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Flood Loss Detection and Analysis using Image Processing

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Abstract - *Floods are one of the most devastating natural disasters worldwide, which lead to loss of human life, damage to property, destruction of crops, and loss of livestock and worsening of health conditions. Manual detection of flood loss and analysis becomes infeasible and time-consuming at times when flood victims are in urgency of relief. Hence, solution to this problem is using detection of flood based on image processing, which involves Image Acquisition, Image Pre-Processing, Detection using SSIM AND MSE Image processing algorithms. The proposed work aims at making the system available for early analyzation of flood loss.*

Key Words: Image Processing, Binary Threshold, Structural Similarity Index.

1. INTRODUCTION

Flood is an overflow of water on dry ground, flooding is generally caused when a volume of water inside a water body, for example, a lake, overflows outside it. Now and again if a dam breaks, it out of nowhere discharges a lot of water. The outcome is that a portion of the water goes to land, and 'floods' the region. Numerous waterways are in a channel, between stream banks. They flood when the quality of the waterway makes it stream past the banks. This is progressively regular at twists or wanders. Flood harm can be forestalled by moving ceaselessly from places that flood. Notwithstanding, individuals have since quite a while ago preferred to have their homes and organizations close by water since water is useful for farming and transport and in different manners. Floods are likewise caused because of inappropriate administration of channels. Precipitation is the most widely recognized reason. Snow liquefy is likewise a reason for flooding. Tidal waves and Tempest Flood are less normal ways that floods occur. Waterfront Flooding is another normal reason for flooding, and this is brought about by low weight frameworks or tempests.

Flood contributes a key role in wrecking regular and man-made territories. In August 2019, a damaging immersion happened in India which put down the downfall of many individuals and eradication of properties. Flood mapping utilizing remote detecting methods has the value of helping specialists to have a careful outline of working out the measure of harm, and it lightens the crisis techniques, the proposed work aims at making the automated systems easily available for the government authorities who would give the work of assessing and analyzing using SAR (synthetic aperture radar) remote sensing satellite image , the steps involved in the analysis process are Image acquisition ,Image pre-processing (reducing noise from the image , conversion from RGB to Grayscale and histogram equalization) then the system will analyze the area being flooded by comparing two images of pre and post flood event .

The aim of this project is to measure the extents of areas being flooded from given input images of before and after flood event by using image processing techniques. A segment-based harm discovery strategy was proposed. The execution of the methodology was done utilizing OpenCV which works well for Image processing computing, which further is helpful for government in releasing early relief fund to the flood affected victims.

2. LITERATURE SURVEY

In [1], Synthetic aperture radar (SAR) pictures can be an important information source in earth perception undertakings. The most remarkable quality of the radio detection and ranging picture is its ability to enter the cloud and residue. In this manner, checking earth in shady or stormy climate can be accessible by this sort of dataset. Over the most recent couple of years by improving AI strategies and advancement of convolution neural systems in remote detecting applications we are looking with amazingly excessive improvement in characterization assignments. Right now, utilize double polarized VV(vertical transmit and vertical receive) and VH(vertical transmit and horizontal receive) backscatter estimations of Sentinel-1 and Shuttle Radar Topography Mission (SRTM)s Digital height model (DEM) dataset in a proposed convolution neural framework to deliver a land spread guide of an overpowered region while happening.

In [2], inquire about paper proposes a productive approach to perceive and outline territories by utilizing TerraSAR-X symbolism. Initial, a TerraSAR(synthetic aperture radar)-X satellite picture which were captured while a flood occasion was happening to outline immersed regions, Multispectral land satellite picture was utilized to distinguish water bodies before flooding, in engineered opening radar symbolism, the water bodies and flood areas show up in dark ,in this way, the two objects were classified as one. To defeat this disadvantage, the class of the water bodies were removed from the Landsat picture and afterward deducted from that separated from the TerraSAR-X picture. The rest of the water bodies spoke to the flooded areas. Item situated classification and the Taguchi strategy were actualized for the two pictures. The Landsat pictures were arranged into three classes, in particular, urban, vegetation, and water bodies. On the other hand, just water bodies were separated from the TerraSAR-X picture. The classification results were then assessed utilizing a disarray network.

In [3], scientists propose programmed catastrophic event recognition especially for avalanche and flood location by executing the convolutional neural system (CNN) in extricating the element of fiasco all the more successfully. CNN is strong to shadow, ready to acquire the trait of fiasco satisfactorily and above all ready to beat misdetection or misconception by administrators, which will influence the adequacy of catastrophe alleviation. The neural system comprises of 2 stages: preparing stage and testing stage. We made preparing information patches of pre-calamity and post-debacle by cutting and resizing aeronautical symbolism got from Google Earth Flying Symbolism.

In [4], authors proposed a two different preprocessing approaches were being applied to the pictures pre separating harmed structures. Initially, the three TSX pictures were changed into a Sigma Nothing ($\sigma 0$) esteem, which speaks to the radar reflectivity per unit region in the ground go. After the change, the backscattering coefficients of the pictures were between - 35 dB and 25 dB At that point, an upgraded Lee channel (Lopes et al., 1990) was applied to the SAR information to lessen the dot clamor. To limit the loss of data contained in the SAR power pictures, the window size of the channel was set as 3 × 3 pixels. The creator proposed a technique in which they initially harmed and washed-away structures were recognized from the progressions of backscattering coefficients. Next, the normal incentive for the change factors in the layout of each building was determined and used to pass judgment on the harm status of the structure. At that point the subsequent arrangements were contrasted and a GIS harm map delivered by visual translation. The proposed strategy additionally evaluated the tallness of the structure as indicated by the length of delay in SAR pictures.

3. METHODOLOGY

The method of damage detection which works on the base of the number of connected pixel components from the processed image is shown in fig 1 below.

Firstly, the pre-event and post-event satellite images of the area in which flood has occurred are required, which are sharpened using the unsharp technique to produce an improved image of pre-event and post-event image so that the images are free from any noise, are not blurry. Now, these pre-processed images are selected and applied morphological techniques to get a binary image so that we can find out the connected components in the image. Then these connected components are calculated based on the grouping of the image pixels. All pixels with the same intensity values are considered to be connected. After finding out the difference of pixel intensity values in the pre-event and post-event images and comparing both images we can recognize whether the flood has s occurred or not.

Step 1: Pre and Post of the flood event Image Acquisition: In the initial step of the proposed approach, the pre-event and post flood event images are taken as inputs. The pre flood event pictures are caught before happening regular flood while post-flood event images are caught in the wake of happening common disaster.

Step 2: Sharpening of both Images: In the wake of applying pre- and post- flood event pictures, this progression creates a sharp picture using "imsharpen" Open CV work. This capacity restores a redesigned version of the grayscale or (RGB) input picture, where the image highlights, for instance, edges, have been honed using the unsharp veiling technique, it also highlights edges and fine details in both the images.

Step 3: Edge-Thinning sharpened of both Images: Subsequent to getting a honed picture from the above advance proposed procedure apply edge diminishing procedure on that. This progression creates a diminished picture from honing picture using Open CV work with 'slight' activity. Diminishing is essentially a morphological activity which is using to take out or expel chosen front line pixels from both images.

Step 4: Counting connected components: In the wake of diminishing the pictures, the system ascertains mark associated segments to know the all outnumber of associated segments in the picture. This progression computes associated parts from diminished pictures by using Open CV SSME and MSE algorithms. This capacity restores a marked network containing names for the associated segments in a paired diminished picture.

Step-5 Comparison and Result: Finally in the wake of getting associated segment of both pre and post flood event images s we just contrast with them, if the distinction of diminishing an edge of earlier and post picture is more prominent than the edge esteem then the picture is perceived as destructed degree in any case not destructed degree.

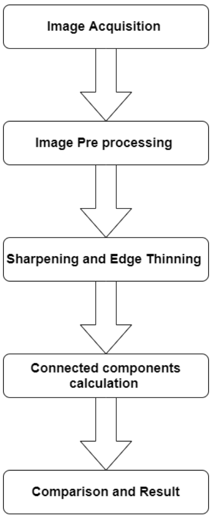

Figure 3.1 Flowchart of the methodology

4. EXPERIMENTAL RESULTS

In the wake of applying all capacities complete quantities of destructed degrees are acquired from above strategy. Further by utilizing all out number of destructed degrees we discover precision of procedure for that we figure:

Our method gives accuracy of 80%, which indicates that system is to an extent of 80 % giving accurate result detecting flood if there is flood it is detecting if flood hasn't occurred it hasn't detected, this system gives precision about 100 % tells us about when flood happened and how often detected is correct, this system gives about 71 % of recall tells us about when flood happened how often it is detected.

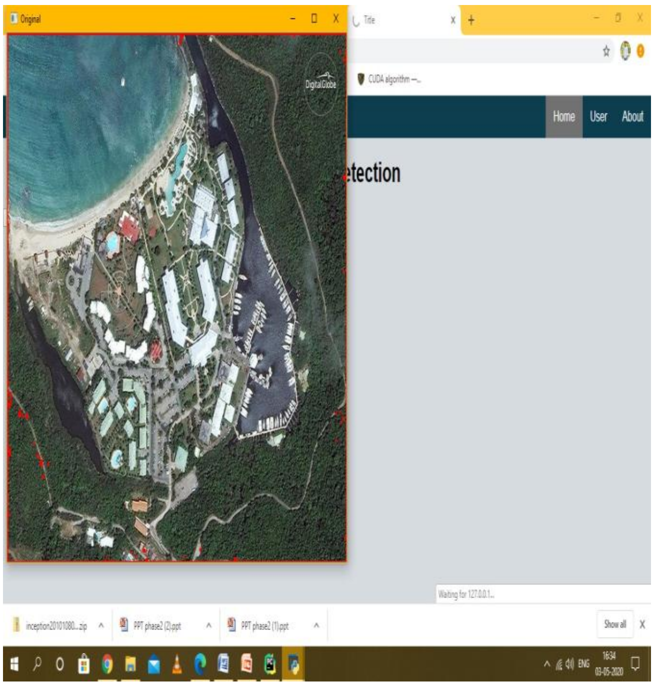

Figure 4.1: Pre-flood image

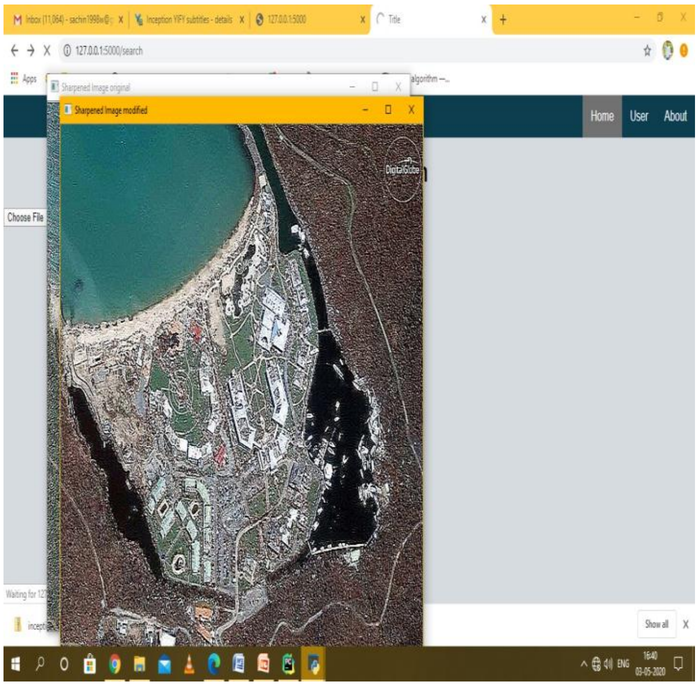

Figure 4.2: Post-flood Sharpened Image

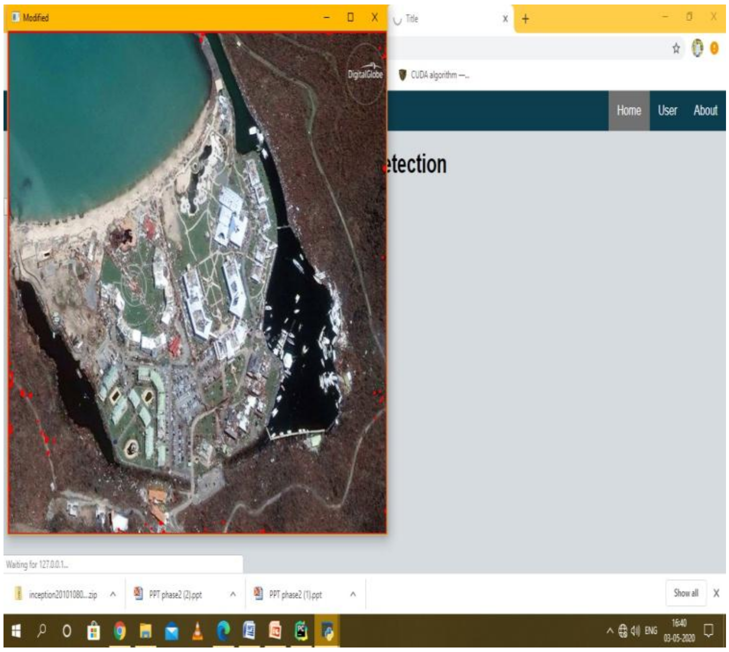

Figure 4.3: Post flood image.

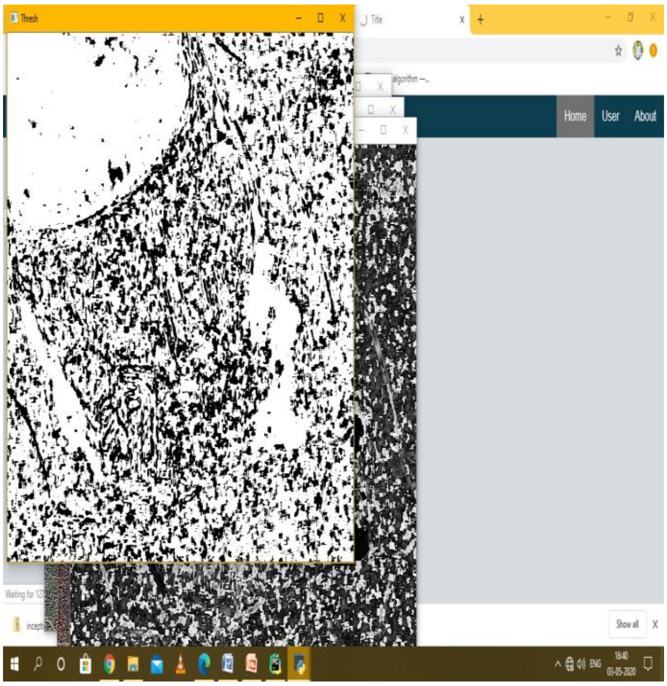

Figure 4.4: Threshold the Difference Image.

Figure 4.1shows how pre flood event image has been acquired into the system

Figure 4.2 shows sharpened image of post flood event which increases contrast between bright and dark regions to bring out features

Figure 4.3 shows how post flood event image has been acquired into the system

Figure 4.4 shows the threshold image of difference of both pre and post flood event image which can be used in segmenting regions

5. CONCLUSION

In view of examination and execution estimates done in the methodology segment, this part closes the proposed system of perceiving the harmed degree from given information sources using 'OpenCV' capacity, for example, improvement, edge, diminishing and name associated segment. Also, as the investigation period has come in progressively broad viewpoints in like manner no examination work stops. Each work has a couple of disservices or has the degree of future work or both. In this way, in this part degree of future work has in like manner been analyzed.

The above approach was implemented on 40 images that include 20 pre images and 20 post images treated as test images which were given as an information source to the system. The proposed methodology can gives accuracy of 80%, which indicates that system is to an extent of 80 % giving accurate result detecting flood if there is flood it is detecting if flood hasn't occurred it hasn't detected, this system gives precision about 100 % tells us about when flood happened and how often detected is correct, this system gives about 71 % of recall tells us about when flood happened how often it is detected.

The proposed system has achieved an approximately 80% accuracy rate. The proposed system does not require any training or a classification which is a very much time-consuming task.

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