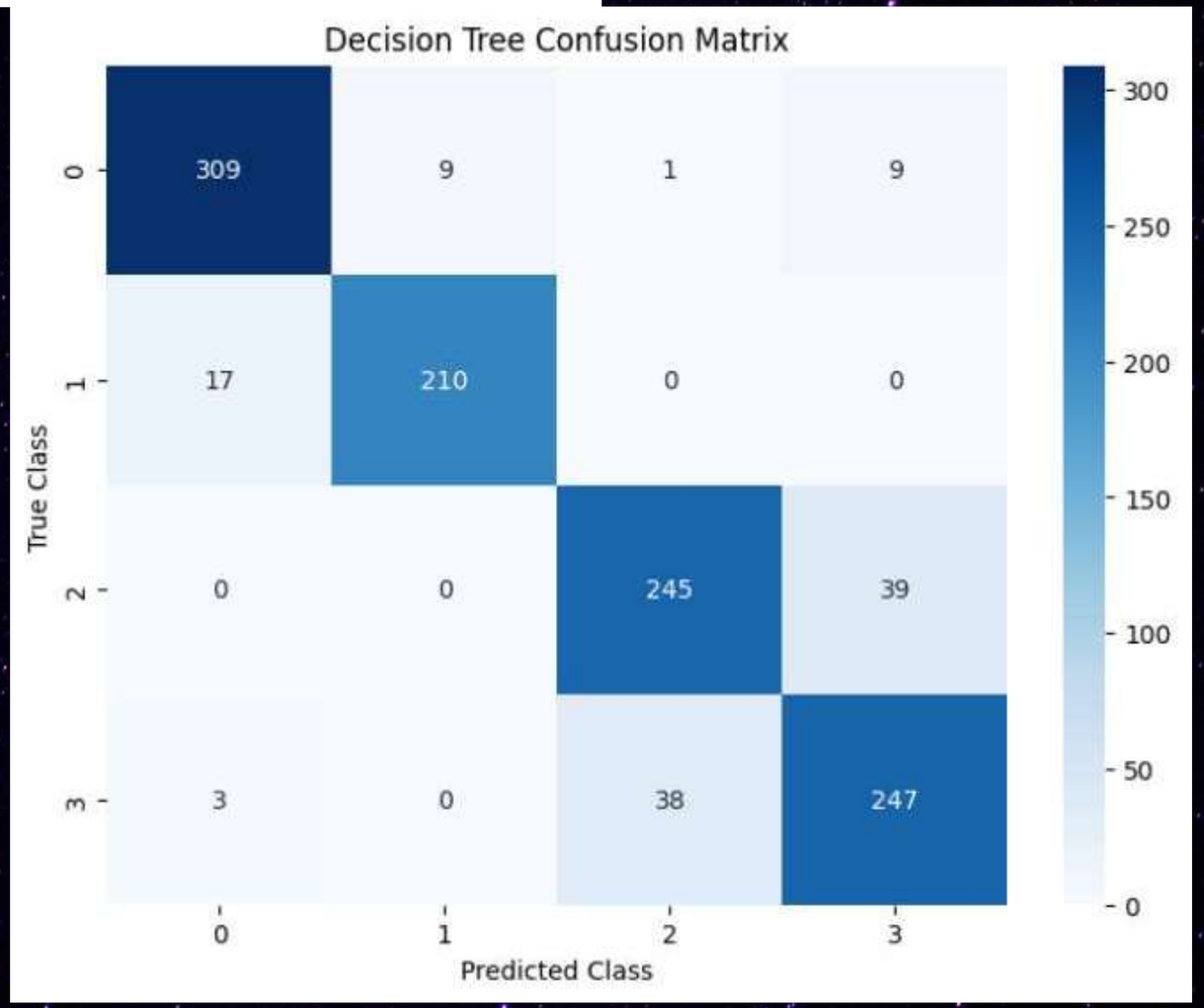
```
KNN Training Time       : 0.01 seconds
KNN Accuracy            : 0.8606921029281278
Precision               : 0.8867238524159108
Recall                  : 0.8606921029281278
F1 Score                : 0.8571986631880876
```



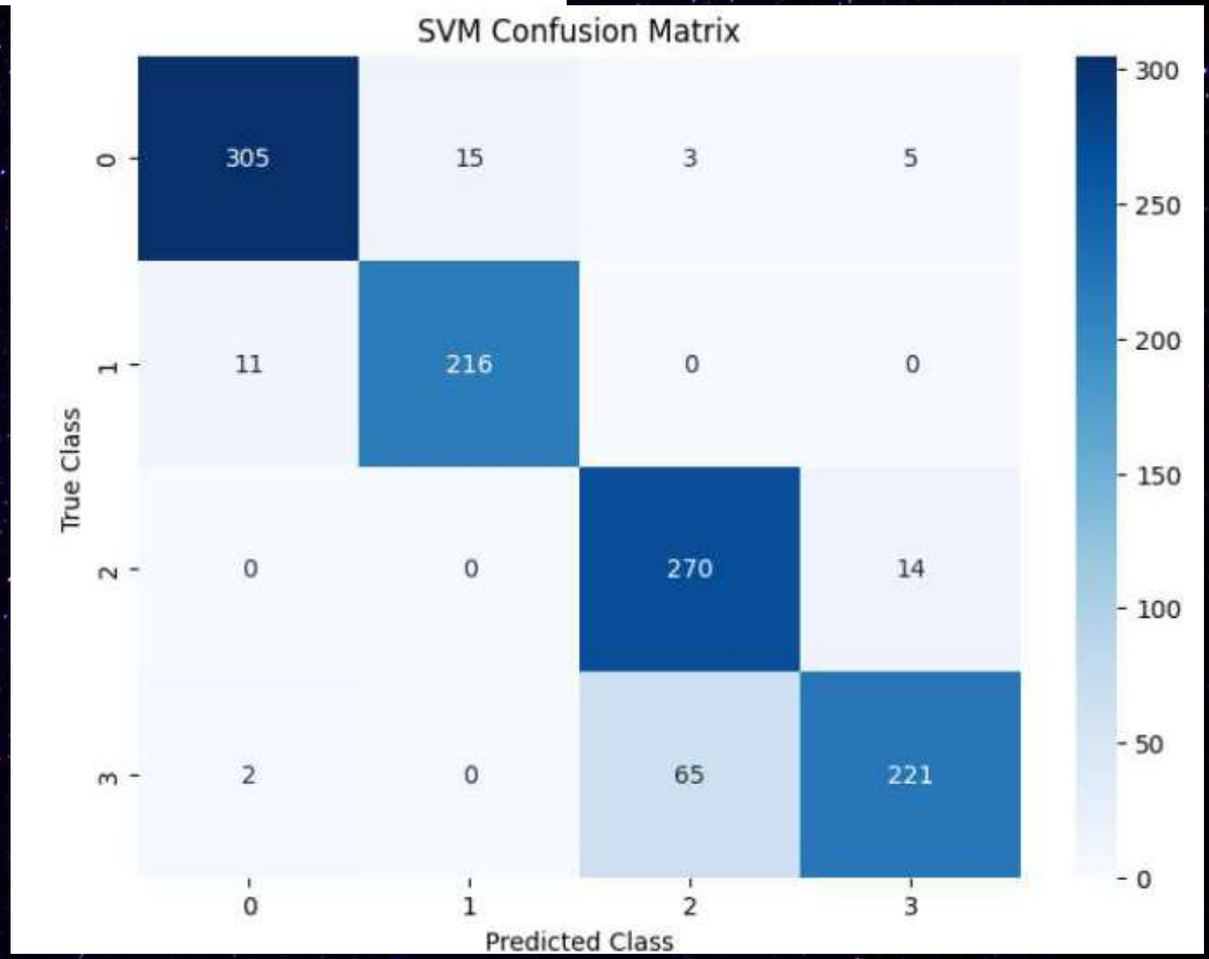
```
Random Forest Training Time: 7.97 seconds
Random Forest Accuracy    : 0.9449866903283053
Precision                 : 0.9455240326318799
Recall                    : 0.9449866903283053
F1 Score                  : 0.945055225145660l
```



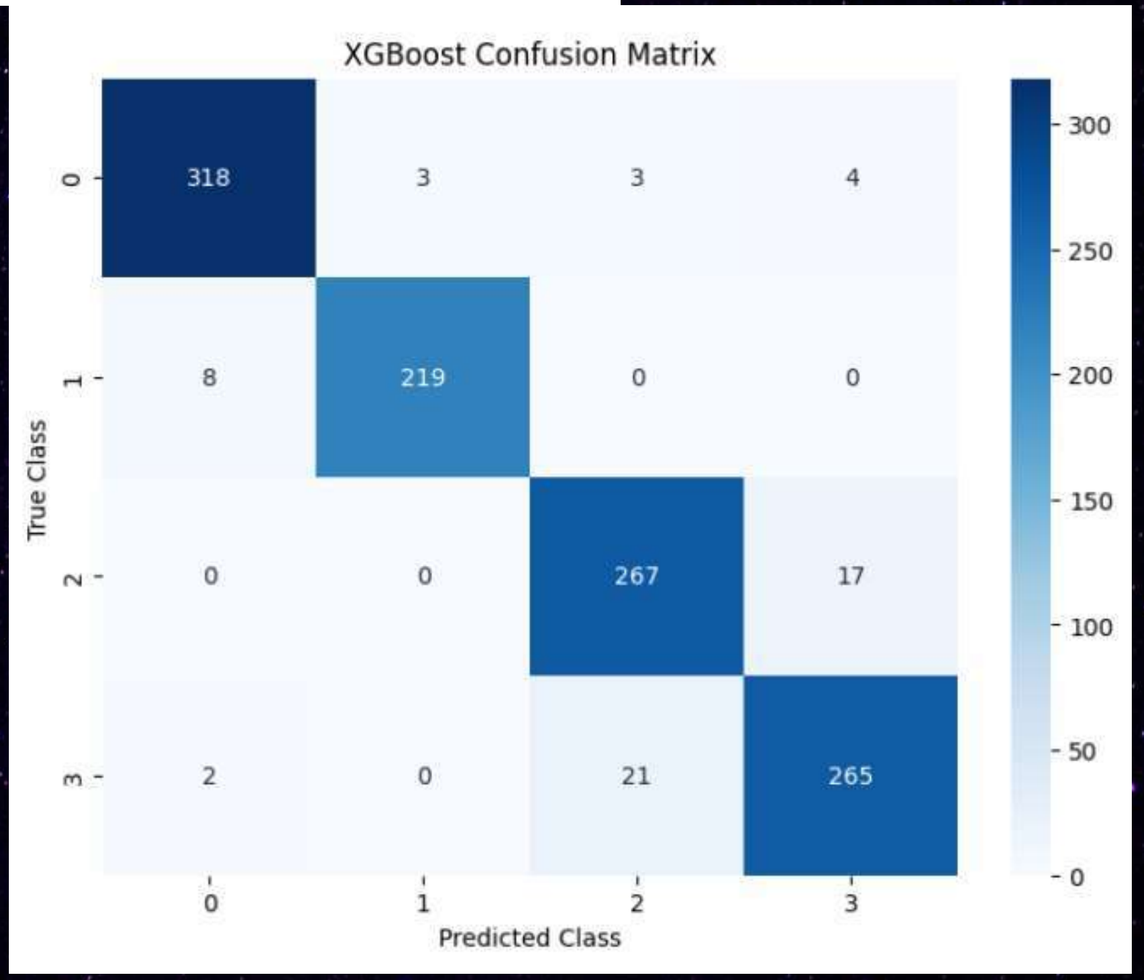
```
Decision Tree Training Time: 5.75 seconds
Decision Tree Accuracy    : 0.8970718722271517
Precision                 : 0.8978447259992156
Recall                    : 0.8970718722271517
F1 Score                  : 0.8973653964739297
```



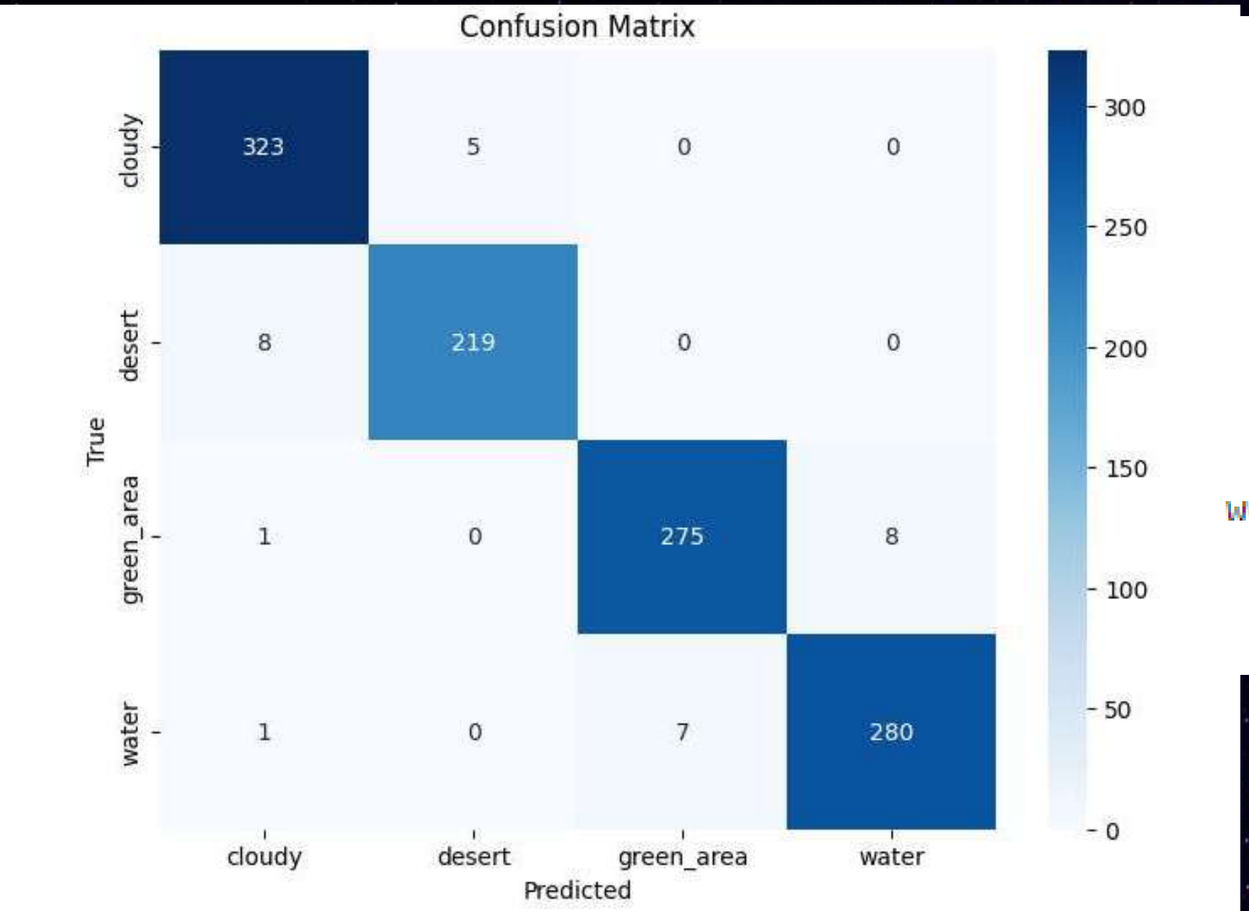
```
SVM Training Time       : 6.99 seconds
SVM Accuracy            : 0.8979591836734694
Precision               : 0.904094800846262
Recall                  : 0.8979591836734694
F1 Score                : 0.8975024791201968
```



```
XGBoost Training Time    : 51.58 seconds
XGBoost Accuracy         : 0.9485359361135759
Precision                : 0.9488579404376293
Recall                   : 0.9485359361135759
F1 Score                 : 0.9486350159264336
```



CNN Model Confusion Matrix Before Augmentation



	precision	recall	f1-score	support
0	0.97	0.98	0.98	328
1	0.98	0.96	0.97	227
2	0.98	0.97	0.97	284
3	0.97	0.97	0.97	288
accuracy			0.97	1127
macro avg	0.97	0.97	0.97	1127
weighted avg	0.97	0.97	0.97	1127

CNN Model Confusion Matrix After Augmentation

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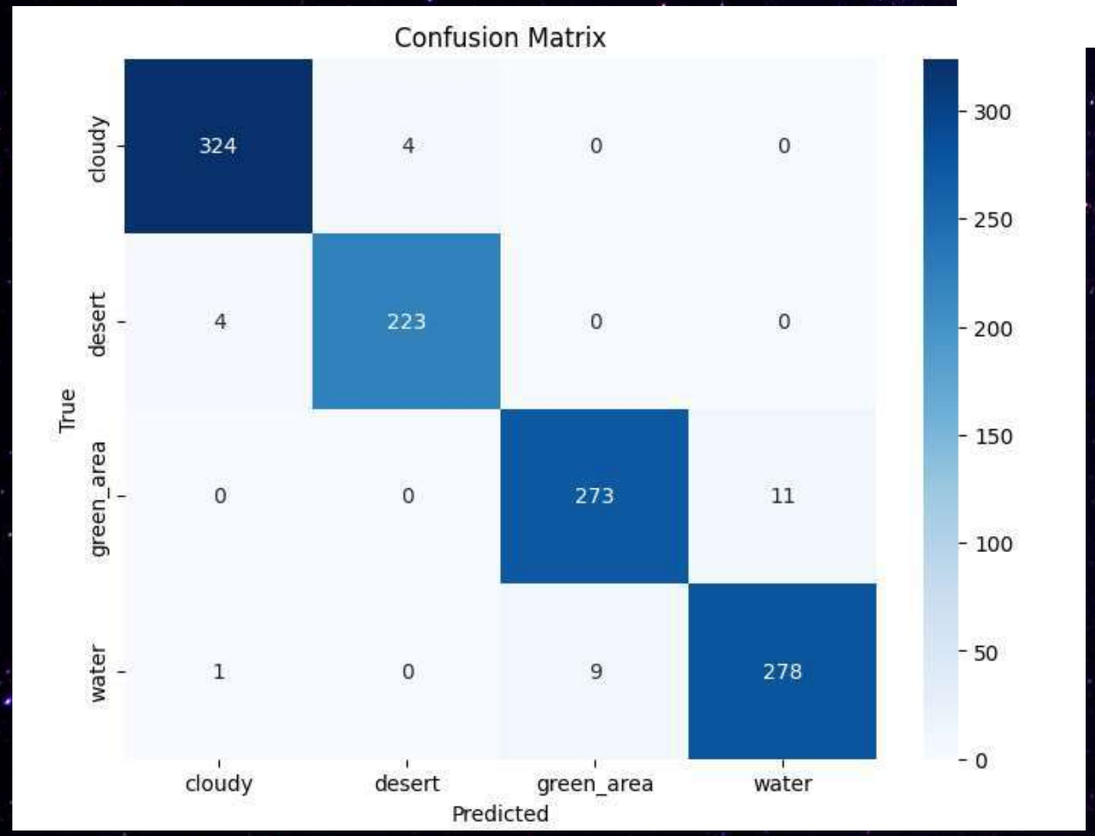
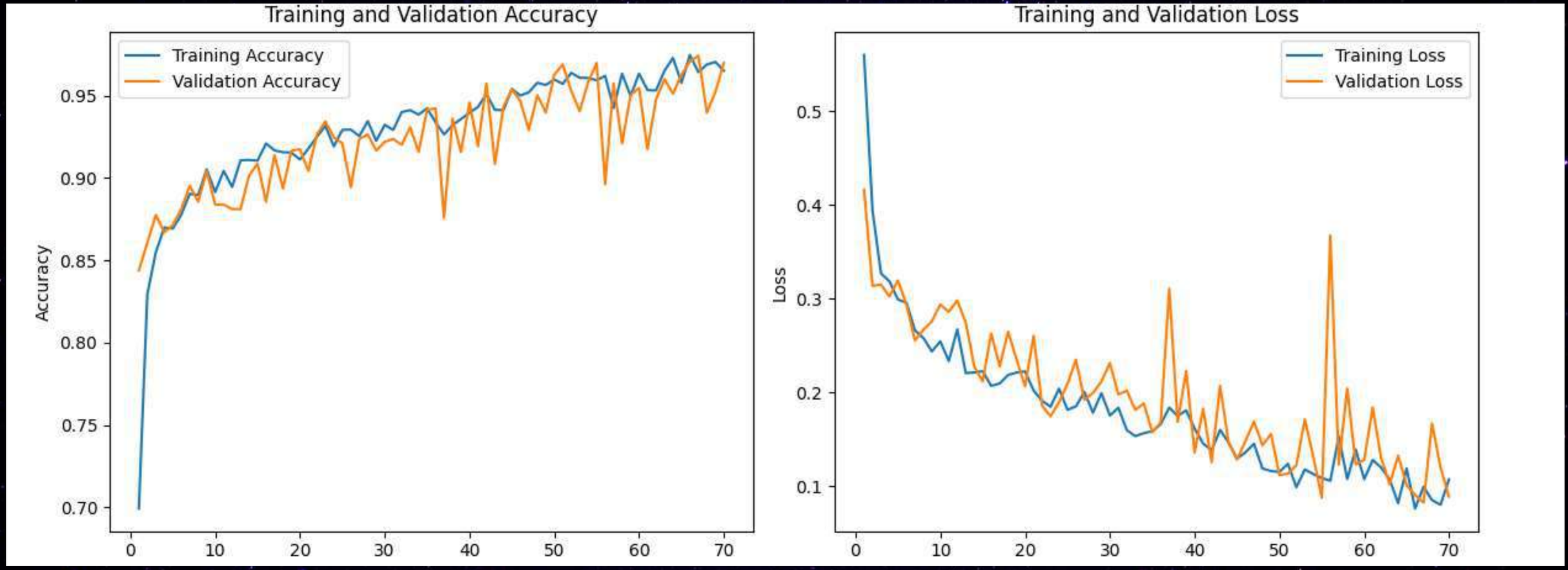


Training and validation Accuracy & loss



CNN model Test

Randomly Selected Image

```
Model Prediction:
 green_area
Actual Class:
 green_area
```

week
3

MODEL DEPLOYMENT

THANK YOU