Oil Spills Impact Using Image Processing

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ABSTRACT

Marine life may be a huge ecosystem that faces many threats, the most important one being pollution. And one among the main contamination sources are oil spills. Oil spills are often devastating, especially when a large area of the ocean/sea is covered with it. The oil that gets leaked into the ocean pollutes the water and prevents algae from getting sunlight and fish from getting the oxygen trapped in water. The oil also gets trapped within the wings of birds that feed on the fish, making it difficult for them to fly. In short, oil can pose an excellent threat to ocean life if not taken care of. Oil spill incidents occurred outside the Kamarajar Port in Ennore near Chennai in Tamil Nadu, India. The spill occurred on 28 January 2017 when an outbound empty tanker BW Maple collided with an inbound loaded oil tanker Dawn Kanchipuram at 04:00 local time. Image processing may be a rapidly growing technology, which has applications in computer vision also as remote sensing. Identifying oil spill impact with Machine Learning Random forest classifier, K-means algorithm and WebGnome tool using Landsat8 dataset. We aim to broaden its range of applications in controlling global pollution.

Keywords : Image processing, WebGnome, GIS, Oil spill, HFO, Oil spill analysis.

I. INTRODUCTION

Contamination of seawater due to an oil pour, as a results of an accident or human error, is termed an oil spill. Oil is among the foremost important energy sources within the world and since of its uneven distribution, it's transported by ships across the oceans and by pipelines across the lands. This has resulted in several accidents within the past while transferring the oil to vessels, during transportation, breaking of pipelines, also as while drilling within the earth's crust. These spills contaminate the coasts and estuaries and may cause serious health problems to groups of people. Public health impacts include illnesses caused by toxic fumes or by eating contaminated fish or shellfish. However, there are other less obvious public health impacts, including losses and disruptions of economic and recreational fisheries, seaweed harvesting, boating, and a range of other uses of affected water.

On 28 January 2017, 4.00 am, BW Maple, an outbound Liquefied Petroleum Gas (LPG) tanker and an inbound chemical tanker MT Dawn Kanchipuram, collided about two nautical miles (13.2282∘N,80.3633∘E) of Kamarajar Port, Ennore. according to the local port authority, the hull of the vessel MT Dawn was ripped, damaging the ship's accommodation also because the pipelines on the deck. As per the knowledge from the Indian Coast Guard, East, this accident has resulted within the spillage of 196.4 metric plenty of Heavy Furnace Oil (HFO). The nowcast and predictions were made for the drift of HFO, using an oil spill trajectory model,

General National Oceanic and Atmospheric Administration (NOAA) Operational Modeling Environment (GNOME).

II. STUDY AREA

The study region extends from Ennore port to Chennai. The Ennore is located in Thiruvallur District, Tamil Nadu. The latitude and longitude of Ennore 13° 12' 23.4864'' N and 80° 19' 38.0100'' E. Ennore is a neighbourhood in Chennai, India. Ennore is situated on a peninsula and is bounded by the Korttalaiyar River, Ennore creek and therefore the Bay of Bengal. Ennore Port lies on the northeastern corner of the Chennai City of Tamil Nadu State on a flat land referred to as the Eastern Coastal Plains. It is located on the East Coast of the Indian peninsula referred to as the Coromandel Coast within the Bay of Bengal. Ennore, India visibility is going to be around 10 km i.e. 6 miles and an air pressure of 1012 mb. The daytime temperature goes to succeed in 29 °c and therefore the temperature goes to dip to 25 °c in the dark . It will be dry with no precipitation and cloud covering 28% of the sky, the humidity are going to be around 72%. The study area is that the hub of a variety of commercial projects, mainly thermal power stations, fertilizer factories, industrial ports and coal yards. The model was re-run with this particular quantity (196.4 MT) during 0400 hrs of 28 January,2017 to 2300 hrs of 5 February, 2017 to estimate the drift of spilled HFO. Nearly about five tonnes of viscous mousse has been recovered using weir, disc, brush skimmers and manual mopping using absorbents.

III. LITERATURE SURVEY

The paper [1] describes the feasibility of identifying oil-impacted land within the Niger Delta region of Nigeria with a machine learning random forest classifier using Landsat 8 (OLI spectral bands).Oil spill incident data for the years 2015 and 2016 were obtained from published records of the National Oil Spill Detection and Response Agency and Shell Petroleum Development Corporation. This provided the idea for the identification of the simplest variables for discriminating oil-polluted from unpolluted land. The classification accuracy of cropland, grassland and tree cover areas was 60.61%, 65%, and 70%. The overall classification accuracy was 30.14%.

The paper [2] deals with oil spill drift advisory and also the prediction was made by Indian National Centre for Ocean Information Services (INCOIS) using General National Oceanic and Atmospheric Administration (NOAA) Operational Modelling Environment (GNOME), an oil spill trajectory model. The trajectory model was forced with analysed and forecasted ocean currents from the worldwide Ocean Data Assimilation System (GODAS) supported the Modular Ocean Model 4p1 (GM4p1). It was found that the spread of HFO obtained from the oil spill trajectory model GNOME, has matched well with the observed spread from the Sentinel-1A satellite dataset.

The paper[3] deals with deepwater Horizon caused a large shift of research attention to the Gulf of Mexico. There is a huge post-Deepwater Horizon shift of research attention to the Gulf of Mexico, from 2% of studies in 2004–2008 to 61% in 2014–2015, thus ranking Deepwater Horizon as the most studied oil spill. There's a longstanding gap in research in that just 1% of studies affect the consequences of oil spills on human health.

The paper[4] describes the oil spill and debris detection of the Arctic region using SAR images

within the early stages and may contribute to minimizing damage to ocean ecosystems.

IV. PROPOSED SYSTEM

The existing system has built-in tools for analysing the oil spill for the Nigeria region. The SAR images are used for analysing the oil spill. In proposed system, oil spill impact is analysed within the 2017 and 2019 datasets in Ennore, Chennai.

Fig.1 Workflow of proposed system
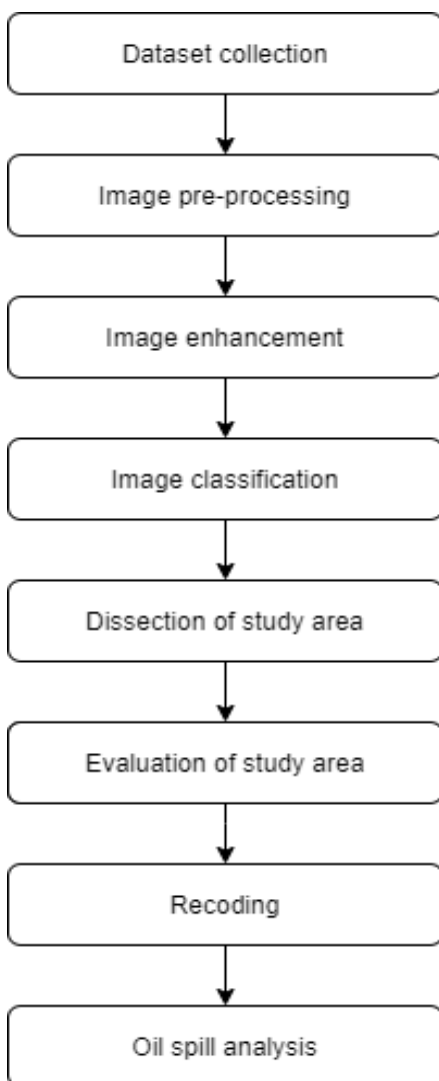
TOOLS

1.Earth Explorer

Earth Explorer is a user interface online search tool developed by United States Geological survey (USGS). It is used to collect dataset in Landsat8.

2. ERDAS Imagine

Earth Resource Development Assessment system. It is image processing software tool. It is used for study and analysis of satellite images. Image pre-processing, Image enhancement and dissection of study area are implemented using Erdas tool.

3. Google Earth

It is computer program that renders a 3D representation of earth. It allows users to see cities and landscapes from various angles. Recoding of enhanced image is implemented using this tool.

4. WebGnome

It is publicly available oil spill trajectory tool. It is used to analyse the oil spills in the sea by providing Ennore oil spill incident data. Oil spill analysis is implemented using WebGnome.

5. ArcMap

It is ArcGIS Desktop application to create maps, manage and analysis geographic data. It allows the user to explore data within data. The mapping of oil spill in the dataset is done by ArcMap tool.

V. IMPLEMENTATION

1. Dataset collection

A data set (or dataset) is a collection or group of data. data set is the unit to measure the information released in a public open data repository. The Landsat 8 dataset are collected from Earth explorer. Select the

Ennore dataset(2017,2019) without cloud and fog and download the dataset in Tiff format.

2. Image pre-processing

Image Pre-processing is a technique that is used to convert the raw data into a clean data set. It is an improvement of dataset image which convert raw data into a clean data and suppresses unwanted distortions. The obtained image from the dataset is converted to clean data by creating stack which combine multiple images into a single image.

3. Image enhancement

The pre-processed image is enhanced for adjusting digital images which remove noise, sharpen, or brighten an image. The unwanted pixels are removed. It ensures accurate, efficient, and meaningful analysis for obtained image.

4. Image classification

The combined classification is used for enhancing the image which has both supervised and unsupervised classification.

5. Dissection of study area

The study area Ennore port to Chennai. The classified image is dissected for further analysis.

6. Recoding

Recoding is a process of reclassification of classes. This is done by combining them based on similar characteristics and having a more general class. The dissected region is recoded into five classes.

Colour	Region
Purple	Barren land
Blue	Water

Green	Forest
Red	Urban Area
Yellow	Agriculture field

7. Evaluation of the study area

Evaluation of the study area is estimated by finding accuracy. The accuracy assessment utility allows image analysts to compare certain pixels in the thematic data layer to the reference pixels with known class labels. This is an organized way of comparing classification result with ground reference data.

Accuracy for 2017 dataset

Overall Classification Accuracy: 90.00%.

Accuracy for 2019 dataset

Overall Classification Accuracy: 95.65%.

8. Oil Spill Analysis

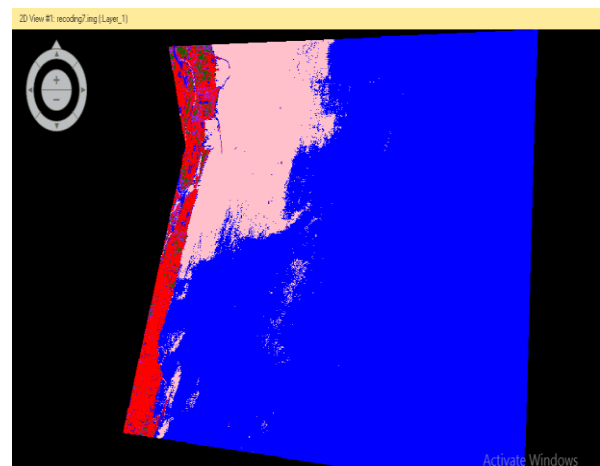Analyzing the oil spill present in the sea region. The oil spill is analyzed in the 2017 and the 2019 dataset.
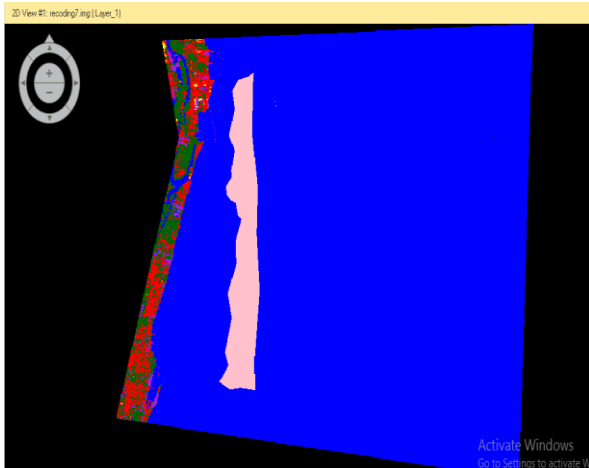

Fig.2 Oil spill analysis in 2017 dataset

Fig.3 Oil spill analysis in 2019 dataset

The pink colour in the dataset represents the oil spill in Ennore region.

VI. CONCLUSION

The sea regulates our climate. It soaks up the warmth and transports warm water from the equator to the poles, and cold water from the poles to the tropics. Holding 97% of the water of our planet, the majority rain that drops ashore comes from the ocean. Seawater is rich in minerals like magnesium, zinc, iron and potassium. The oil gets polluted in to sea water which is more harmful to living being. The target defined has been achieved successfully. The implementation has been worn out step by step process. Each module has been developed. By using this technology, we are assured that the data are going to be used efficiently. In future, real time analysis of oil spill application is developed.

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