International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 04 Issue: 03 | Mar -2020 ISSN: 2582-3930

A Building of Fish Concentration Maps Based on Sonar Data Using Deep Learning Neural Network and Fuzzy Logic

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Abstract -This paper proposes a powerful technique for acquire topographic lake map with fish fixation dependent on the consequences of a keen sonar information preparing. Fuzzy logic uncommon usage for guess of sonar information is utilized. The science contraption of Fuzzy logic gives the probability of adaptable alteration approximator under states of issue to be unraveled when working with information of high dimensionality. A calculation for acquiring fish fixation maps dependent on the consequences of keen handling of the sonar information is likewise proposed. The calculation depends on the accompanying advances: input outline division into covering squares, squares preparing utilizing convolutional neural network YOLO v2, and combining separated bouncing boxes around one item. Test results for fish discovery and fish focuses map building are displayed.

***Key Words*:**sonar data, fish concentration, maps of lakes, fuzzy logic, CNN

1.INTRODUCTION

Present day instruments for identifying submerged items with use of ultrasound (sonars) have gotten across the board in taking care of different applied issues. An exceptionally particular class of sonars intended to examine the help of the lake base and quest for fish are called reverberation sounders. At present, there is a wide scope of sonars from various providers. The most renowned sonars are delivered by Lowrance, Raymarine and Humminbird. Also, most present day sonars have a GPS module. Such gadgets are called chartplotters. Chartplotters fix echogram information to X, Y directions of Mercator projection (WGS-84/UTM facilitate framework). The idiosyncrasy of echograms is that GPS information is refreshed a lot less every now and again than ultrasonic sounding information. Along these lines, every individual demonstration of acoustic sounding can't be topographically fix.

Generally, different techniques for spatial addition are utilized to develop a topographic guide of the base from a discrete arrangement of estimations. Geostatic estimation techniques, for example, kriging, require a lot of calculation, however permit us to acquire interjections that are ideal in a specific sense. With regards to the handling of sonar information, it is essential to take note of a component that information is fragmentary, constrained, and regularly insufficient to get dependable measurable assessments. The nearness of vulnerability of this sort is an extra contention for delicate estimations. In the event that we view the obscure parameter as ceaseless, at that point we can draw an equal between the decision about the estimation of the obscure parameter and the guess of the capacity.

Applying a fuzzy logical approximatorfor developing a base topographic map follows from a relationship. The arrangement of profundity point estimations can be considered as an arrangement of information about the properties and structure of the water body. Every acoustic sounding can be depicted as far as formal rationale. The arrangement of the best apparatus for picture acknowledgment dependent on profound learning neural systems permits us to discuss the utilization of the reverberation sounder for tackling new applied issues, for example, traveler, biological, nature insurance, search errands.

We propose novel way to deal with create fish focus maps dependent on sonar information utilizing CNN and that can adjust to various condition conditions. The introduced way to deal with recognize angles or different articles on sonar pictures depends on the accompanying steps: 1) partition of the information picture into covering squares; 2) squares preparing utilizing CNN YOLO v2, and 3) combining extricated bouncing boxes around one item. After fish discovery, to build maps of the dissemination of highlights along the lake, we propose a novel technique for building the estimation of GPS-referenced CNN results dependent on the first execution of fuzzy logic.

II. FISH DETECTION USING CNN

Profound AI frameworks give ideal execution to protest discovery and order difficulties. Article identification frameworks need to devote following commitments: exactness, exact extraction of locales of intrigue (RoIs) on pictures, and their grouping with negligible deviation and speed. Generally run of the mill picture handling frameworks (optical character acknowledgment framework, fire location video frameworks and others) incorporate the accompanying advances: preprocessing, highlights extraction, grouping, and setting preparing [5, 6]. AI frameworks reproducing the human cerebrum, can take care of recognition and characterization issue tantamount to or far and away superior to the human cerebrum. Simultaneously, AI frameworks are quicker in critical thinking than the human cerebrum. Presently, CNNs are progressively utilized for picture preparing in different down to earth regions. In contrast to customary systems, CNNs give a diminished number of removing parameters and as an option of entire picture preparing and can process just separated component map,

which considers the picture topology and is stable to relative change.

CNN Darknet-19 has 19 convolutional and five max-pooling layers. It can recognize 9000 classes. At preparing time, rather than fixing the information picture size, the system was changed in each couple of cycles. After ten bunches YOLO v2 arbitrarily picks another picture measurement size. Since this model down-inspected by a factor of 32, was pulled from the accompanying products of 32: {320, 352, … , 608}. Information picture goals were resized to that measurement and keeps preparing. Since the sonar moves during the examining of the lake along a perplexing direction with an exchanging speed, it is important to play out the strategy of echogram normalizing. For this reason, a calculation to change over the echogram to metric organizes along the length of the sonar track was created. Because of the relating extending/pressure of the echogram, all objects of the acoustic reverberation might be spoken to on a solitary scale (fig.1).

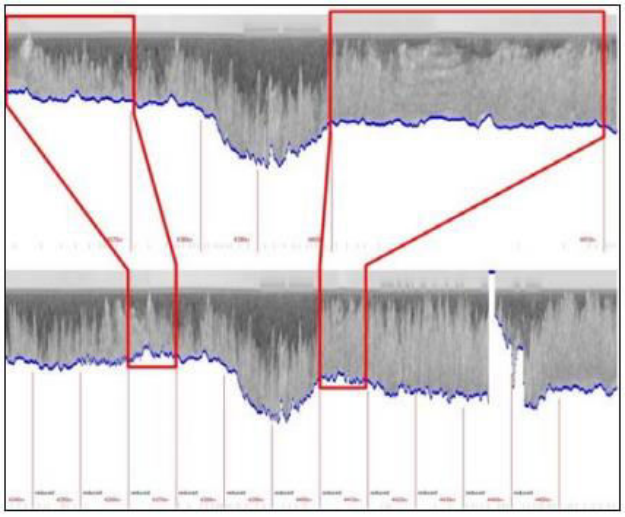

Fig 1. Example for echogram normalization process

The information pictures scaled before CNN handling. This implies the modest articles (angles) can be missed. To take care of this issue, we chose to process patches of reverberation picture for definitely little article location and along these lines link the yield results with performing post preparing activities. We propose a powerful calculation for fish recognition on sonar pictures dependent on the following advances: input outline isolating into covering squares, squares handling utilizing CNN YOLO v2, consolidating extricated jumping boxes around one item.

$$IOU = \frac{B_1 \cap B_2}{B_1 \cup B_2}, \qquad (1)$$

III. MAPS BUILDING BASED ON FUZZY LOGIC

The possibility of "fuzzy logic approximator" application to base geographical guide building or for building highlight map depends on following similarity: The get together of isolated profundity estimating might be displayed as information based frameworks including data about body water highlights and structure. The reverberation discovery is portrayed with formal rationale as:

IF coordinates X, Y AND time t THEN depth D, water temperature T and other parameters.

On the off chance that separation between two focuses estimating administrator is L(p,pi) at that point, as relationship of creation framework, water body piece information multiplies on neighbour parts in understanding unimodal capacity has most extreme incentive in indicated point. We propose participation work in good ways from nodal guess guide pi toward point p as:

$$\varphi(p, p_i) = \frac{1}{L(p, p_i)^n} \mid L(p, p_i) < L_{limit}, \qquad (2)$$

In case application defuzzification by COG (Center Of Gravity) method, desired feature value for unknown point p can be calculated as:

$$p.z = \frac{\sum_i \varphi(p, p_i) p_i.z}{\sum_i \varphi_i}, \qquad (3)$$

Fuzzy logic estimation, as opposed to conventional guess strategies, can consider a few predicates and assemble complex conditions. For instance, we can figure guess condition which permits profundity as well as data of structure of the lake base for redress sudden profundity change which may emerge by base items (antiques). On the off chance that directions X, Y AND base structure without curios, THEN profundity D, water temperature T, and different parameters. We likewise proposed changes to the defuzzification techniques to dispense with the disparity of the impact of close by focuses. This was finished by space discretizing and supplanting the impact of the standard gathering, remembered for a solitary discretization interim, because of one guideline with the most extreme enrollment work at point p. An intriguing method to take out the impact of the hubs area lopsidedness is the precise discretization.

The key contrast between fuzzy logic estimation and conventional strategies for guess is the probability of considering a few predicates. For instance, we figure a guess condition that ought to incorporate both the profundity data and the base structure data so as to dispense with the impact of profundity hops from bottomed ancient rarities.

IV. RESULTS

For Yolov2 we assemble our own preparation set including around 80 000 articles. We chose ground truth bouncing boxes around RoIs physically utilizing VOTT (Visual Object Tagging Tool) programming [15]. VOTT can make ground truth facilitates and convert them into Yolo group. Utilizing this program, we furthermore made explanations records. We anticipated five classes of items: "fish", "grass", "school of fish", "predator", "base fish". Fig. 2 portrays ground truth confines VOTT.

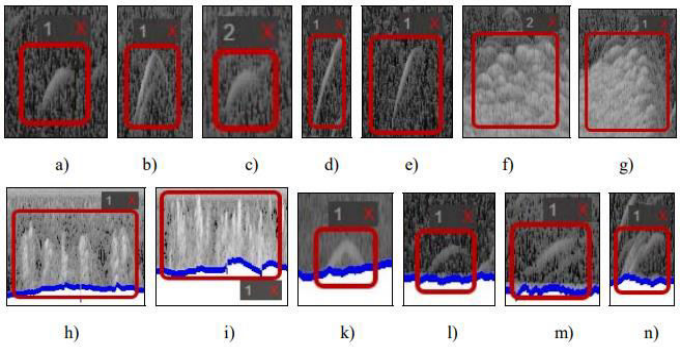

Fig 2. Ground truth bounding boxes in VOTT: a,b,c)"fish"; d,e) "predator"; f,g)"school of fish"; h,i)"grass"; k,l,m,n)" bottom fish"

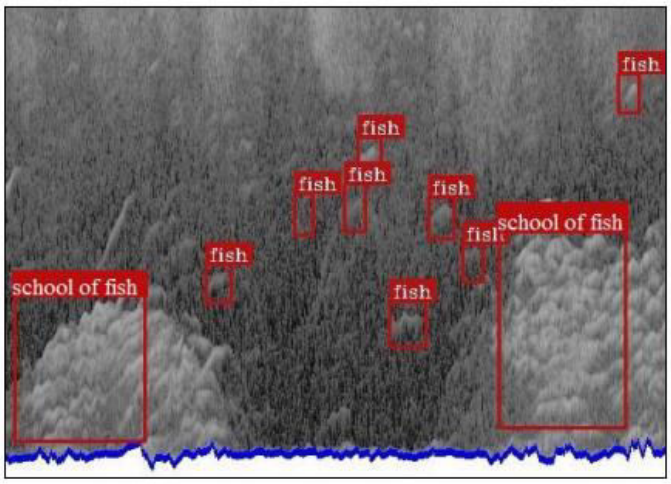

Fig 3. Fish detection and classification results

Exhibited calculation has an exactness of 72.1% and a low level of bogus positive outcomes if there should be an occurrence of fish nearness. In any case, our methodology, as appeared in Fig 4, can't appropriately recognize classes "grass" and "school of fish", particularly on the off chance that comparable shapes.

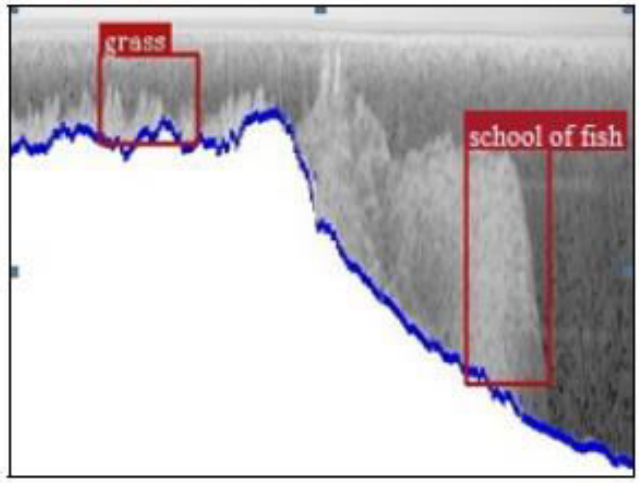

Fig 4. Example for incorrect classification

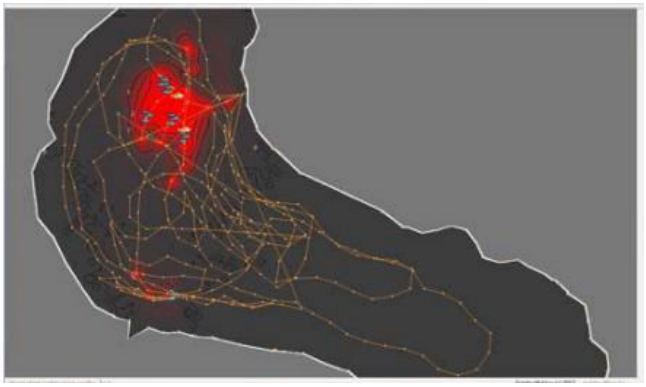

Fig 5. Example for map of fish concentration

V. CONCLUSION

Strategy for acquiring topographic maps of lakes, maps of fish fixation and a guide of predator area dependent on the consequences of shrewd sonar information handling is introduced. The displayed calculation depends on sonar pictures for the recognition of classes "fish", "grass", "school of fish", "predator", "base fish". The calculation incorporates following advances: input outline isolating into covering squares, blocks processing utilizing CNN YOLO v2, and consolidating removed bouncing boxes around one object, fish fixation map building. To develop maps of the dissemination of features along the lake, we propose a novel technique for developing the guess of GPS-referenced CNN results dependent on the first usage of fuzzy logic. Our technique has a precision of 72.1% and has low level of bogus positive outcomes in the event of fish nearness. To build the exactness, we have to essentially extend the dataset for CNN preparing.

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BIOGRAPHY

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