

Oil Spill Detection in MATLAB Software using SAR Images

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Abstract - A major aspect of marine pollution, oil discharge into the sea has become a frequent phenomenon, and it can have severe biological and economic impacts. Automatic detection and monitoring of oil spills and illegal oil discharges is of fundamental concern in ensuring consent with marine legislation and safety of the coastal environments, which are under considerable risk from intentional or accidental oil spills, uncontrolled sewage and wastewater discharged. The main aim of this research is to detect oil spills using satellite images. SAR (Synthetic Aperture Radar) imagery is a common medium for detecting oil spills. Object detection is a frequent and important field of study in Image processing and in Earth Observation. It has emerged into an important application for the society. A successful handling operation to a marine oil spill depends on the accelerated response from the time the oil spill is recognized. In this paper, an oil spill detection method is approached. The method consists of four stages, namely: 1) RGB to Grayscale 2) Image Filtering 3) Image Thresholding; and 4) Object understanding of the segmented objects as oil spills. This approach is implemented and results are verified in MATLAB software

Key Words: Image processing, Oil Spill Detection

1. INTRODUCTION

Every year, several thousand tonnes of oil are spilled or illegally dumped into the ocean. Finding them with an automatic arrangement could give an early warning so it may be cleared up before doing too much harm. Oil pollution from shipping constitutes one of the environmental concerns on which much international cooperation and law making has taken place.

Towards the compliance with marine legislation and the efficient surveillance and protection of coastal environments, automatic detection and tracking of oil spills and illegal oil discharges is of fundamental importance. Mineral oil spills soaring on the sea surface are noticeable by imaging radars because they soak the short surface waves that are responsible for the radar backscattering. Oil spills come out as dark areas on radar images. Oil spills are seriously affecting the marine ecosystem and cause political and scientific matter since they vigorously effect delicate marine and coastal ecosystem. The in spite of toxic waste discharges and associated effects on the marine environment are important parameters in evaluating sea water quality. If the oil washes towards marshy estuaries, mangrove forests, fibrous plants and grasses swallow the oil, which can prejudice the plants and conduct the complete area faulty as wildlife habitat. Hence to provide protection to the marine

species and applying proper methods to reduce oil slicks it is necessary to find the location of the oil spill in the sea.

SAR sensors have an influence over optical sensors in that they can give data under poor weather conditions and during darkness. Users of remotely sensed data for oil spill applications encompass the Coast Guard, national environmental protection agencies and departments, oil companies, shipping industry, insurance industry, national departments of fisheries and oceans and department of defense.

2. MATERIALS AND METHODS

STUDY AREA: In the early morning of January 28, 2017, a liquefied petroleum gas tanker, the BW Maple, while coming out of the Kamarajar port, Ennore, clashed with another tanker, the MT Dawn Kanchipuram, laden with 32,813 tonnes of petroleum lubricant. As per the real-time data of Port's Vessel Traffic Management System (VTMS), the Maple smashed into the side of the Dawn Kanchipuram at about 3.45 AM.

When the municipal pumps declined, authorities fell back on thousands of poorly equipped workers armed with little more than plastic buckets. Two weeks into the clean up operation, the oil slick's almost noticeable traces have largely disappeared, but environmentalists fear that the damage has just started.

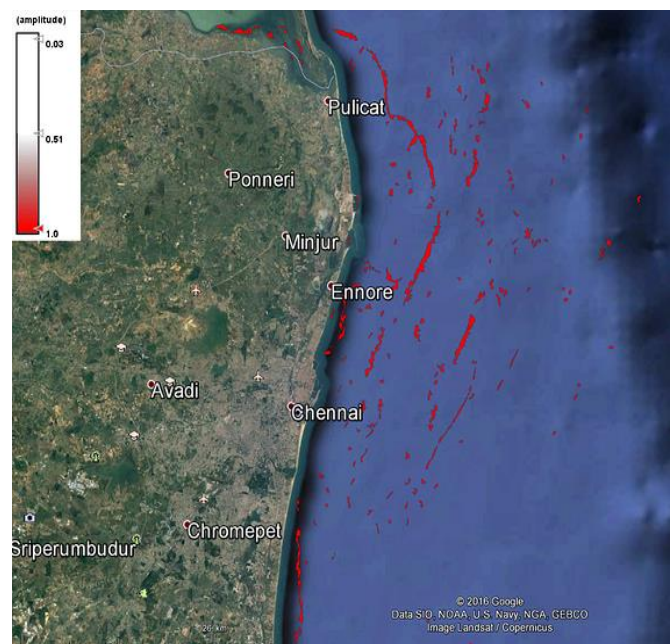


IMAGE : ENNORE OIL SPILL

METHODS: Requirement of digital image processing stems from two predominant effort areas: the first being the enhancement of visual information for human perception and the second one thing is the processing of a representation data. Image processing has a huge cable of applications such as remote sensing, image and information depot for delivery in business applications, medical imaging.

Images plays an important act in today's age of blunt information. The field of image processing has presented huge proceed over past few decades. Mostly, the images dealt in virtual environments or entertainment applications possess high fidelity resulting in large storage requirements. Images may submit to distortions at some stage in preliminary acquisition process, compression, restoration, communication or very last display. Hence image quality measurement plays a significant role in several image processing applications. Image quality, for scientific and medical purposes, can be defined when it comes to how thoroughly desired science may well be extracted on the image.

RGB to Grayscale: A grayscale image is one in which the value of each pixek is a single sample representing only an amount of light, that is, it carries only intensity information. Images of this sort, also known as black and white or gray monochrome are composed of shades of gray.

Filtering: Image filtering is beneficial for most applications, including sharpening, smoothing, removing noise, and edge detection. The process used to apply filters to an image is known as convolution. In image processing a Gaussian blur (also known as Gaussian smoothing) is the result of blurring an image by a Gaussian function (named after mathematician and scientist Carl Friedrich Gauss). It can be a regular outcome in graphics software, generally to decrease image noise and shrink detail.

Edge detection: The Sobel operator, sometimes called the Sobel–Feldman operator or Sobel filter, is used in image processing and computer vision, particularly within edge detection algorithms where it creates an image emphasising edges.

Shape detection: Feature extraction techniques are helpful in various image processing applications e.g. character recognition. When the input data to an algorithm is too large to be processed and it is suspected to be redundant (e.g. the same measurement in both feet and meters, or the repetitiveness of images presented as pixels), then it can be transformed into a reduced set of features.

Thresholding: Image thresholding is a simple, yet effective, way of partitioning an image into a foreground and background. This image report technique is a kind of image segmentation which isolates objects by converting grayscale images into binary images. Image thresholding is most effective in images with high levels of contrast.

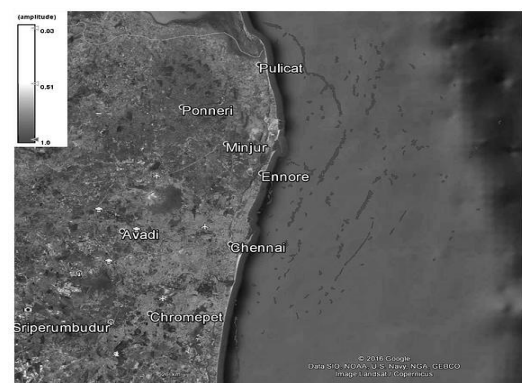
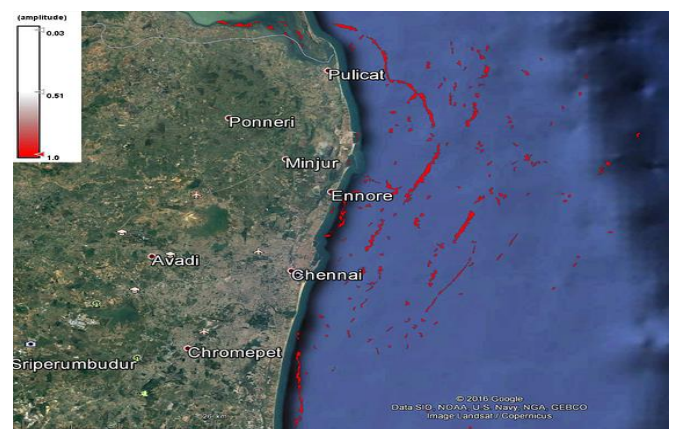
MATLAB is a high-performance language for technical computing. It assimilate computation, visualization, and

programming within a clear-cut to use environment where problems and solutions are expressed in aware scientific notation. Typical uses include: Math and computation

- Algorithm development
- Modeling, simulation, and prototyping
- Data analysis, exploration, and visualization
- Scientific and engineering graphics
- Application development, including Graphical User Interface building

3. RESULTS AND DISCUSSIONS

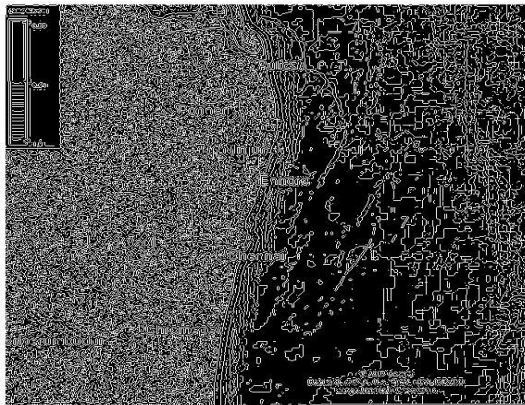
Following images are obtained after applying image processing method



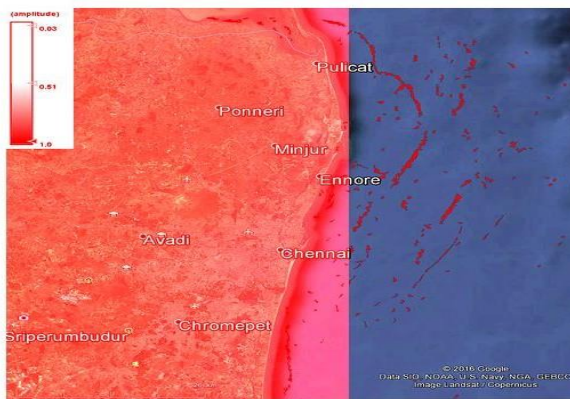
(a)



(b)



(c)



(d)



(e)

Final detection of oil spill

4. CONCLUSION

The oil spill detection algorithm by image processing is programmed in MATLAB software. The image of Ennore oil spill is used and image processing technique is applied step by step to obtain proper detection of oil spill. Following the process of image processing i.e RGB to grayscale, filtering,

Edge detection, Shape detection and thresholding gives accuracy for the output result.

Extracting the locations and extent of oil spill spots accurately in remote sensing images reaps significant benefits in terms of clean up work. Such detection can be useful during assessment of clean up operations.

5. REFERENCES

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