School of Electronics and Communication Engineering

Final Year B. Tech.

MINI PROJECT LOGBOOK

Academic Year 2022 -2023 Semester-VII

Name of Student: Abhishek Hosur

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PRN Number and Batch: 1032190766 [Communication] (C2)

Project Title: Water Bodies Detection on Land using Machine Learning

Project guide: Dr. Parul Jadhav

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Rules & Regulations

1. All students must enter the correct information in the Logbook.
2. All the entries in the mini project Logbook must be verified by the concerned project guide.
3. Student must report to their respective guide and batch coordinator for mini project in the allocated time as per the time table.
4. Submit soft and hard copies of Synopsis, Mini Project report as per the given format.
5. Project Logbook must be brought at the time of interaction with guide, review presentation & Final project exam.
6. Changes, if any, must be countersigned by the concerned project guide.
7. For project exhibition / seminar / project evaluation all the students must report 15 mins before the schedule.
8. For queries, if any, contact your project guide and batch coordinator.
9. This booklet must be submitted to Guide / Batch Coordinator or the Head of School.

Weekly Chart Activity

Month: September

Week	Date	Activity Planned/Completed	Sign of the Students	Remarks by Guide And Sign of Guide	Remarks and Sign of Batch Coordinator
1.	01/09/2022	Finalized an innovative topic after discussion with guide. - Water Body Detection using Machine Learning.			
2.	08/09/2022	Started working on synopsis and necessary pre-requisites for the project.			
3.	15/09/2022	Started working on the dataset collection for the project, and tried to make the dataset even stronger, with addition of large number of images.			
4.	22/09/2022	Researched different Machine Learning Models through which we could make the Image classification model work.			

Project Guide **Batch Coordinator**

Weekly Chart Activity

Month: October

Week	Date	Activity Planned/Completed	Sign of the Students	Remarks by Guide and Sign of Guide	Remarks and Sign of Batch Coordinator
1.	06/10/2022	Started preparing for Mini-Project Mid Term Examination.			
2.	13/10/2022	After the examination and feedback from guide and our project coordinator, we started working on various other models as well.			
3.	20/10/2022	Finally trained the model to be stronger and more accurate through addition of new images through Diwali Vacation.			

Project Guide **Batch Coordinator**

Weekly Chart Activity

Month: November

Week	Date	Activity Planned/Completed	Sign of the Students	Remarks by Guide and Sign of Guide	Remarks and Sign of Batch Coordinator
1.	03/11/2022	Started working on the final step of our project - App Creation.			
2.	10/11/2022	Worked towards creating the most apt and strong app which would help in fulfilling the main objective of our project.			
3.	17/11/2022	Completed the app – **AquaDet** which was now capable of detecting the presence of water bodies on land through the images captured.			
4.	24/11/2022	Worked on creation of final synopsis, report, and other documents necessary for the mini project.			

Project Guide **Batch Coordinator**

B. Tech. Semester 7 MINI PROJECT

REPORT

On

Water Bodies Detection using Machine Learning

Submitted by:

Abhishek Hosur (1032190992)

Rishabh Garg (1032191511)

Swarni Gujar (1032190766)

Project Guide: Prof. Parul Jadhav

Final Year: 2022-2023

School of Electronics and Communication Engineering

MIT World Peace University, Pune

School of Electronics and Communication Engineering

MIT World Peace University

Pune

CERTIFICATE

This is to certify that the B. Tech. Mini Project entitled

Water Bodies Detection using Machine Learning

work has been carried out successfully by

Abhishek Hosur (1032190992)

Swarni Gujar (1032190766)

Rishabh Garg (1032191511)

during the Academic Year 2022 – 2023 in partial fulfillment of their course of Mini Project for Final Year Electronics and Communication Engineering as per the guidelines prescribed by the MIT World Peace University, Pune

Project Guide	Batch coordinator	Mini Project Coordinator	Head of School
(Dr. Parul Jadhav)	(Dr. Anuja Askhedkar)	Dr. Trushita S. Chaware	Dr. Vinaya Gohokar

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Chapter 1

Introduction:

India is a land farmer. They play a very important role in the development of the nation, in all ways. Hence, its important to make it easy for them to do the farming using the ever-growing technology using hardware as well as software. Walking in hand with the growing edge of technologies like Machine Learning, Artificial Intelligence etc. can always give them an advantage over the other conventional methods of farming and this would surely help them to prosper.

Accurate quantitative water body recognition is crucial to many applications including environmental monitoring, resource survey, flood assessment and drought detection. The presented research addresses a pervasive crucial concern, volumetric detection of water bodies.

Numerous machine learning methods have emerged to overcome the above problems such as neural network, random forest, decision trees. Machine learning refers to automatic or semi- correlations, patterns, and rules among data. Machine learning approaches are now commonplace which have been successfully applied for predicting water using remotely sensed data in the semi-arid region.

The primary motive of this project is to detect the presence of water body on the land using the applications of Machine Learning and a model which has trained set of data.

Background:

Small water bodies, both man-made and naturally formed, are numerous and widely distributed. These water bodies are smaller than river, lakes, and oceans, and range in size from 1 to 50,000 m^2 . They include ponds in mountains and forests, agriculture/fishery water bodies, and landscape water bodies in cities. They serve various functions, including ground water storage for domestic use, agriculture/fishery, and landscaping, and hence are an important part of the water environment and ecology.

Small water bodies, often located near residential areas, may affect many aspects of human life, such as environmental pollution and disease transmission. Moreover, in cities, they sometimes have an aesthetic value, which can improve the mental wellbeing of citizens. Therefore, the identification and monitoring of small water bodies is necessary for environmental protection, controlling water-borne diseases, and establishing habitable environments.

Chapter 2

Problem Statement

Develop a Machine Learning optimized Mobile Application for detection of Water bodies on land using Image classification.

Objectives

1. To gather images from different sources and create the most suitable dataset with around 1000-1200 examples.
2. The comparative analysis of different ML mode.
3. To design an optimized ML model through which we will be able to determine whether the land contains water body or not.
4. To develop an easy-to-use Android application and deploy the trained ML model into it.

Specifications

The components/Tools/IDEs used during implementation of this project were as follows:

- Tensorflow
- Jupyter Notebook
- Google Colab.
- Androiod Studio
- Programming Languages - Python and Java
- Android Mobile Phone
- Python Libraries used – Numpy, Sklearn, Matplotlib, OS, TensorFlow.

Chapter 3

Block Schematic:

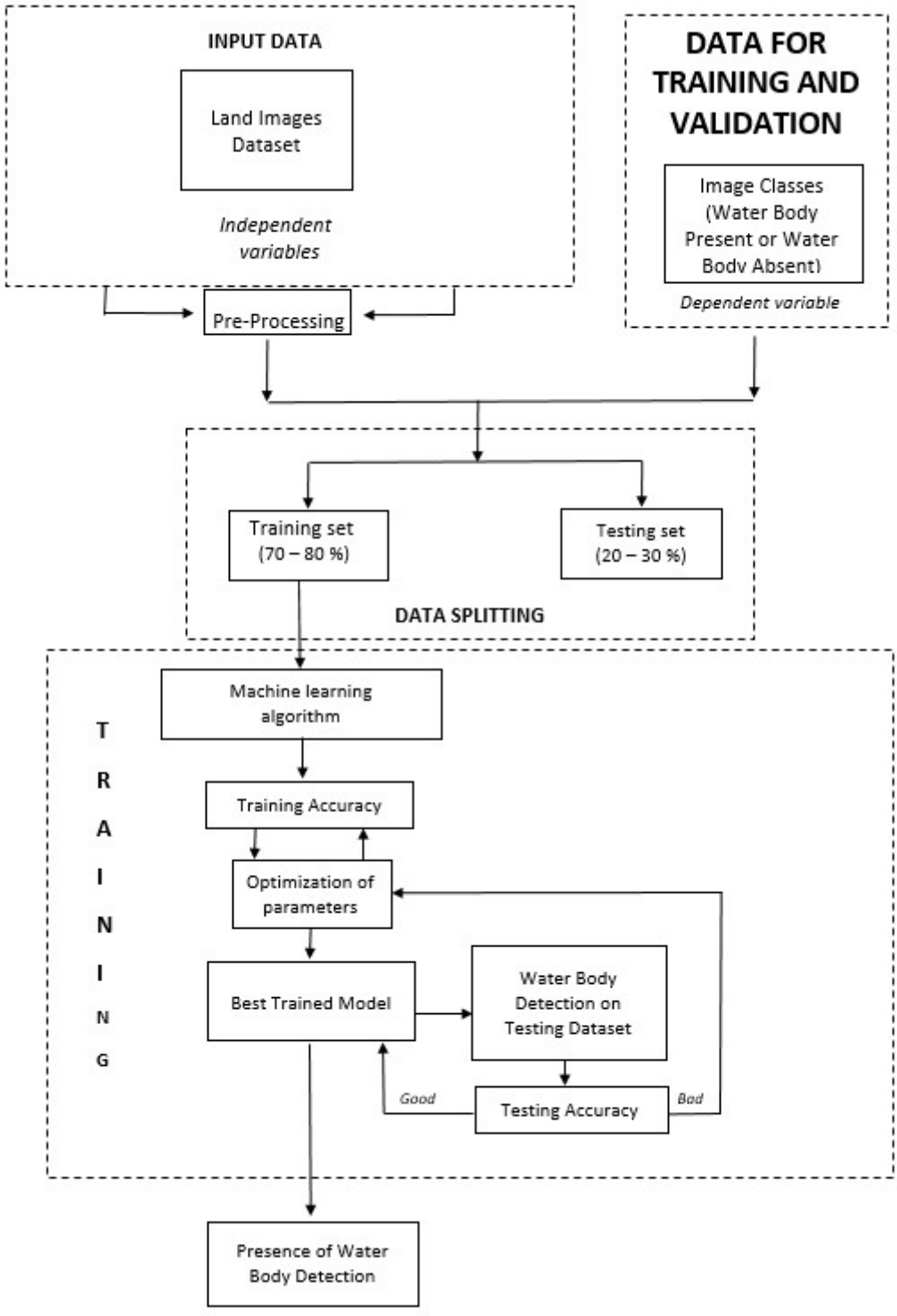


Fig (1.1): Block Schematic Diagram of Water Body Detection model.

Following steps were taken to complete the implementation of project: -

Step 1- Creating a Dataset: This step includes collection of a huge set of images from different sources which include blogs, videos, internet etc. Set of images was used for training the model to make it work for the project.

Step 2- Data Pre-Processing: Data pre-processing refers to manipulation or dropping of data before it is used in order to ensure or enhance performance, and it was an important step in the data cleaning process.

Step 3- Splitting of the Dataset: We split the dataset into two categories, one for testing the model and the other for training the model. So, the ratio of training dataset to testing dataset was 70:30.

Step 4- Training different classification models: The dataset which Was accumulated for the purpose of training the model was further used to train various classification models and algorithms like Random Forest, K-nearest neighbors, Support vector Machines and Convolutional Neural Networks.

Step 5- Comparing different models: The next step was to compare the different models on the basis of accuracy using different performance matrices like confusion matrix & F-1 score. The model with the highest accuracy was deployed in the Application.

Step 6- Front-end App Creation: An app was developed with the help of Android Studio and Java. Also, Android Camera Integration was implemented.

Step 7- Deploying best model in App's Backend: From step 5, we'd now be having the most accurate and the best suited model for this project, hence; we did deployed that particular model in the backend department for the app development.

Mobile Application Flow Chart

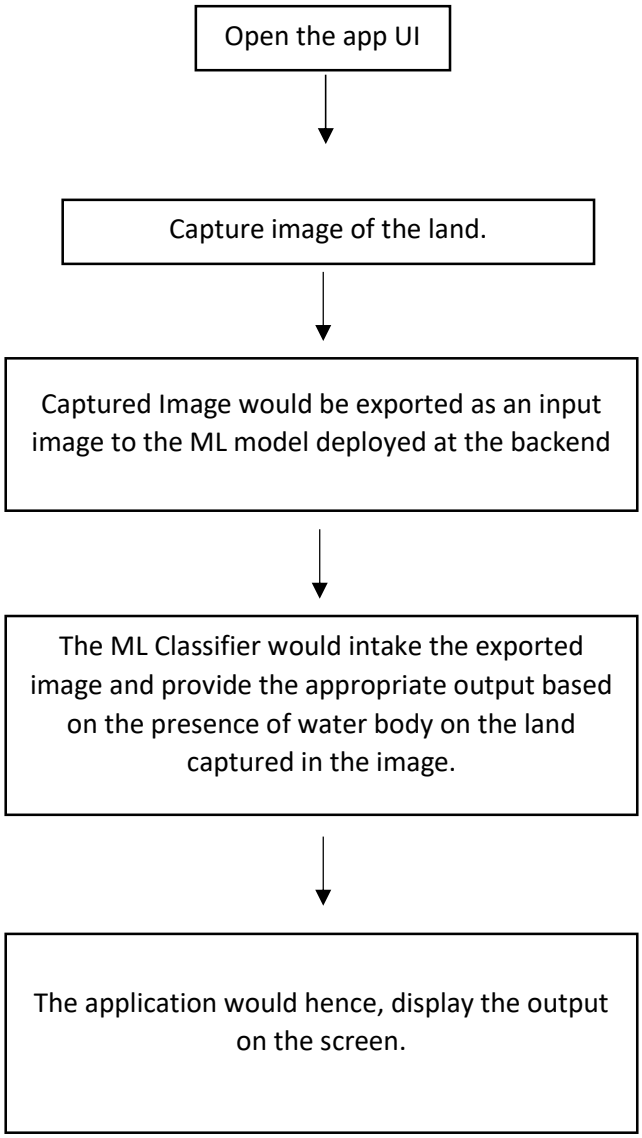


Fig (1.2): Block Schematic Diagram of the Application flow.

Chapter 4

Methodology:

Selection of the best ML models was processed amongst the various classification models which we had trained. We trained common Image Classification ML models like : -

- Non-Linear Regression: - Nonlinear regression refers to a regression analysis where the regression model *portrays a nonlinear relationship between dependent and independent variables*.
- Logistic Regression: - Logistic regression is used to describe data and to explain the relationship between one dependent binary variable and one or more nominal, ordinal, interval or ratio-level independent variables. It uses sigmoid function.
- Random Forest: - Random Forest is a classifier that contains a number of decision trees on various subsets of the given dataset and takes the average to improve the predictive accuracy of that dataset.
- Support Vector Machine: - Support Vector Machine (SVM) is a classification technique used for the classification of linear as well as non-linear data. SVM is the margin-based classifier. It selects the maximum margin. It works with different kernels like RBF, polynomial, Gaussian, etc.
- Convolutional Neural Network: - The Convolutional Neural Network (CNN or ConvNet) is a subtype of Neural Networks that is mainly used for applications in image and speech recognition. Its built-in convolutional layer reduces the high dimensionality of images without losing its information. That is why CNNs are especially suited for this use case.

Further we evaluated these models using evaluation metrices like confusion matrix, F1 score for performance evaluation and hence deployed the **Convolutional Neural Network** model to our Application as it had the highest accuracy.

A Mobile Application with an integrated camera was successfully developed which will be helping the user to detect the presence of the water body on the land. The Application have a well trained ML model which would be deployed at its backend.

Comparative Study

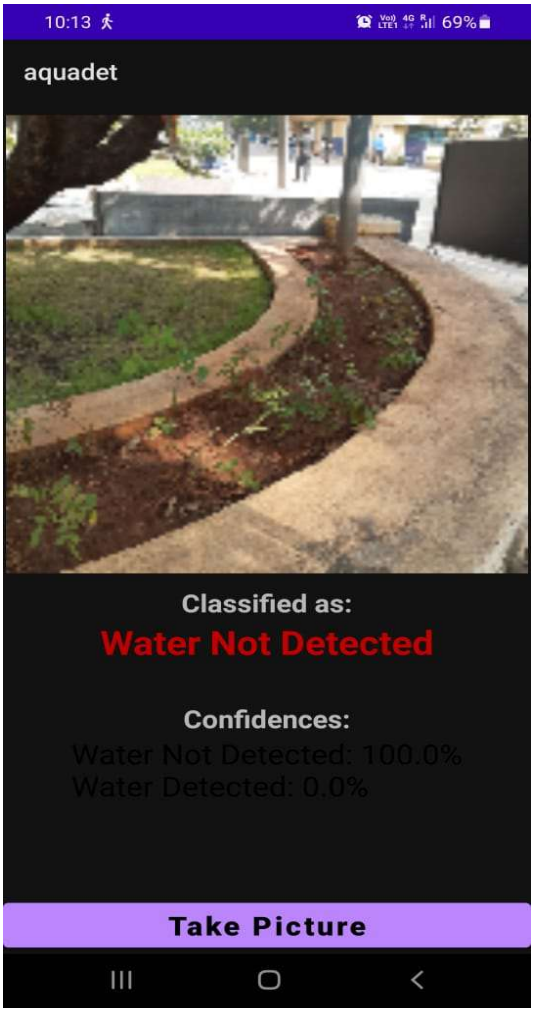
Accuracies of different models trained

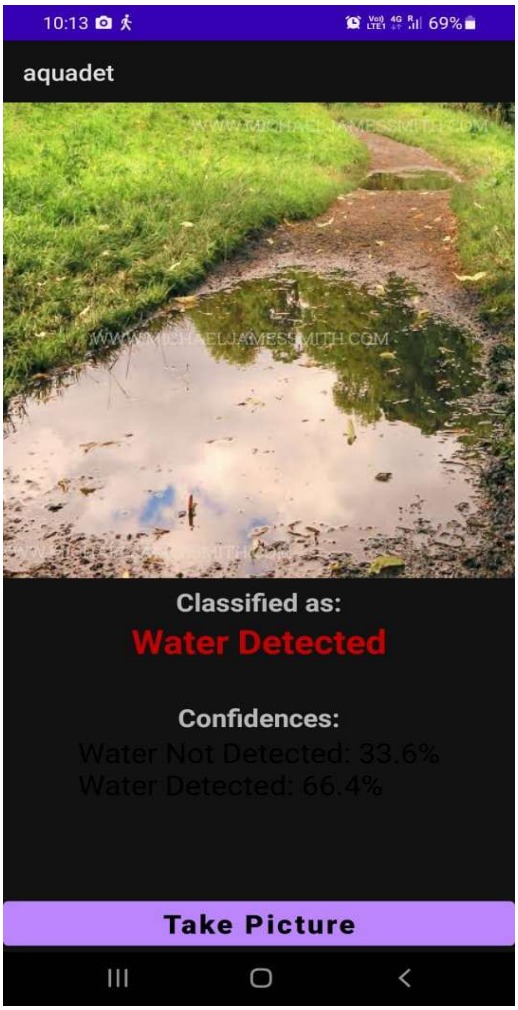
MODEL	Accuracy
Random Forest Classifier	98.63%
SVM- RBF kernel	94.55%
SVM- Linear kernel	94.33%
SVM- Polynomial kernel	94.10%
KNN – Manhattan Distance	93.65%
KNN – Euclidean Distance	93.65%
Convolutional Neural Network – Relu Activation	**100%**

Comparative Study reflected that CNN is best suited Algorithm for Image Classification Applications. Hence, We deployed our CNN model into Application with help of TensorFlowLite and Android Studio.

Chapter 5

Result Analysis and Conclusion





The Application displays user a message stating whether or not water is present on that particular piece of land along with that it also indicates the confidence levels of both classes i.e. Water is present and Water is absent.

The Application can successfully detect Water Bodies on Land with at most accuracy. Also, we can conclude that CNN is one of best ML Algorithm for Image Classification or equivalent Applications where complex Models are required.

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Signature of Students: Guide/Batch Coordinator