Remote Sensing Image categories classification using machine learning methods and Image Processing

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Abstract – In this research remote sensing image categories classification using machine learning methods and image processing is used. Satellite images are one of the important sources of data collecting all regions and areas around the world. Which is more useful then camera-based images for analysis of difficult regions. In this research work, an advanced study on remote sensing image categories is classified and examined using two classes' ocean ship and ocean oil spill satellite images. This research help in characterizing the type of satellite image classification for the particular two classes. The following stages have been considered are preprocessing, segmentation, and classification methods using a support vector machine classifier. The present investigation results that coiflet5 analysis works well in remote sensing image categories classification with an accuracy of 97% using an SVM classifier.

Keyword- Remote Sensing, SVM classifier, preprocessing, segmentation, wavelet analysis.

1. Introduction

The oil spill is one of the important issues which were faced by many marine animals in the ocean Satellite. Remote sensing image category classification is a very useful process to analyze many images with a large geographical area. Many developing countries are doing research

based on satellite image monitoring and tracking process [1]. Any kind of research satellite dataset helps in deep analysis and monitoring of a particular region of interest. Every year many research conducted using satellite image monitoring and detection. As we know many government and international agencies work on environment-based research from past decayed [2]-[3]. In which satellite image play a vital role in the identification and testing of land detection. So it is very important to keep track and regular monitoring of land area using satellite images [4]. Every year due to population growth and climate change many forest areas are degraded with the unnecessary cutting of forest and trees which result in biodiversity losses, soil erosion, and land degradation. In many research conduction for prediction of changes between satellite images, land change detection, ocean monitoring system, and climate change detection [5]. In the year 1970's the satellite images are considered for observations [6]. Based on the satellite images it will help in urban area design and planning. This provides an efficient modal for analysis and detection of land. The geographical area can be track and monitored regularly using satellite image technology [7].

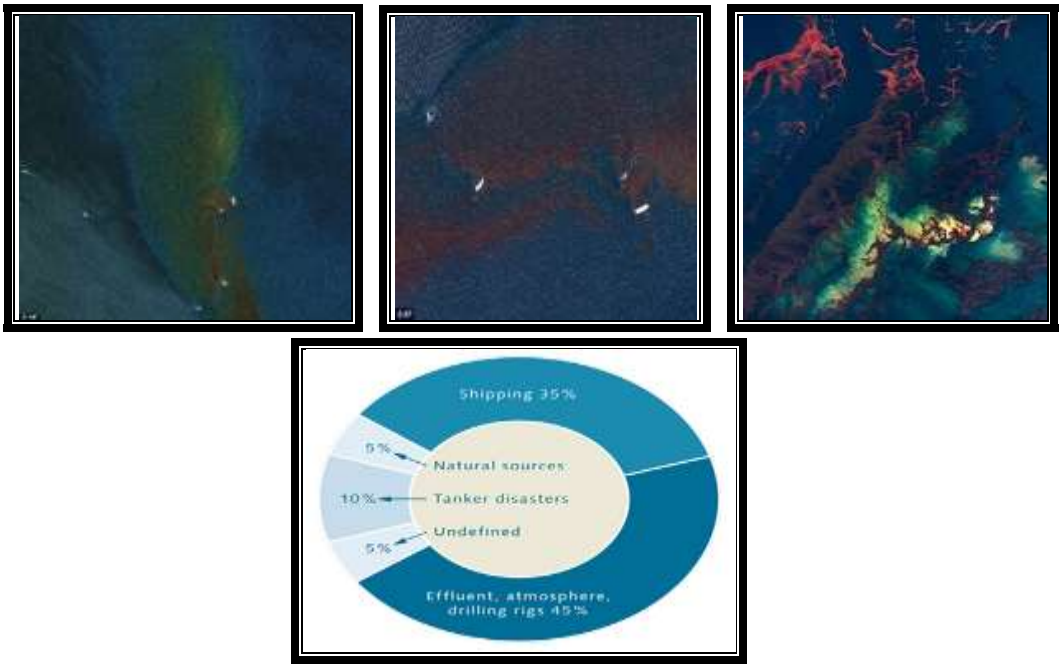

Figure 1- Satellite Image

There are many satellites which used to monitor the area for better development and protection such satellite images are SCATSAT-1, ENVISAT-ASAR, and INSAT-3DR. The satellite image captured gives detail about hourly, half-hourly, and depends on conditions according to atmospheric changes. Satellite image helps in monitoring man mad changes in agriculture and land-based changes detections [8]-[9]. Oil spills in the ocean produce a larger impact on marine animals and the ocean marine ecosystem. Due to the oil spill, a large number of animal dies and infected with many diseases. A large number of oil transport done through one country to another country. Oil spill disaster occurs due to accidental cases through the ship, pipe blowup, and overfilling tanks [10]. To achieve information related to the ocean it is very

important to regularly track and monitor the satellite image. Many agencies are regularly monitoring the particular image for climate change detection, weather forecasting, volcanic eruption monitoring, and detection and land survey analysis. This satellite image help to achieve information related to real-time measuring and tracking system around the world. Based on this latest technology it is very easy to monitor the changes based on the ocean.

2. Methodology

The research investigates on satellite image preprocessing, segmentation, feature extraction, wavelet analysis, and classifications using image processing methods and machine learning algorithms. A 50 satellite image of the ocean with ship and ocean with oil spill has been collected for investigation through different commercial satellite monitoring agencies through from internet for research purposes. Satellite monitoring agencies belong to the government of India and international agencies for research platforms of earth monitoring and observation categories.

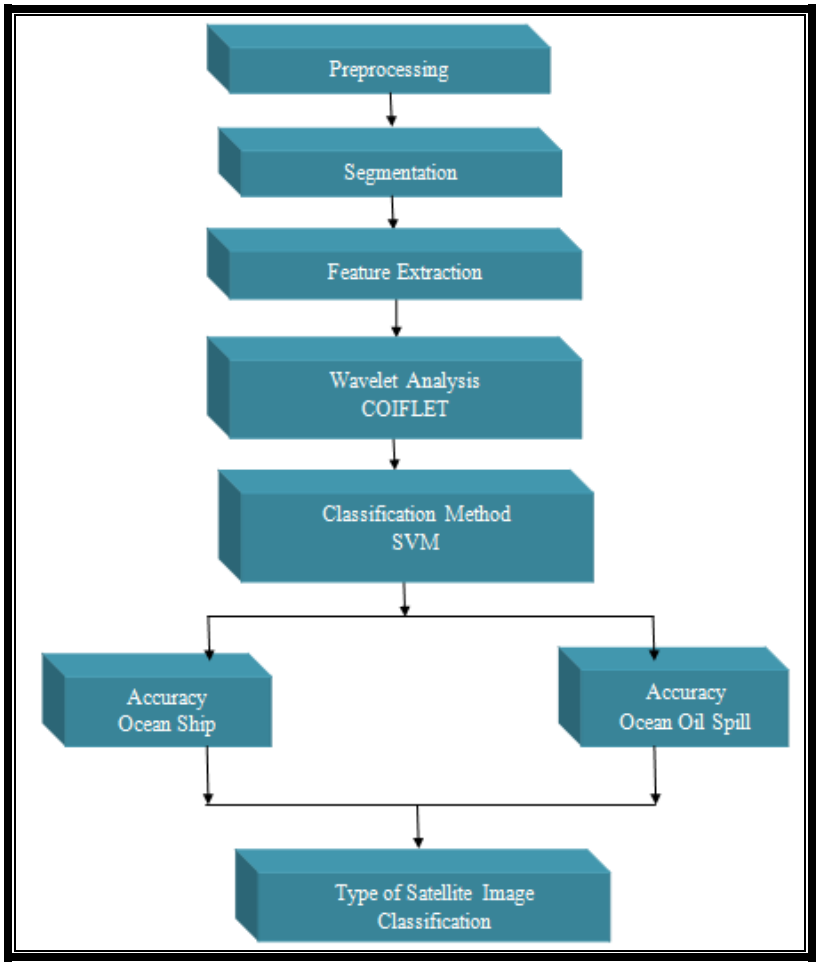

Figure 2- Methodology

The above figure represents the methodology for research work, initially preprocessing methods is consider for avoiding background noise, then segmentation method is applied, after segmentation method features extracted using wavelet with COIFLET1, COIFLET2, COIFLET3, COIFLET4, and COIFLET5 analysis is performed then finally type of satellite

image classification with two classes such as accuracy of ocean ship, the accuracy of Ocean oil spill detected and classified. Features extracted are red color, blue color, green color, mean value, standard deviation value, entropy, skewness, and ellipticity for the research work.

3. Preprocessing

A media filter is used during the investigation of satellite image classification. It removes image noises and smoothing of satellite images for investigation. During the whole process, the pixel which is nearer will consider for analysis, and remaining will be rejected. It helps to provide smoothening of satellite data.

3x3 Masks operation $\begin{bmatrix} 1 & 4 & 6 \\ 1 & 8 & 9 \\ 3 & 7 & 10 \end{bmatrix}$

Arrangement in ascending order for the median filter

1	**1**	**3**	**4**	**6**	**7**	**8**	**9**	**10**

Compute the median filter value

1	**1**	**3**	**4**	**6**	**7**	**8**	**9**	**10**

Calculated with the original image

$$\begin{bmatrix} 1 & 4 & 6 \\ 1 & 8 & 9 \\ 3 & 7 & 10 \end{bmatrix} \longrightarrow \begin{bmatrix} 1 & 4 & 6 \\ 1 & 6 & 9 \\ 3 & 7 & 10 \end{bmatrix}$$

Original-Image Median filter-Image

4. Segmentation

For satellite image classification in ocean segmentation method works with thresholding techniques work well during observation. The thresholding technique produces segments with similar intensity values for the satellite image. Thresholding is useful in developing boundaries in satellite images for investigation. The image is segmented using multiple regions with better understanding and features extracting.

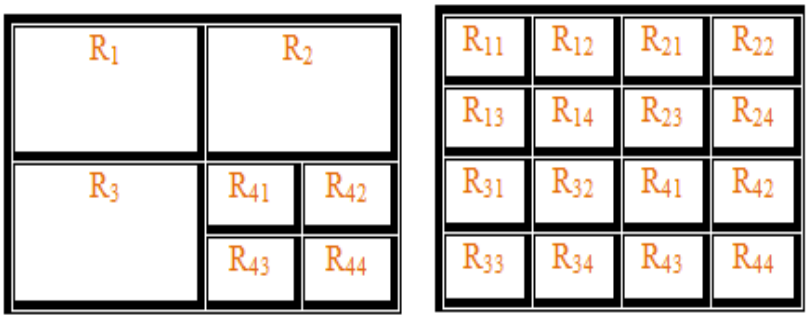

Figure 3- Segmentation

5. Feature Extraction

For this investigation features are extracted as Red _Blue _Green (RGB) color, mean value, standard deviation value, entropy, skewness, and ellipticity are considered for the research work with wavelet with COIFLET analysis. Any kind of research satellite dataset helps in deep analysis and monitoring of a particular region of interest. Every year many research conducted using satellite image monitoring and detection based on ocean monitoring.

6. Classification

For this research Support, a vector machine classifier method is investigated with two Classes Ocean with ships and ocean with oil spills using satellite images. It is a non-parametric method used for classification. The total number of the dataset used is 50 satellite images with classes for classifications. This investigation contains 70 % for training data and 30% for testing data. SVM is used for regression and classification methods. This work represents the SVM algorithm which helps to create a decision boundary or best line that can segregate n-dimensional space into classes, based on this we can easily put the new data point in the correct category in the future. The best decision boundary is called a hyperplane. To create hyperplane, SVM chooses the vector point for the process. These vectors are called support vectors. The investigation is based on two different categories that are classified using hyperplane and decision boundary.

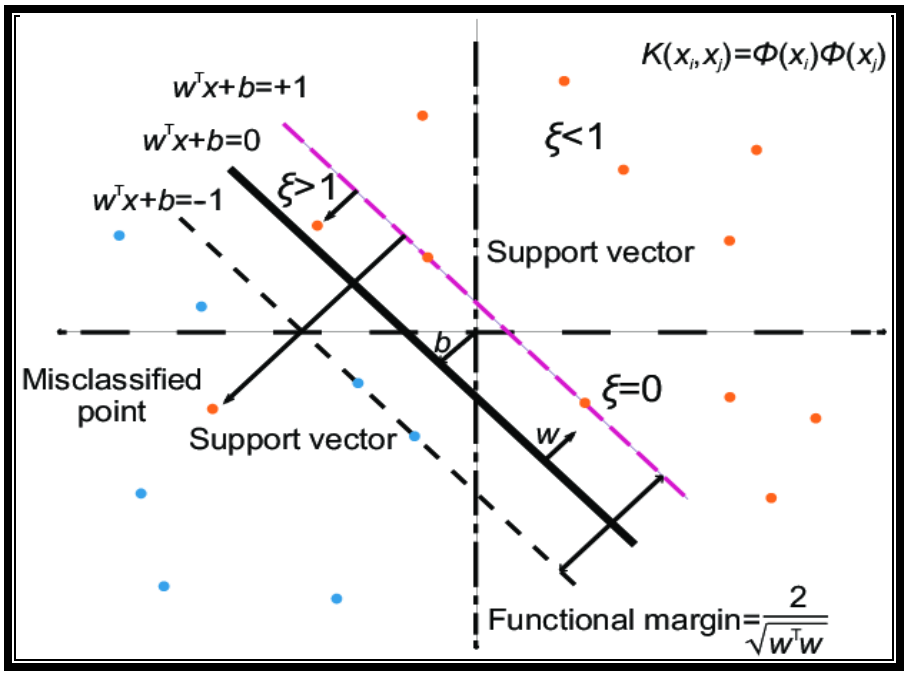

Figure 4- Support Vector Machine Classification

7. Result and Discussion

The result represents satellite data classification using machine learning and image processing methods. It investigates on stages with satellite image preprocessing, segmentation, feature extraction, wavelet analysis, and classifications using image processing methods and machine

learning algorithms. A sample dataset of 50 satellite images for Ocean ship and Ocean oil spill has been collected for investigation.

Table 2: Analysis with SVM classifier for Remote Sensing Image categories classification

SVM Classification for Remote Sensing Image categories classification								
Coiflet1 Analysis								
Features	**R Color**	**G Color**	**B Color**	**Mean Value**	**SD Value**	**Entropy**	**Ellipticity**	**Skewness**
Ocean Ship Accuracy (%)	75	68	75	55	83	52	68	68
Ocean oil spill Accuracy (%)	80	52	68	61	75	82	60	65

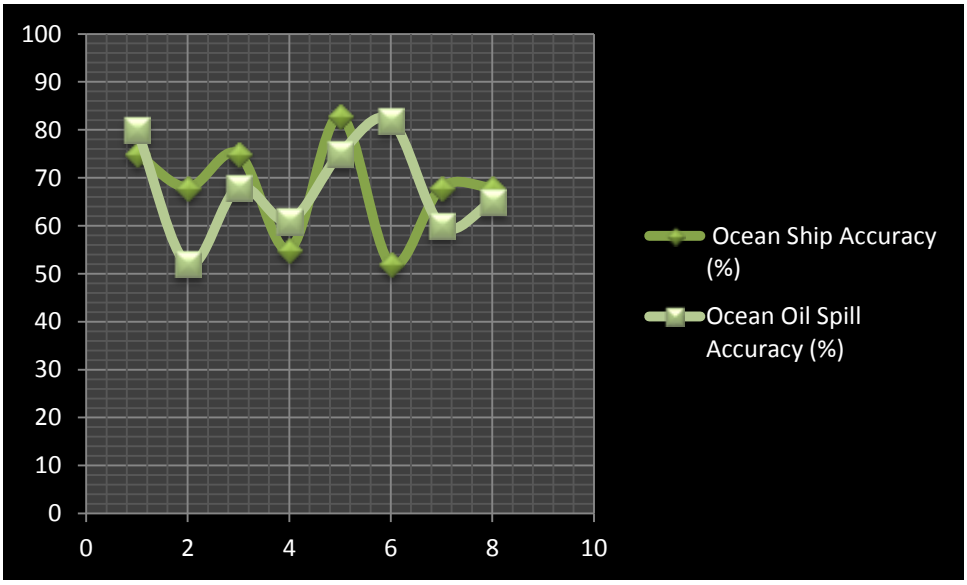

Figure 5- Remote Sensing Image categories classification using Coiflet1 Analysis

Table 2 and figure 5 represents detailed results of remote sensing categories classifications using SVM classifier and wavelet with coiflet1 analysis for satellite image classification for remote sensing image categories classification using features ocean ship and ocean oil spill satellite image. This research help in characterizing the type of satellite image classification for particular classes.

Table 3: Analysis with SVM classifier for Remote Sensing Image categories classification

SVM Classification for Remote Sensing Image categories classification								
Coiflet 2 Analysis								
Features	**R Color**	**G Color**	**B Color**	**Mean Value**	**SD Value**	**Entropy**	**Ellipticity**	**Skewness**
Ocean Ship Accuracy (%)	55	57	77	59	71	55	40	77
Ocean oil spill Accuracy (%)	60	82	53	79	67	70	50	80

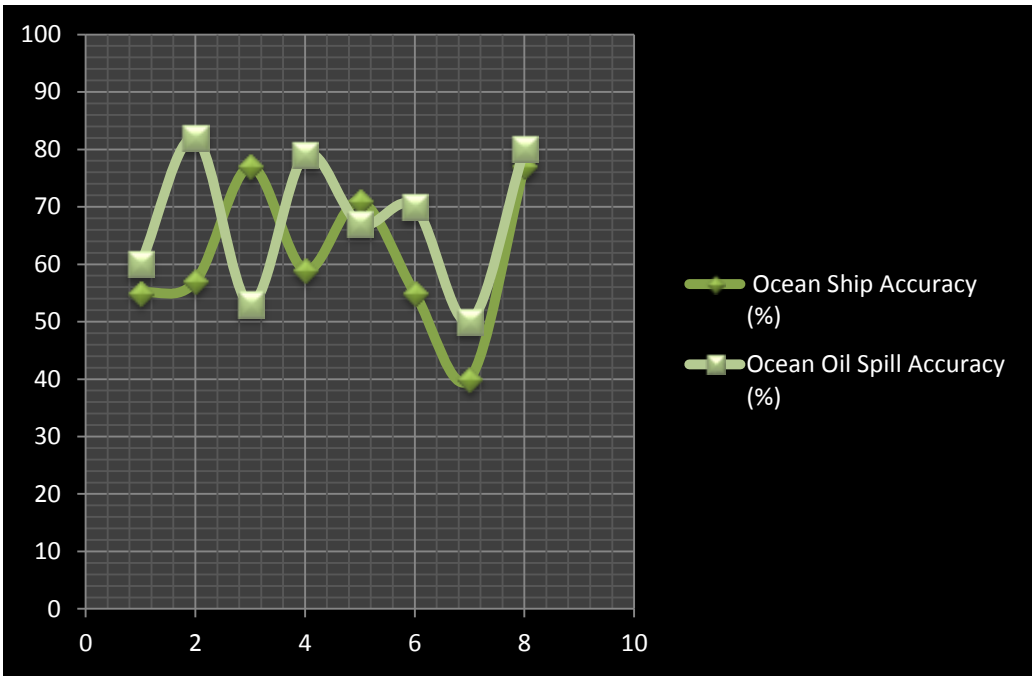

Figure 6- Remote Sensing Image categories classification using Coiflet2 Analysis

Table 3 and figure 6 represents detailed results of remote sensing categories classifications using SVM classifier and wavelet with coiflet2 analysis for satellite image classification for remote sensing image categories classification using features ocean ship and ocean oil spill satellite image. This research help in characterizing the type of satellite image classification for particular classes. To achieve information related to the ocean it is very important to regularly track and monitor the satellite image.

Table 3: Analysis with SVM classifier for Remote Sensing Image categories classification

SVM Classification for Remote Sensing Image categories classification								
Coiflet 3 Analysis								
Features	**R Color**	**G Color**	**B Color**	**Mean Value**	**SD Value**	**Entropy**	**Ellipticity**	**Skewness**
Ocean Ship Accuracy (%)	58	89	51	68	70	54	82	52
Ocean oil spill Accuracy (%)	77	65	44	82	59	55	77	71

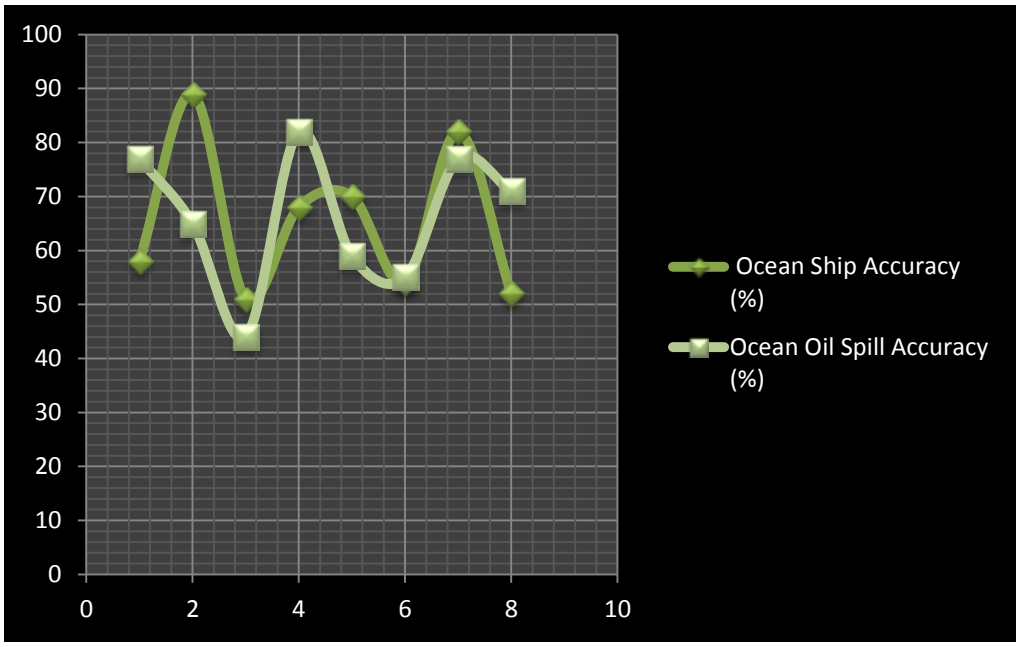

Figure 7- Remote Sensing Image categories classification using Coiflet3 Analysis

Table 3 and figure 7 represents detailed results of remote sensing categories classifications using SVM classifier and wavelet with coiflet3 analysis for satellite image classification for remote sensing image categories classification using features ocean ship and ocean oil spill satellite image. This research help in characterizing the type of satellite image classification for particular classes.

Table 4: Analysis with SVM classifier for Remote Sensing Image categories classification

SVM Classification for Remote Sensing Image categories classification								
Coiflet 4 Analysis								
Features	**R Color**	**G Color**	**B Color**	**Mean Value**	**SD Value**	**Entropy**	**Ellipticity**	**Skewness**
Ocean Ship Accuracy (%)	67	64	70	70	88	60	50	71
Ocean oil spill Accuracy (%)	60	57	76	79	69	75	78	68

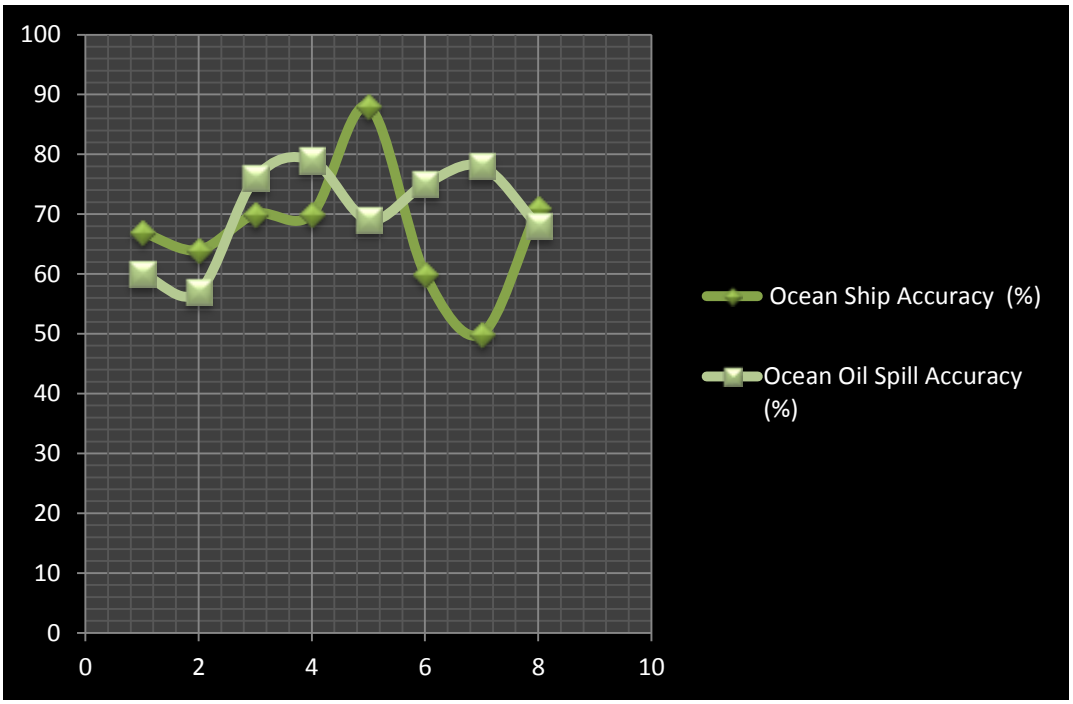

Figure 8- Remote Sensing Image categories classification using Coiflet4 Analysis

Table 4 and figure 8 represents detailed results of remote sensing categories classifications using SVM classifier and wavelet with coiflet4 analysis for satellite image classification for remote sensing image categories classification using features ocean ship and ocean oil spill satellite image. This research help in characterizing the type of satellite image classification for particular classes.

Table 5: Analysis with SVM classifier for Remote Sensing Image categories classification

SVM Classification for Remote Sensing Image categories classification								
Coiflet 5 Analysis								
Features	**R Color**	**G Color**	**B Color**	**Mean Value**	**SD Value**	**Entropy**	**Ellipticity**	**Skewness**
Ocean Ship Accuracy (%)	77	88	60	50	71	60	81	73
Ocean oil spill Accuracy (%)	84	70	97	78	70	50	69	70

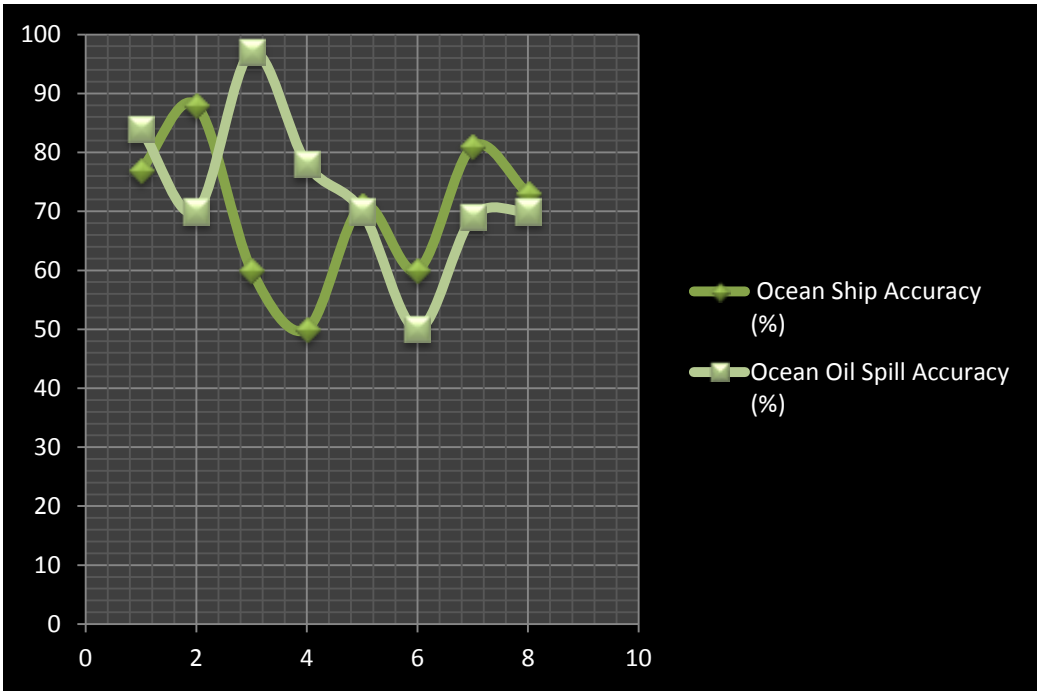

Figure 9- Remote Sensing Image categories classification using Coiflet5 Analysis

Table 5 and figure 9 represents detailed results of remote sensing categories classifications using SVM classifier and wavelet with coiflet5 analysis for satellite image classification for remote sensing image categories classification using features ocean ship and ocean oil spill satellite image. This research help in characterizing the type of satellite image classification for particular classes.

Table 6: Analysis with SVM classifier for Remote Sensing Image categories classification

SVM Classification for Remote Sensing Image categories classification					
Analysis	**Coiflet 1**	**Coiflet 2**	**Coiflet 3**	**Coiflet 4**	**Coiflet 5**
Ocean Ship Accuracy (%)	83	77	89	88	88
Ocean oil spill Accuracy (%)	80	82	82	79	97

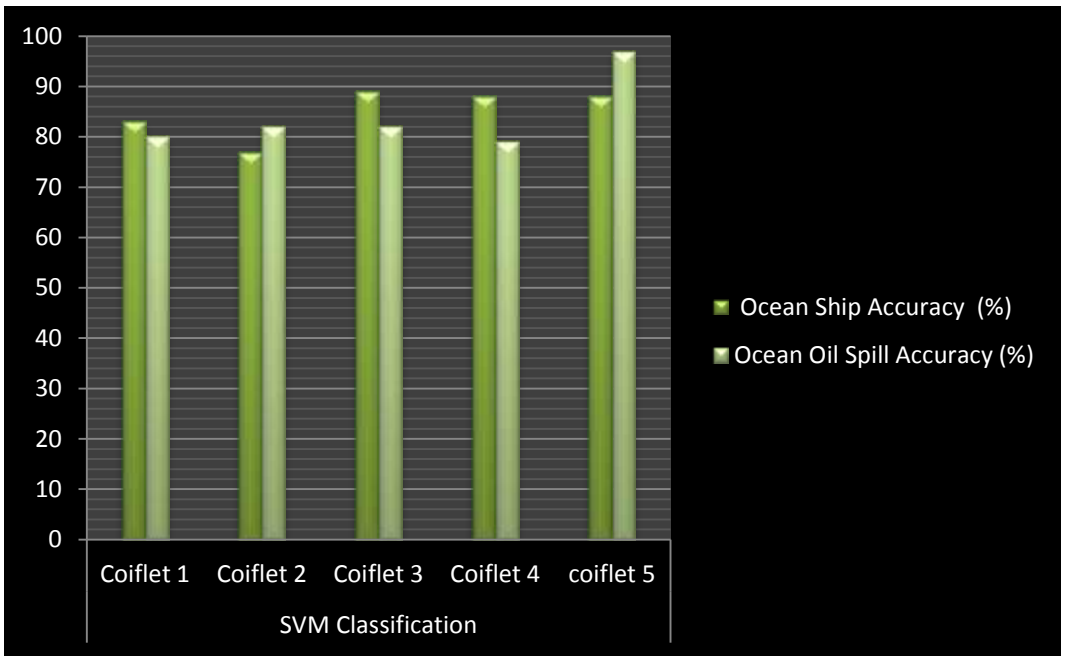

Figure 10- Remote Sensing Image categories classification using COIFLET Analysis

Table 6 represents detailed results of an investigation using SVM classifier and wavelet with coiflet analysis for satellite image. This research help in characterizing the type of satellite image classification for particular two classes such as accuracy of ocean ship and accuracy of ocean oil spills for investigation. The total number of the dataset used is 50 satellite images with classes for classifications. This investigation contains 70 % for training data and 30% for testing data. It represents the SVM algorithm which helps to create a decision boundary or best line that can segregate n-dimensional space into classes, based on this we can easily put the new data point in the correct category in the investigation. When compare with coiflet1, coiflet2, coiflet3, coiflet4, and coiflet5 analysis coiflet5 performs well with an accuracy of 97% of ocean oil spill satellite image characterization compare with other measures.

Conclusion

In this research remote sensing, image categories classification using machine learning methods, and image processing are used. Satellite images are one of the important sources of data collecting all regions and areas around the world. This research work contains an advanced study on remote sensing image categories that are classified and examined using two classes' ocean ship and ocean oil spill satellite images. This research help in characterizing the type of satellite image classification for a particular two-class ocean ship and ocean oil spill. The present investigation results that coiflet5 analysis works well in remote sensing image categories classification with an accuracy of 97% using an SVM classifier. When compare with coiflet1, coiflet2, coiflet3, coiflet4, and coiflet5 analysis with SVM classifier, coiflet5 performs well with an accuracy of 97% of ocean oil spill satellite image characterization compare with other measures.

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