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A Study on Typhoon Eye Extraction from Cloud Imagery using Flat Maxima Enhancement

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Abstract:- A typhoon cloud is a time-dependent cloud, its action is based on climatic changes. Depending upon climatic changes, the visuality of typhoon clouds will be reduced. To increase the visuality of typhoon clouds, the flat maxima enhancement technique has been adopted. In general, the image enhancement technique has been done by reducing the noise or improving the image's global contrast. Compared to the existing enhancement techniques, the flat maxima enhancement technique provides better enhancement results, absolute typhoon cloud detection, and extraction of typhoon eyes. The above-proposed method can be done by using MATLAB software. The Typhoon eye shows the density of the typhoon cloud. As density increases climatic changes will be high, and for low density normal climatic conditions are obtained. The above-proposed method can be used in remote sensing applications.

Keywords:- *Typhoon Cloud, MATLAB, Prediction, Typhoon Eye.*

I. INTRODUCTION

Typhoon is a monsoon which appears often in equatorial region. Typhoon prediction and identification involves six steps. First step will be adequate warm condition in sea, secondly hot condition in outer area, thirdly increasing moisture, and fourth step will be formation of a typhoon eye due to low pressure at the center of cloud. Fifth step will be pressure level increases at outer region of the typhoon cloud. Sixth step will be decrease in cyclone shift. Formation of typhoon eye at the middle of the cloud will have low pressure fifteen percentage less compared to pressure at the outer surface. Classification of typhoon involves three types, Typhoon, Severe typhoon, and Super typhoon. Speed of typhoon will be 64-79 knots or 91-149 kmph. Speed of severe typhoon will be 80 knots or 92–150 kmph. Speed of super typhoon can be indicated as 100 knots or 120 – 190 kmph. Above records are observed from Japan Meteorological Agency (JMA). But United States Joint Typhoon Warning Center (JTWC) represents speed of typhoon will be at-least 130 knots or 150-241 kmph based on average time interval. Record of JTWC is higher than JMA. According to JMA, occurrence of tropical cyclone can be represented in a different colours with respect to density and classification, they are violet alert indicates very strong typhoon in the speed of more than 105 knots or 194 kmph. Red alert indicates strong typhoon occurs at the speed of 104 knots or 118 – 156 kmph. Yellow alert indicates typhoon occurs at a speed of 64 – 84 knots or 118 – 150 kmph. Green alert indicates severe storm will appear at a speed of 48 – 63 knots or 89 – 117 kmph. Light blue alert appears at a speed of 34 – 47 knots or 62 – 88 kmph. Thick blue alert indicates tropical depression occurs at a speed of less than 33 knots or 61 kmph. Above reports are generated by JMA with JTWC for 18 countries along with Philippines and Hong Kong are combined and they are scared by occurrence of typhoon every year.

II. LITERATURE REVIEW

Kim et.al [1], in this paper, typhoon vulnerability in the region of South Korea has been analyzed and used the information regarding typhoon MAEMI. The proposed method of this research work is based on the parameter metrics to predict the loss of typhoon cloud damage and typhoon vulnerability methods are implemented to reduce the loss. Typhoon causes more economic loss and financial risk, especially in the South Korean region. Many insurance companies and governments intend to produce typhoon hazard determination methods directed at the reduction of loss economically. Developing a typhoon risk assessment model plays a vital role in risk evaluation every year. Many research works are concentrating on developing a vulnerability function to reduce the economic loss caused by typhoons. To take the above situation as a concern, this paper created vulnerability functions which are used to indicate damages held naturally and analysis has been done by using the information provided by insurance companies.

Zhou et.al [2], typhoons are the most common climatic hazard every year, especially in the equatorial region. To overcome climatic hazard situations, perfect identification of typhoon levels should be made. Perfect grouping of typhoon levels is identified by using the structure used in neural networks and a graph-convolutional long short-term memory network has been proposed. The above framework was designed for images of the Himawari-8 satellite from the years 2010-2019. Graph convolutional network (GCN) efficiently performs a spatial arrangement of satellite images from time to time. Here efficiency and identification of typhoons have been obtained perfectly when compared to other models. Achieved prediction accuracy of typhoon cloud level by using above method is 92.35% and for super typhoons reaches 95.12%. The above method efficiently identifies the detection of eye and coiled cloud belts. When compared to other models, the above method has more strength.

Zhao et.al [3], this paper aims to provide efficient typhoon eye detection in real-time for remote sensing images using a deep learning algorithm. The initial step of a deep learning algorithm is to identify the invisible instructions in remote sensing images that contribute essential details to identify accurate typhoon information. The proposed method provides better simulation results in detecting accurate typhoons. Total detection accuracy can be indicated as 99.43%. The moderate time taken to identify a typhoon is 6 ms, completely detecting the typhoon eye.

Wang et.al [4], in this paper, an improved optical-based fuzzy clustering method has been proposed to predict typhoon clouds by using advanced 10.8-micron geo synchronous radiation imager. Fuzzy C-means clustering has been used for the identification of typhoon clouds. Here the combination of the optical flow method and Fuzzy C-means has been used with the LAGRANGIAN method to predict the type of typhoon cloud. Obtained results show that effective prediction and clear visuality of typhoon clouds especially on the outer surface and optical flow method has improved the predicting accuracy of typhoon clouds. Standard parameters like PSNR, relative SD, and RMSE have been obtained effectively by using the optical flow method.

Zhang et.al [5], in this paper, a study has been proposed typhoon hydrometeors simulation and calculation of five microphysics schemes present in weather research and prediction method due to occurrences of the super typhoon in 2014. Chinese satellite FY-3B has been used to evaluate hydrometeor simulation. Based on microwave radiometer imager, parameters like emission index and, scattering index are used to evaluate the calculation of microphysics scheme implemented in liquid level and frozen level hydrometeors. By using weather research reports, typhoon precipitation has been obtained in increased and decreased rainband values. National Severe Storm Laboratory (NSSL) with a microphysics scheme has obtained values closer to microwave radiometer imager. NSSL provided an effective histogram by using scattering and emission index than the microphysics scheme. Lucas-Kanade optical flow has been used to identify the horizontal distribution of hydrometeors in a typhoon, obtained ~ 10 to 20 km intensity. The above calculation helps to implement weather models for hydrometeor distribution in complete typhoon systems for all regions.

Jun–Heng et.al [6], this paper aims to provide a proposed model for regenerating the directions and shape of typhoon clouds in satellite imaging systems. It is very difficult to predict the direction and shape of a typhoon cloud concerning methods available in a satellite imaging system. Initially, by using accurate visuality of typhoon clouds based on the satellite imaging system, the prediction of typhoon clouds has been done effectively. Regeneration of the direction and shape of a typhoon cloud has been obtained by using cloud pattern recognition. Here the proposed method shows an easy way to find the accurate visuality of typhoon clouds in order to increase the performance of typhoon shape regeneration. Observed typhoon cloud direction over regions and regeneration of shapes appeared in recent years provided satisfactory results. The above method can be implemented for effective analysis and earlier prediction of typhoon occurrence.

P.Shrivastava [7], this paper aims to provide efficient detection of clouds with respect to satellite images. In the remote sensing field of research, the detection of clouds plays a vital role. Based on the weather conditions, due to more heat radiation, accurate detection of cloud with respect to boundary levels are not obtained effectively. This paper provides efficient techniques for the detection of cloud and the software used for the proposed techniques is MATLAB.

III. RECOMMENDED METHOD

Here flat maxima enhancement technique has been proposed. The flow of recommended method could be pictured below,

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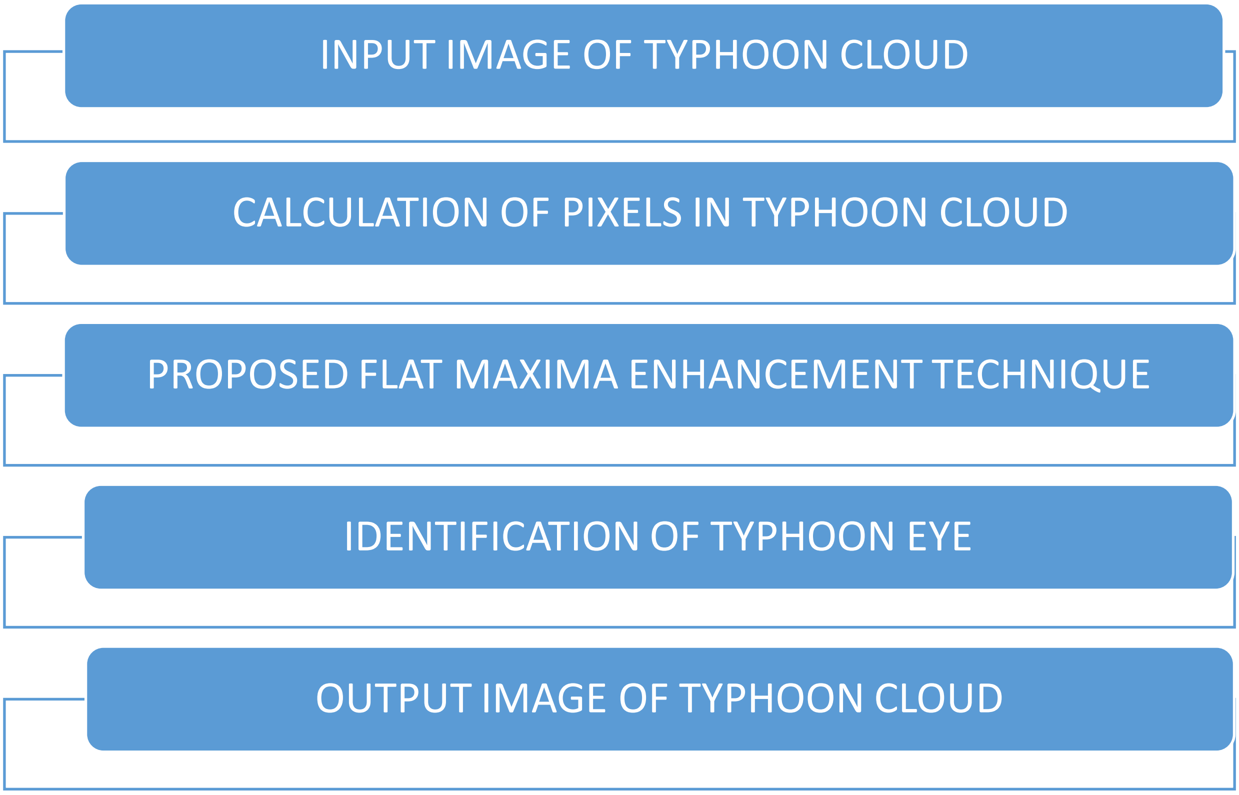

Fig 1 Flow diagram of proposed method

Here, an initial image of a normal typhoon cloud has been taken for the implementation of the flat maxima enhancement technique. In this technique, the calculation of pixels has been done for the typhoon cloud to represent the pressure level inside and outside of the surface. In the calculation, the starting point of the typhoon cloud has been detected and represented, force of the typhoon cloud can be indicated by the pressure level in the region of the middle and in the outer surface.

Due to low pressure in the middle of the typhoon cloud leads to the formation of a typhoon eye and it is represented with the mark of a yellow color circle. Above mentioned enhancement technique provides extraction of typhoon eye efficiently and it improves the visuality of clouds with a better contrast level. Pixels mark with the circle such that the typhoon eye will low-pressure level when compared to the pressure level at the outer surface. MATLAB software and inbuilt function have been used to provide better enhancement resulting in an effective indication of typhoon eye. The proposed flat maxima enhancement technique can be extended for future research work like data compression.

IV. SIMULATION AND RESULTS

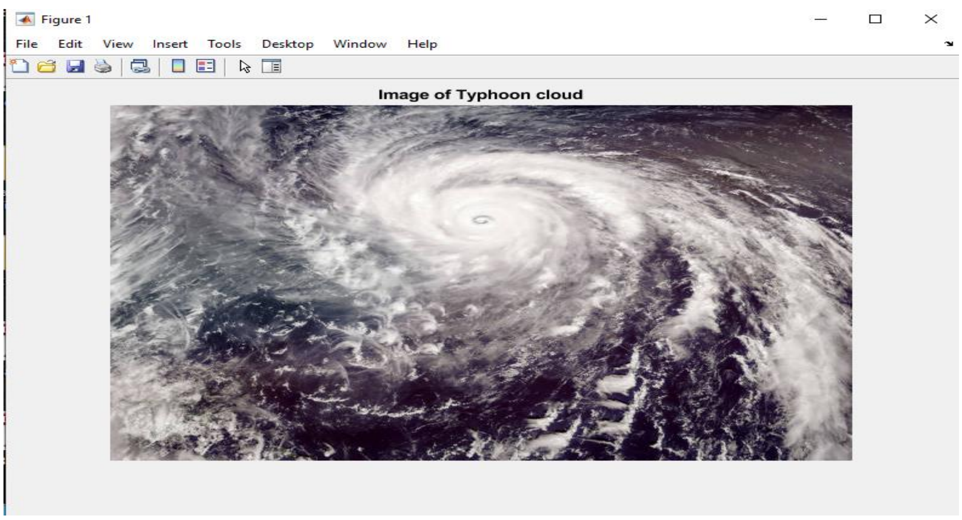

Fig 2 Input Image of a Typhoon Cloud

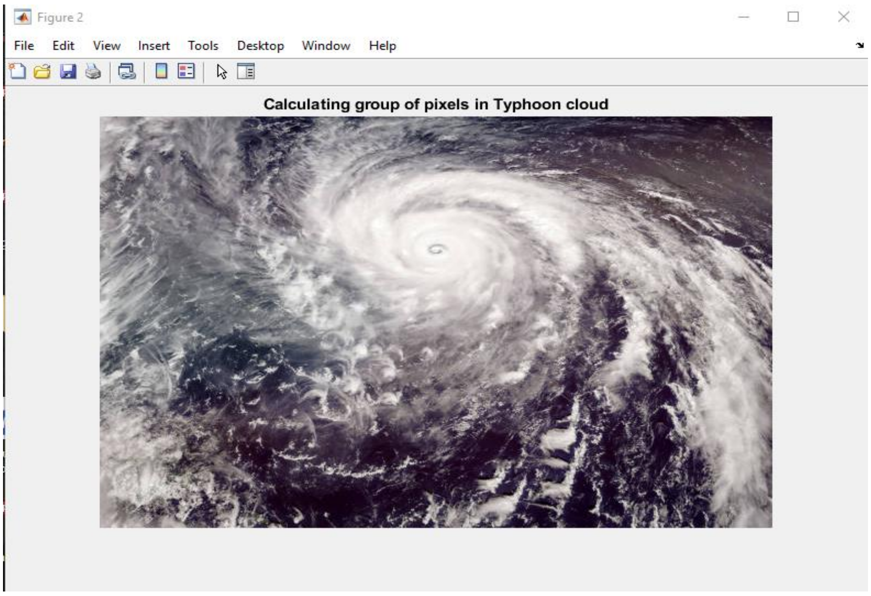

Fig 3 Calculating group of pixels

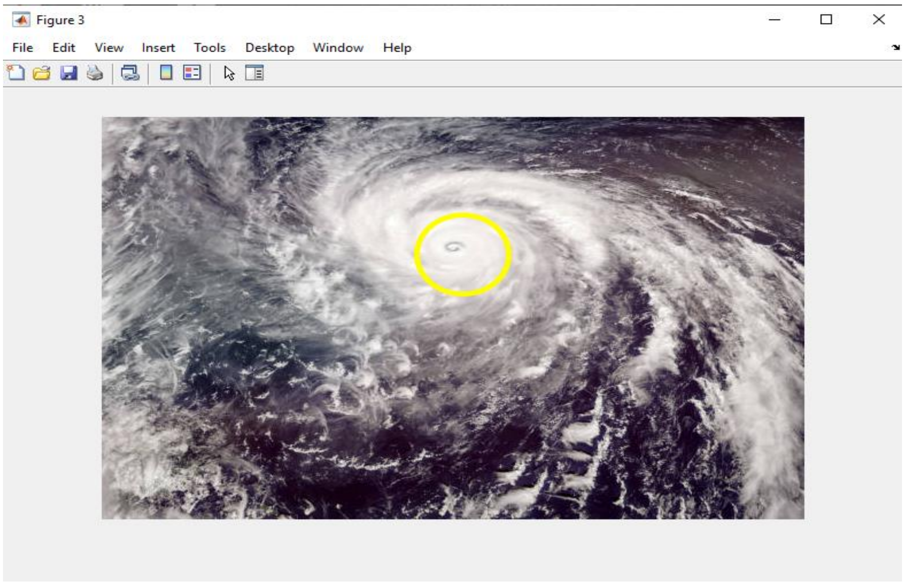

Fig 4 Identification of Typhoon eye

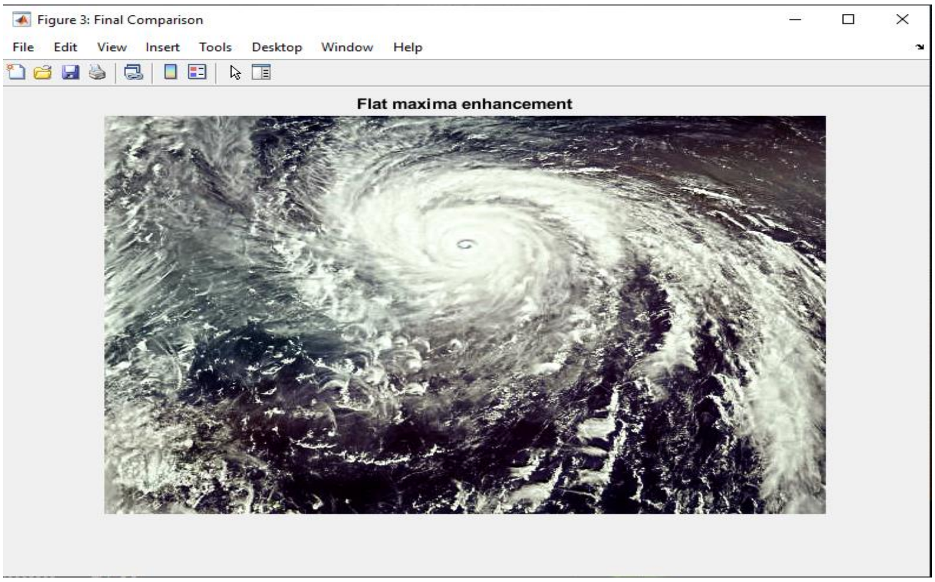

Fig 5 Output of Flat maxima enhancement technique

V. CONCLUSION AND FUTURE WORK

The proposed flat maxima enhancement technique provides effective enhancement results and the formation of typhoon eye has been indicated clearly, obtaining a better contrast level of typhoon cloud. A better result has been provided by using MATLAB software. Future research work can be extended for the proposed data compression method with hardware implementation.

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