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EXTRACTION OF WATER BODY AREA FROM HIGH-RESOLUTION SATELLITE IMAGES

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Abstract: *In India, water body's assumes a significant part in provincial regions for many uses it has numerous lakes and repositories which are changing because of urbanization. Remote detecting and GIS methods are broadly utilized for water body extraction and water body change identification. This study assesses water body extraction from satellite pictures of an Indian city. Water assets utilized in ecological, transportation, and area arranging, catastrophic event, modern and agrarian creation, etc. Reviewing water bodies and outlining their elements appropriately is an absolute initial step for any preparation, particularly for places like India, where the land cover is overwhelmed by water bodies. Recording pictures, from satellite, now and again doesn't mirror the recognized qualities of water with non-water highlights, for example, shadows of super constructions. Picture of the water body is mistaken effectively for the shadow of the high rise since quiet water surface prompts reflect reflection when it brings forth reverberation wave. Water transport is the least expensive. Creating/helpless nations like India will be benefitted on the off chance that water transport is empowered. In water transport, the connection ought to be made between different landmasses, including building blocks, through the appropriate navigational framework. Henceforth there should be a clear differentiation between quiet water and the shadows of structures. Throughout the most recent ten years, a lot of exploration has been led to removing the waterbody data from different multi-goal satellite pictures. The target of this paper is to audit approaches applied for water body extraction utilizing satellite remote detecting.*

Key Words: *Feature extraction, remote sensing, waterbody, satellite images.*

1. INTRODUCTION:

In recent years, remote sensing is a type of distant sensing. Object detection using remote sensing photos has become a major subject that has attracted a lot of attention from both the scientific and industrial communities. Surveying, planning, and preserving water resources, particularly flood catastrophe management, requires reliable extraction of water body information from remotely sensed photography. Several innovative ways to water extraction for remote sensing images from various sources have recently been developed. Object-oriented programming is a relatively new technology that has emerged in recent years. Water identification is critical for a variety of precise calculations and human survival. Many more image processing algorithms have been established in recent decades to detect and extract surface water areas from satellite data. There are single-band and multi-band methods available. were commonly employed in Land sat imaging for identifying and extracting surface water area, as well as a threshold value, which might be positive or negative. The development of several machine learning techniques for information representations, as well as traditional examination tactics, is prompted by the large electronic database and data storage with fast computing processors. The activity of studying huge pre-existing databases to generate fresh information is known as data mining. It is the hunt for hidden links and global patterns in massive data sets [1]. "Data mining is the use of statistics to uncover patterns and trends in very big databases through exploratory data analysis and predictive models." (From the user documentation for Insightful Miner 3.0) Its definition shifts depending on who is using it"Data mining is the process of sifting through huge volumes of data kept in repositories, employing pattern recognition technology as well as statistical and mathematical tools to identify important new connections, patterns, and trends." (Source: Gartner Group) (3). Data mining is a method for extracting information from large amounts of data in a database [2]. Data mining aids in the discovery of patterns, the clustering of data for data association, and the discovery of previously unknown information in large databases. Statistical models, mathematical algorithms, and machine learning approaches are some of the data mining technologies that can be used to locate predictive information that is beyond the

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expert's imagination. Data mining, also known as Knowledge Discovery in Databases (KKD), is a technique for extracting relevant information from a large database.[3].

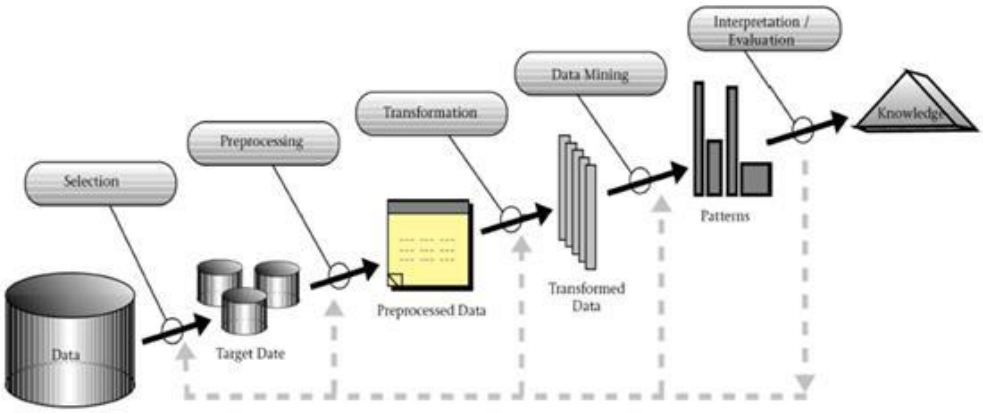

Figure 1: Stages of Data Mining Process [3]

1.1 Introduction on Image Mining:

Image Mining is a challenging task among researchers in the discipline of data mining. Image mining is the technique in the extraction of features of patterns from a large collection of images [4]. The images of the database are preprocessed to improve the image quality. Then images are utilized to measure salient features and user aimed vital parameters by various transformation, selection, and extraction. Using these features, mining can use exploration techniques to find the significant pattern. These patterns are evaluated and interpreted to find the knowledge. Now a day, with the rapid development of digital satellite image capturing devices, geological and land topography information databases have included not only the structural information of land surfaces but also have unstructured geophysical image information. Even geophysical satellite images give a detailed picture of resources on earth, it may take more time to extract useful information. Because the geophysical engineers consider the effectiveness of the management depends upon the information in the geological database. So that geological information plays a vital role in the geological field. The researchers have to concentrate more to find out the exact feature selection of the geological satellite images.

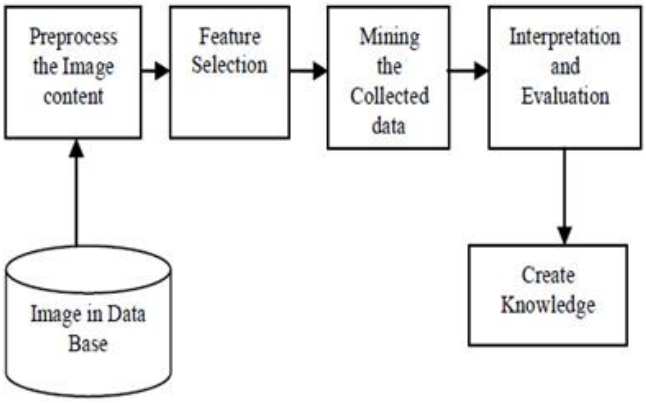

Figure 2: Image Mining Process [4]

1.2 Introduction on Study of Water Resources Bodies:

Water bodies on the outer layer of the Earth are a Fundamentals part of the hydrologies cycle. Surface water, groundwater, Island water, Stream, lakes, momentary waters, seaside waters, and springs are crucial water assets (5). This concentrate takes a gander at the extraction of data on lakes since water assets have been corrupted and depleted in the most recent couple of years. In different cases, numerous catastrophic évents are brought about by water bodies, along these lines extricating waterbody data has acquired importance now. It is a must to comprehend the progressions in local degrees of water assets. Lakes are inland collections of standing water. Lakes are a fundamental part of the hydrological cycle and consequently key instruments for overseeing water assets. Inland water body is one of the significant determining assets for human endurance and social advancement [6]. It is fundamental for people, food harvests, and biological systems [7] Reliable information about the spatial conveyance of open surface water turns out

to be significant in appraisal of present and future water assets, environment models, horticulture crop importance, waterway stream, wetland degrees, watersheds, surface water overview and the executives, flood planning, and climate observing [8].

1.3 Introduction on Remote Sensing:

Recent advances in the spatial and spectral resolution of satellite images have resulted in stupendous growth in large image databases. The data acquired via satellites, radars, and sensors possess cardinal geographical information that is used for remote sensing applications such as region planning, disaster management. The main tasks generally associated with many applications are spatial data classification and object recognition. Satellite imagery becomes the main resource for various remote-sensing applications. Remote sensing technology edges superior by advanced technical insights in recognizing the spatial distribution of land cover, water, and other objects like vegetation; each image consists of valuable information and objects inside it, extracting useful patterns from it manually is very complicated. Identifying and classifying objects in images is a difficult task.

1.4 Introduction on Image Processing:

Feature extraction and classification are performed using image processing and patterns are recognized through data mining techniques [9], to obtain relevant knowledge for object recognition in satellite data. Each image consists of valuable information and objects within it, extracting useful patterns manually from it is very tedious. The most widely used method to generate such objects is image segmentation [10]. It is a grouping of neighbor pixels of an image into similar regions as a subdivision with set criteria of the same characteristics. Each object extracted in the segmentation process will have spectral parameters, texture, morphological attributes, and contextual features, which are utilized to analyze the image. Further, the objects in an image with the defined patterns are designated to a specific class by comparing different identified objects. The object classification is done with object-oriented classification considering that the features of the object are uniform. Data mining techniques do automatic recognition of objects and classification in an image. Remote sensing satellites with various spatial, spectral, and temporal resolutions shed a large amount of data that have become necessary sources, being tremendously used for detection and extraction of inland water bodies and their changes in recent years. Several image processing algorithms for extracting water features from satellite data have recently been proposed. Information on aquatic bodies is extracted. through remote sensing and data mining has gained significance for water survey, protection of wetlands, disaster prevention, monitoring water resources, etc. Several methods like the threshold method, exponential method, decision tree, and other spectral methods are adopted for collecting water body information. For collecting waterbody data, single-band and multi-band methods are used in obtaining the reflectance of the surface body, which is useful in extracting essential information like calculating ratio and spectral relationships as Normalized Difference Water Index [7].

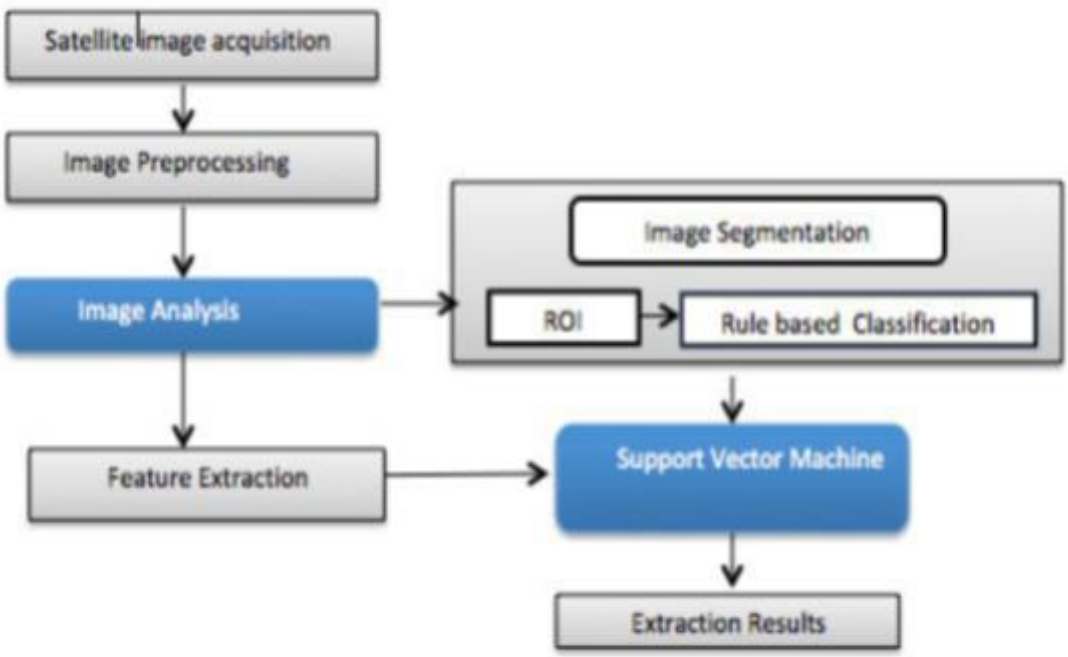

Figure 3: Flow Chart to illustrate proposed Image analysis and Data mining approach to classify water bodies

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2. METHODOLOGY:

There are several algorithms proposed on satellite image processing and data mining that are available as separate but effective and efficient integration are remain an open challenge. Most of the existing image processing algorithms to extract water bodies and changes of lakeshore contour with 90% level of accuracy, using of other algorithms of image processing and data mining queries must have to be performed for its high level of accuracy. Only a few kinds of literature on water body extraction combined with data mining are available. The comparative study of different algorithms of image processing combined database queries of data mining based on their performance are not available in the literature.

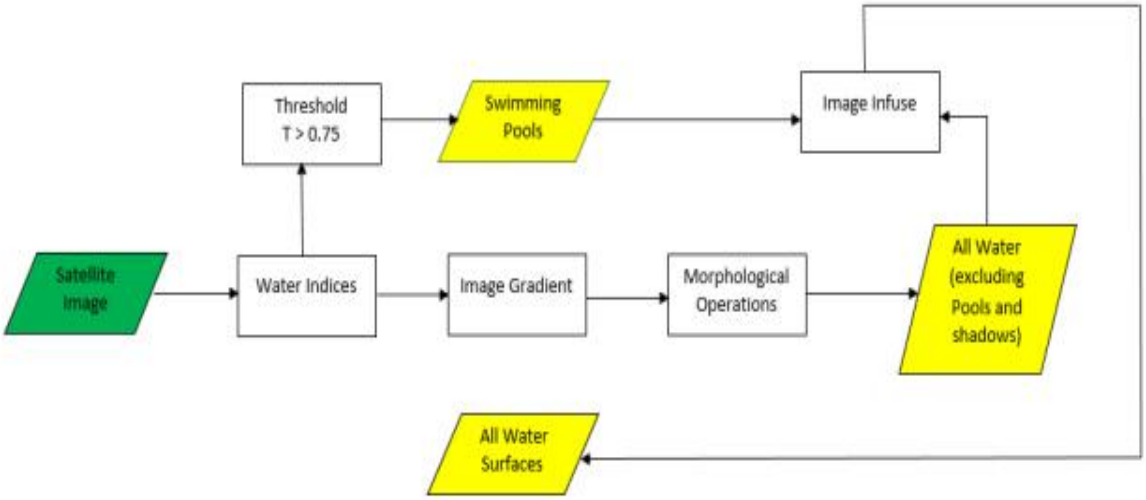

Figure 4: Water Bodies Feature Extraction Methodology

Fig 4 Water Bodies Feature Extraction Methodology According to the preceding flowchart, water capabilities may be extracted from the Satellite Imagethe use of special Water Indices, Gradient of the Image and finally, accompanied up with the aid of using Morphological Operations. Each of those steps may be defined throughout this paper, and the way every step is essential to extract water bodies' capabilities

2.1 OBJECT DETECTION IN MACHINE LEARNING:

Object Detection is a methodology that makes use of the pc creativity and photograph processing this is used to understand/learn/perceive numerous kinds of items gift withinside the photograph. Talking deeper into this topic, we might also additionally come through face detection, face recognition, emotion detection, or weather. It is used to understand different items withinside the photograph like visitors' lights, roads, pedestrians, zebra crossings, animals, or some other real-global item. Every item is numerous from every different and is precise in its way. To pick out any item, the photograph processing might also additionally use to stumble on its shape-clever, for eg, if its a square, it'll be perpendicular, if it faces it's going to have 2 eyes, nose, lips, etc.

2.2 TECHNOLOGY USED PYTHON:

Python is referred to as high-diploma, interpreted, interactive, and additionally the object-oriented language. Python is advanced to be especially readable.

- It employs English key phrases frequently, even though exceptional languages employ punctuation, and it has fewer syntactical formations one-of-a-type languages.
- Interpreted − python is typed out at runtime with the aid of using the use of manner of the interpreter. You do not want to collect your code earlier than executing it.
- This is similar to Perl and PHP. Interactive − you could take a seat down with a python installation and interact with the interpreter directly to write down your programs.
- Object-orientated – python allows object-orientated fashion or approach of programming that encapsulates code indoors objects research.

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3. IMPLEMENTATION:

```
deep_learning_object_detection.py
# USAGE
# python deep_learning_object_detection.py --image images/example_01.jpg \
#          --prototxt MobileNetSSD_deploy.prototxt.txt --model MobileNetSSD_deploy.caffemodel
# import the necessary packages
import numpy as np
import argparse
import cv2
# construct the argument parse and parse the arguments
ap = argparse.ArgumentParser()
ap.add_argument("-i", "--image", required=True,
          help="path to input image")
ap.add_argument("-p", "--prototxt", required=True,
          help="path to Caffe 'deploy' prototxt file"
if not check_integrity(os.path.join(root, "EuroSAT.zip")):
         download_and_extract_archive(URL, root, md5=MD5)
# Apparently torchvision doesn't have any loader for this so I made one
# Advantage compared to without loader: get "for free" transforms, DataLoader
# (workers), etc
def __init__(self, paths: [str], loader=default_loader, transform=None):
      self.paths = paths
      self.loader = loader
      self.transform = transform
def __len__(self):
return len(self.paths)
def __getitem__(self, idx):
image = self.loader(self.paths[idx])
if self.transform is not None:
image = self.transform(image)

 # WARNING -1 indicates no target, it's useful to keep the same interface as torch vision
return image, -1
```

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3.1 SCREENSHOTS:

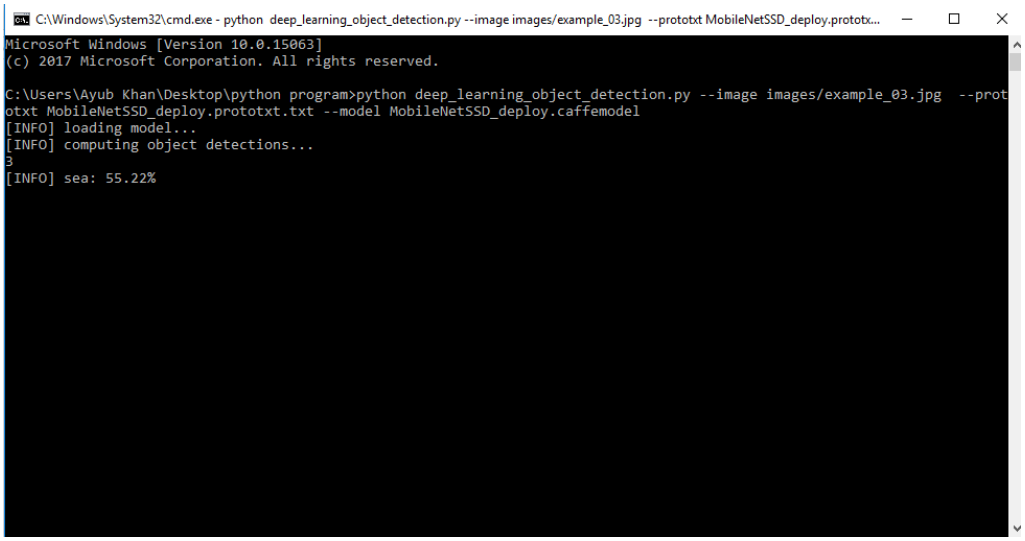

Figure 5: Water Bodies Program Running

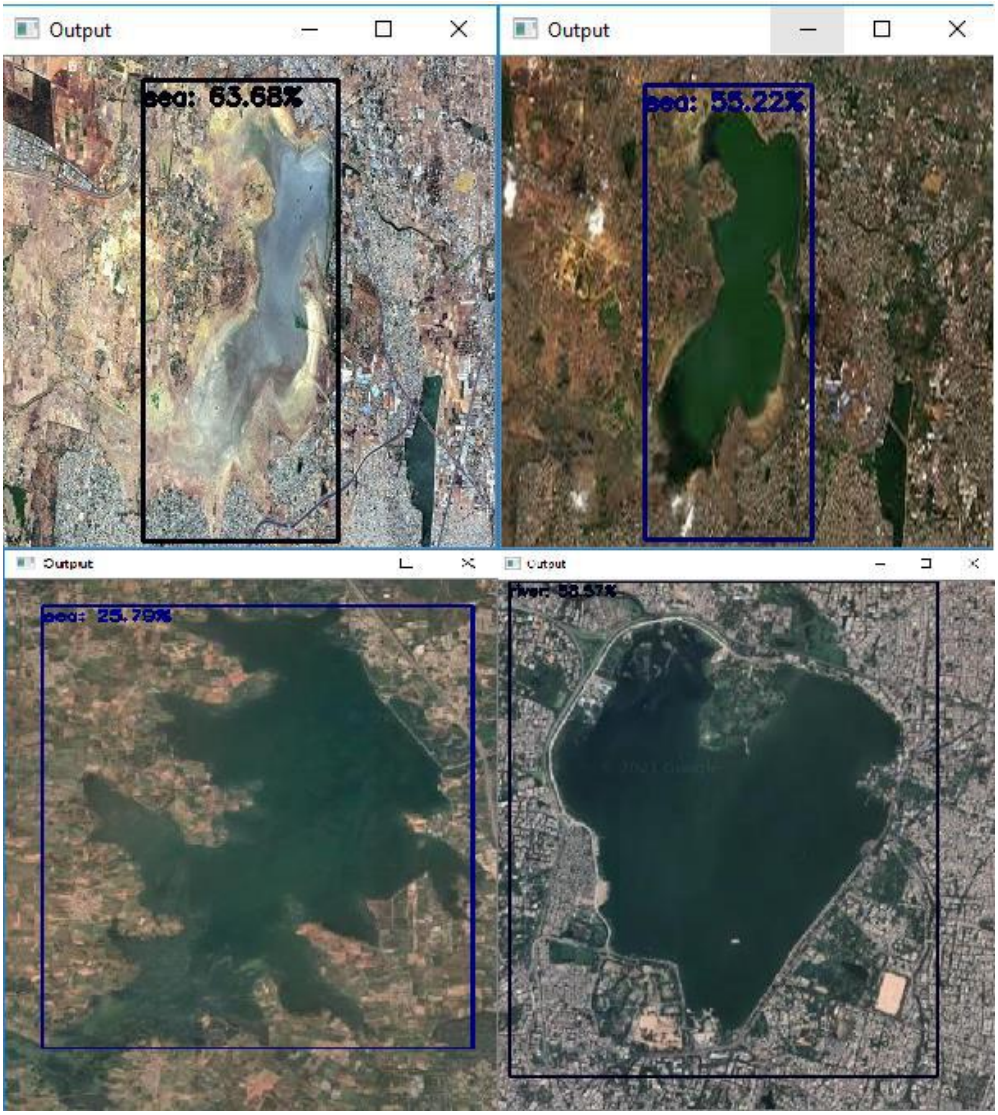

Figure 6: Water Bodies Program Output

4. CONCLUSION:

The initial part of this paper describes the importance of the water body statistics, the objectives of acting water characteristic extraction, and the essential complexities in water frame segmentation. It additionally explains the numerous styles of satellites and seniors utilize in obtaining satellite tv for pc images for the water characteristic extraction. Few outcomes have been discussed. Subsequently, a trial became made to conclude the current issues and additionally the destiny on water frame extraction techniques. Along with satellite data, the process of water body mining will also depend on the land use land cover of the landscape under study. The current study used the landscape structure of the urban scenario of the rapidly growing Hyderabad city. It is required to test the suggested method's capabilities in various landscape structures, such as water bodies in densely forested landscapes or rural areas. scenario with an intermingling of water bodies among agricultural lands having different crops or water bodies adjacent to large rivers and streams. In a sense landscape matters because the land use classes around the water bodies vary in different landscapes. Water bodies are extracted further by distinguishing water from nonwater features, which serve as boundary classes for the water bodies, and discerning those classes may be difficult in the context of feature spectral overlap. In light of the foregoing, future research in the field of perceptron models has a lot of promise to build and develop a potentially unique method that can function on a variety of satellite data and extract water bodies with greater accuracy, including smaller water bodies. The principal reason for this study was to devise a technique that enhances water extraction precision by expanding otherworldly distinguishableness in the middle of water and non-water surfaces, especially in regions with shadows and urban foundations. The procedure exhibited in this study was actualized on different information sets which were gotten from the satellite sources. This report depicts different ways for separating water bodies from satellite pictures taking into account diverse systems, which turned out to be hearty when considering the got subjective also, quantitative (visual and numerical) results. The suggested methods can be viewed as helpful both for examination in the range of Picture Analysis that has highlight extraction as one of its principal targets and for the exploration identified with data extraction in Remote Sensing pictures since they utilize the highlights extricated consequently or semi-naturally into advanced pictures for allotting them semantic attributes. The importance of this work for the territory of Image Analysis is specifically connected to the tools of Digital Image Processing that are utilized for the extraction of water bodies. This procedure can be characterized as a logical extraction because it utilizes particular attributes of the highlight of enthusiasm as directives to characterize the arrangement of techniques for extraction, which in this case are the waterways, lakes, oceans in satellite pictures, In addition, the improvement within the water body extraction set of rules is needed so that the gadget needs to be computerized for managing all styles of sensor pics and it is going to be included with the alternative equipment to provide properly facts for flood, availability of underground water. Those views are a primary issue in growing international locations. Frequently, it's miles boring to gather statistics manually

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