A Review: Classification of Sonar images using neural network approach

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Abstract : In many research areas, intelligent recognition and classification systems gained an important role. The reliability and the success of these systems are depend on the effectiveness of applied data pre-processing techniques and neural networks which can be used for efficient modelling of human's visual system during the recognition or classification of patterns. In this purposed work, Sonar Image Classification System which was developed to simulate human experience in the recognition of underwater shapes by using Pattern Averaging and Back Propagation Learning Algorithm, will be presented. Experimental results suggest that automatic intelligent classification of these shapes may provide more effective researches in oceanic engineering. There are five main phases i want to used in this proposed work .They are image pre-processing, extraction of Side scan Sonar Images from segmented images, feature extraction, classification of five type of Underwater Shape sonar images. For classification neural classifiers in Fast Fourier Transformed (FFT) and WHT or DCT are used. The main aim of the method is to develop a Sonar Image Classification which was developed to simulate human experience in the recognition of underwater shapes.

IndexTerms - MatLab, Nuero Solution Software, Microsoft excel, Various Transform Technique.

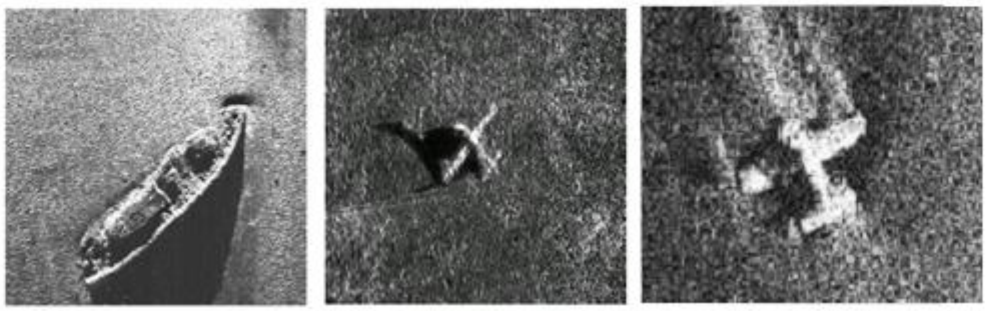
I. INTRODUCTION

In Discovering our world has gained an importance. Oceans are the biggest unknowns of our world. There is a history and treasure lying at the sea floor. In every part of the world, scientific developments have been performed to get more information about them. In oceanic engineering, one of the most important things is experience. Sonar Image Classification System had been developed to get a human experience and vision. Neural networks have an important part in the modeling of human decision making processes to computers. They have been applied in many applications such as automotive, aerospace, medical, robotics …etc. Because of its' success in classification of images, back propagation learning algorithm has been applied to Sonar Image Classification System. In many research areas, intelligent recognition and classification systems gained an important role.

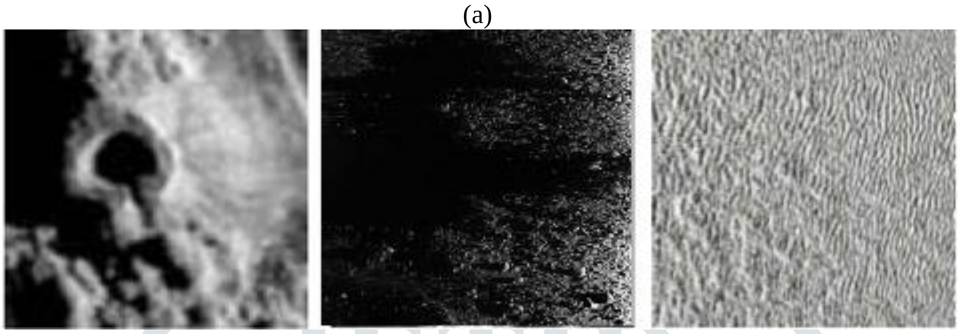
One of the most popular tool for underwater researches is Side Scan Sonars. Side Scan Sonars are used to create an image of sea floor to provide an understanding of the differences in material and texture type of the seabed by using acoustic reflections of pulses. Sometimes, these images cannot provide an efficient information to researchers and scientists to easily recognize them. They are mostly in grayscale or in two colors, and additional noise, such as depth and water pollution of sea floor decrease the quality and visibility of sonar images. But, in spite of all these disadvantages, scienctists are still performing researches and experiments to discover and recognize the depth of the oceans.

However, classification or recognition of the objects that appear in these images is difficult task and needs human experience. But, if we consider the amount of the area that is covered by the oceans, it is more effective to provide automatic intelligent recognition or classification that simulates human experience. Sonar Image Classification System developed to simulate human experience by classifying sonar images, if they are human made wreck (H-M Wreck) or natural underwater shapes (N-U Shapes). Examples of Human-Made wrecks and Natural Shapes can be seen in Figure. This purposed work is organized as the follows: In this purposed work, Sonar Image Classification System which was developed to simulate human experience in the recognition of underwater shapes by using Pattern Averaging and Back Propagation Learning Algorithm, will be presented.

The reliability and the success of these systems are depend on the effectiveness of applied data pre-processing techniques and neural networks which can be used for efficient modeling of human's visual system during the recognition or classification of patterns. Neural networks have an important part in the modelling of human experience and decision making process into computers.



(a)



(b)

Figure1 : Sample Test Side scan underwater Images (a) Ship, Airplane and (b) Volcano, rock,Ripple and send

II. LITERATURE REVIEW

In the past, researchers were dependent on the traditional methods of sonar image classification, which includes various skilled techniques that can only be performed by experts from the field of ocean engineer . Earlier interest in sonar image classification was restricted to the image recognition and was hindered by slow computers with insufficient memory.

From the related work reported so far in the published literature, it is observed that some of the researchers employed neural network for sonar image identification and classification are as follow.

Philipp, F.Schweizer,et.al. "Method and Apparatus for Automatically Identifying target sonar images," UnitedStatesPatent,PatentNo:5,214,744.May25,1993.[11]

This article explains the system developed by the authors to automatically identify targets in sonar images. The proposed method uses three processing systems and two neural networks to identify the target by using highlight and shadow clusters, highlight ridges, shadow troughs, anomalies and background within the sonar image. One of these neural networks uses a threelayer feed-forward network with sigmoid transfer functions, where as the other accepts as an input the spatial allocation of each scan window detected as a high light or a shadow by the first network. Theses neural networks are combined with the Cuer algorithmt or reduce the false alarm rate for each of the three processing systems.

G.J.Dobeckand John C.Hyland ,"Sea Mine Detection and Classification Using Side-Looking Sonar,"inProc.SPIE,Vol.2496,442,Orlando,FL,June1995.[12]

This article describes the Detection Density ACF Approach for detecting and classifying mine-like object sin side looking sonar. The Detection Density ACF Approach integrate seight step stop produce a probability of detection of 0.84 with a false alarm rate of 1.4 false call sper image when applied to a test set of 30 sonar images. The eight step sin include image normalization, adaptive clutter filtering(ACF),selecting the largest ACF output pixels, convolving the selected pixel a mine-size rectangular window, applying a Bayesian decision rule to determine-like pixels, grouping the mine-like pixel sin to objects, extracting object features, and classifying objects as either a mine or a non-mine with an neural network. The results from this approach are comparable to the performance of an expert sonar operator with the same data.

Esther Dura, Gerald J.Dobeck, et.al." Active Learning for Detection of Mine-Like Objectsin Side-Scan Sonar Imagery,"IEEE Journal of Oceanic Engineering, vol.30, No.2 , pp .360-371, April 2005.[13]

Dura and Do beck present an new frame work applicable to the mine counter measure (MCM) problem. The new frame work accounts for the fact that it is unlikely that an appropriate a prior training set is available for operations in general environments. The authors as sume that data gathered from a wide surveillance area is performed by a side-scan sonar (SSS) and that access to small mobile unmanned under water vehicles (UUVs) and or divers that may interrogate sign natures of interest at close range (i.e. with camera so other closer range sensors)are available to determine the corresponding labels (target/clutter).This information yields a set of sign natures and corresponding labels with which a classification algorithm is designed to examine the remaining side scan sonar imagery.

Jin Tian, Weiyu Yu, and Shengli Xie," An Ant Colony Optimization Algorithm for Image Edge Detection,"IEEE World Congresson Computational Intelligence 2008, pp.751-756, Hong Kong, China, June1-6, 2008.[14]

The Ant Colony Optimization (ACO) Algorithm presented by Tian, Yu and Xie was inspired by the natural phenomenon of ants depositing pheromones on the ground for other member sof the colony to follow a favorable path. The ACO algorithm finds the best possible solution of the target problem through a guided search over the 2-D sonar image by constructing the edge information at each pixel location. The "ants" are steered over the edges of the target by the local variation of the image's intensity values. When the ACO algorithm was applied to four testimages, it always out performed the method presented by

Nezamabadi and Pour[15],a previous edge detection approach, in terms of the visual quality of the extracted perimeter information.

Helge Balk, Torfinn Lindem, and Jan Kubecka,“ New Cubic Cross Filter Detector for Multi Beam Data Recorded with DIDSON Acoustic Camera,” Proc .of 3rd Intern .Conference & Exhibition Underwater Acoustic Measurements: Technologies & Results, Nafplion, Greece, 2009. [15]

The authors describe a cubic cross filter to detect and count fish in DIDSON data. The authors first developed the cross filter detector and then extended these filters from one dimension in to cubical running window filter operators, running along the frame, beam, and range dimensions. In order to apply the cross filter to the DIDSON data, an ordinary echo gram must first be generated. The cross filter detect or works by first applying an arrangement of two filters, a fore ground and a back ground filter, followed by a comparator. The fore ground filter improves echoes and the back ground filter reduces noise levels. The output from the comparator is then loaded into an evaluate or which tests the size and shape criteria and sort soutanyun wanted detections. The evaluated or extracts features like perimeter length, width, height, area, and elongation from the clusters and compares the se with user defined minimum and maximum values to separate fi she chose from noise.

III. RESEARCH METHODOLOGY

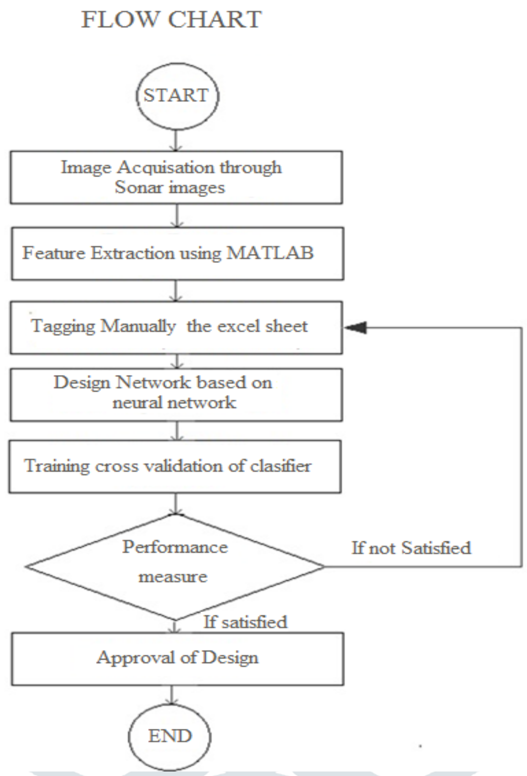


Figure 2:Flow chart

It is proposed to study the classification of four type of fabric defect images Using Neural Network Approaches.. Data acquisition for the proposed classifier designed for the Recognition of four type of fabric defect images. Image data will be Collected from the different- different textile hub .The most important un correlated features as well as coefficient from the images will be extracted .In order to extract features, statistical techniques, image processing techniques, transformed domain will be used.

Computational Intelligence techniques include the following will established techniques.
i) Statistics
ii) Image processing
iii) Learning Machines such as neural network .
iv) Transformed domain techniques such as FFT, DCT, WHT, etc.

For choice of suitable classifier following configuration will be investigated.
i) Multilayer perceptron Neural network.
ii) Support vector machine.
iii) Generalized Feed Forward Neural Network

For each of the architecture, following parameters are verified until the best performance is obtained.
i) Train-CV-Test data
ii) Variable split ratios
iii) Retraining at least five times with different random initialization of the connection weights in every training run.

iv) Possibility different learning algorithms such as Standard Back-Propagation, Conjugate gradient algorithm , Quick propagation algorithm, Delta Bar Delta algorithm, Momentum.
v) Number of hidden layers
vi) Number of processing elements of neurons in each hidden layer.

After regions training & retraining of the classifier, it is cross validated & tested on the basis of the following performance matrix.
i) Mean Square Error
ii) Normalized Mean Square Error
iii) Classification accuracy

In order to carry out the proposed research work, Platforms/Software's such as Matlab, Neuro solutions, Microsoft Excel will be used.

III.RESEARCH OBJECTIVES:

i)To develop an efficient classification algorithm based on computational intelligence approaches, with accuracy similar to that achieved by experienced oceanic engineer .
ii)To increase the classification accuracy use maximum number of side scan sonar images for classification. .
iii)To maintain the correctness & accuracy in the underwater object classification with sonar images characteristics even though the input images are contaminated by known or unknown noise.

IV. CONCLUSION

This paper demonstrated how to using artificial neural networks(ANN)could be used to build accurate side scan sonar image classifier and iam also try to achieved result more accurate and reliable.

V. ACKNOWLEDGMENT

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