

ASSESSMENT OF LANDSLIDE PREDICTION USING SATELLITE IMAGE PROCESSING (DIGITAL IMAGE PROCESSING)

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Abstract:

Assessment of suspicions related to the landslides dislocation prediction is necessary for civilizing the landslide in the early hours warning systems. To save life of people in mountainous area from it is very important to warn them early. So I proposed a system which will provide the solution , it will takes the satellite images from Bhuvan, SAS Planet ,Google Earth etc of the prone areas then those images get processed and with the help of machine learning algorithm it is possible to detect upcoming threat of landslide in large area more accurately. It will also use rainfall data in the prone areas. With the proposed work it will be possible for us to predict landslide in area for which we have satellite access and rainfall data access. This work presents a landslide prediction by using satellite images and method based on SVM, neural network and fuzzy approach in order to increase the prediction of landslide and safer route suggestion. Aim of the proposed work to warn administration or people so that they can take necessary actions to life, environment & economic loss.

Keywords: Sound frequencies, Plant growth, frequency generator, Digital image processing, Machine learning, etc.

I. Introduction

In the phase of hazard assessment and hazard relief, efficient role is performed by the Landslide inventory mapping (LIM). Still work is performed in last year but there is scope for improvement in correctness of the mapping system. It indicates that the knowledge of remote sensing systems and geography information systems have a extraordinary benefit for the compassion study of landslide areas influence parameters. The objective of this study is to find areas where landslides may occur in the near future by using satellite imaging data and thematic-map data related to landslide areas with GIS (geographic information system) techniques and safer route suggestion.

In most cases the occurrence of a landslide is originated by the loss in equilibrium of the soil mass due to changes in one or more parameters mainly due to heavy rainfall & Earthquake, which contribute to leaving the mass itself stable. [1-2]

II. Literature Survey

Landslides are an progressively more important apprehension in a globe of growing whether instability, and also there are huge amount of hard work to progress the prognostic knowledge with the use of diverse range of techniques to advance landslide monitoring methods [1, 2]. Landslides repeatedly occur without any obvious caution. Penalties are disastrous in conditions of living beings sufferers. Governments are consequently paying attention to collaborate with researchers to notice landslide and moderate their belongings. So far away, plenty of practical investigation is paying attention on using physical preprocessing technique various forms of landslides methodologies. [3-5]

As until the time long-established by theories, the approach to handle the danger of landslides is to plan the scrupulous amount and sort of their spatial possibility in relative to their incidence within a specified known location. Therefore, this is more often than not term as vulnerability mapping. This is in general collected of diverse range of aspect such as taming parameters, landslides category, stoppage mechanism and the treatment of exaggerated locations. Consequently, research of landslide vulnerability model need to take in to account those tinted factors. The assortment of various techniques and training parameters need to consider types of landslides, examination stages, research region features and accessibility of databases .In addition to this, landslides of any kind, the vulnerability is to be observed and categorized separately because diverse range of landslide danger nearby particular individuality associated to unusual threshold circumstances base on the calculating parameters.[5-10]

Currently, in existence there are multiple categories of landslide in the study of survey, in the range of easy to very difficult. There, it incorporates the deep-seat, fall, topple, rotational, flows, lateral spread, complex, shallows and conventional landslide in the midst of different other. Landslide is characteristically hutted due to usual incline a failure that drops overwhelmingly. These hazards usually pose a grave threat to lives, properties, environment, and infrastructure. Considering the various studies, landslides are particularly occurs in hilly and vertical areas in long-drawn-out period of strong rainfall actions. As a result, rainfall grows the whole force in the top soil, and the variation in top soil force is tremendously changeable because of the hydraulic conductivity, topographic form, and extra soil property. Adding together to soil corporal property, land-cover change due to anthropogenic parameters also has an effect on the speed and spatial dispersion of landslide. above all, forest elimination, unsuitable earth uses the practice and crop growing on brittle mount and vertical slope are among the chief trigger of collective actions .[10-14]

All the way through the preceding decade, landslide vulnerability model paying attention towards the assortment of scholar about the globe, on the other hand, landslides motionless comprise a worldwide hazard. Moreover, numerous methods and techniques exist for

susceptibility mapping. Therefore, there are varieties of qualitative approaches to quantitative models. The qualitative approach is mostly based on trained persons view, and they take account the degree of frequencies, active mappings, Boolean logics, fuzzy logics . On the other hand, the quantitative approach is developed on statistical examination and deterministic studies. Furthermore, there is in existence the next further group of approaches that are recognized as semi-quantitative, and they incorporate analytical hierarchy (AHP), the heuristic models and spatial multi-criteria evaluations (SMCE). Surrounded by the extremely current year, another category of model is identified for modeling landslide vulnerability. [15-16]

The study focuses on the variety of models that are extensively compare to know the vulnerability all the way through the globe. Qualitative model and as well as data-driven model name as statistical approaches are explore and functional to know landslide through proportional examination. Accordingly, it was accomplished that map which is developed were accurate. By investigating qualitative and data-driven approaches, it was ascertaining as a result data-driven methods develop objective outcomes and induces the bias at the same time as giving weights to training parameters. They acquiesce the higher purpose and producible results in association with qualitative models.[10-12]

Past theories are concerned with landslides vulnerability mappings which also compares different data-driven methods which also includes multivariate and bivariate mechanisms . Diverse proportional theories indicated that multivariate methods performs superior than vicariate models. Most probably, the susceptibilities examination with multivariate statistic examines the connection between landslide spatial distributions and calculating parameters. Additionally, the vicariate statistic analysis compares separately each habituation parameter with the landslide occurrences. Consequently, forces are applied to training parameters based on landslides density. Furthermore, within current theories on landslide susceptibility, statistical models were applied in assessment with some traditional techniques.[4][7]

Furthermore, for susceptibility study, various studies completed a wide-ranging evaluation among data-driven model and deterministic model. Characteristically, deterministic methods generated a minor delineation in modeling landslide vulnerability as compare to data-driven model .Currently; the deterministic model stated quite capable methodology in modeling landslides vulnerability. On the other hand, the deterministic method is in need of wide-ranging soil databases and they are not good for big locations or where there is small data.[3]

Present studies reveal that diverse methods are compared and observed vulnerability across the world. Nonetheless, very little relative investigation was prepared for current and novel GIS-based approaches, predict landslide vulnerability particularly for Africa. The appliance of recent technique to predict special prospect of landslide is necessary in various African locations because the advanced accuracy of vulnerability map may manipulate land administration, preparation and defense policies in mounting country. Moreover, it is extremely functional to examine the relative analysis between the wide-ranging methods to attain outstanding result and sensible outcomes for vulnerability mappings. Thus, the comparison of method help to emphasize the recompense and boundaries of methods in generating landslide vulnerability map .

Furthermore, this study evaluated and compared the results using different statistical estimators including the receiver operating characteristics (AUROC), root mean square error (RMSE), accuracy and precision.[17-18]

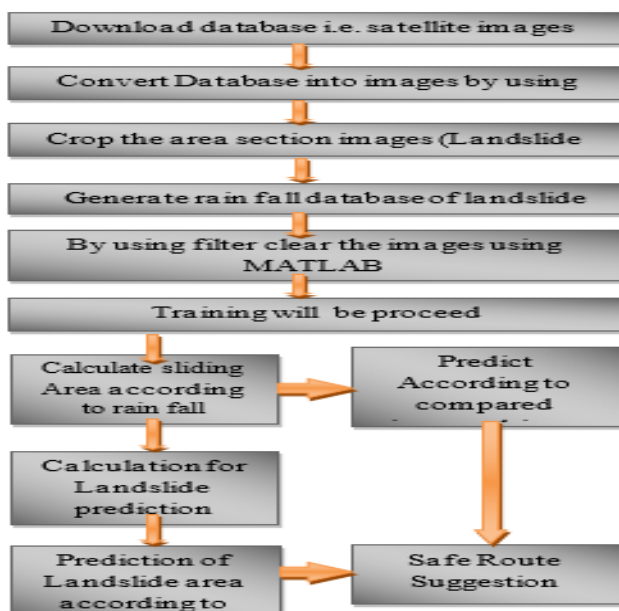
III. System Architecture

First and foremost step is to identify required sample. Our basic required samples are satellite images of landslide area & rainfall database of that area. To know where exactly we can get such types of samples we have to do some survey. After that through various tools we can get our required sample showing landslide and rainfall database. To obtain our required sample we can use some online tool such as Bhuvan, Google Earth and government websites. Then we have to process our sample to perform further operation on it. After all we have to do actual experiment on processed samples then observe and analysis and repeat the process to desired outcome. We can use various algorithms or combination of two or more Machine Learning algorithm as a part of experiment. There is one more factor which can affect our outcome is vertical limit. For that we have to process the image to get vertical limit of that area.

A. Procedural Details:

- Download satellite images from Bhuvan, SAS Planet ,Google Earth.
- Process downloaded satellite images.
- Rainfall Database till the day.
- Train the system on the basis images & Rainfall Database.
- Apply the Different Calculations according available images and rainfall database.
- According to train database prediction of landslide at various levels.

Figure 1. Proposed System Architecture



B. Algorithms Use

Implementation of the Machine Learning algorithms will validate the accuracy to the work. Machine learning is technique use for data analysis which automates analytical model building. System will be trained from earlier data, recognize patterns and make decisions with least human intervention. It is the understanding of computer algorithms that enhance without human intervention through past experience and by the use of earlier data. Machine learning algorithms build a system based on earlier sample data, called as "[training data](#)", in aim to make predictions or decisions without being unambiguously written to do so

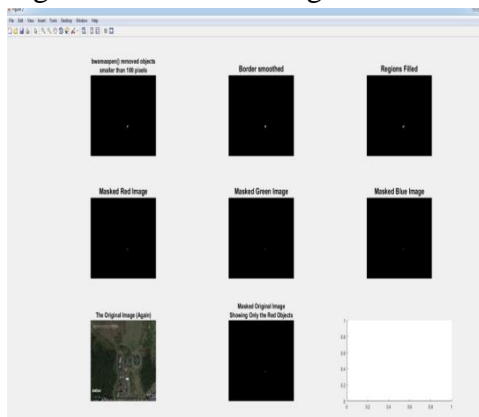
IV. Objectives and expected results

1. The main purpose is to provide the landslide prediction system.
2. Landslide detection will carried out on satellite images captured by bhuvan, SAS Planet, Google Earth, etc.
3. Third objective aim would to compare various images of prone area after heavy rainfall for training purpose
4. Download Rainfall database of landslide prone area
5. There will be observations and measurements are used to develop new calculations which will use to predict land slide.
6. Record keeping for all the results will be established.
7. Start training system with data set.

V. Implementation of image processing on Satellite captured images

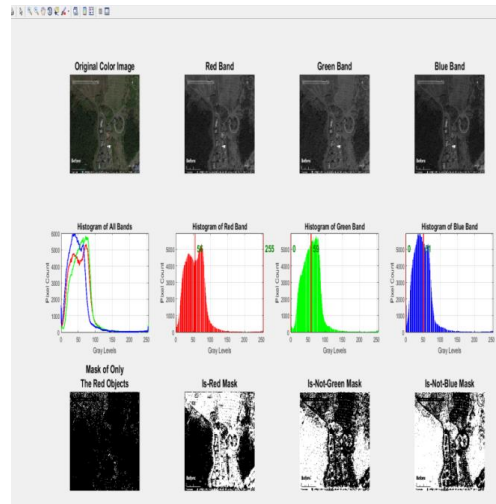
A. Color Masking

Figure. 2 Color Masking



B. Plotting Histogram

Figure. 3 Histogram



VI. Usability and Scope

With the help of satellite imaging we are predicting landslides in this approach. The advance in the technology is the satellite itself will give alert to the landslide & provide safe route suggestion. That will increase the percentage of prediction.

VII. Conclusion

With the use of satellite image processing we can predict landslide before it happens and also we can suggest safer route in landslide prone areas. Eventually we can take corrective measures to save the life of people.

References

- Duan, G., Niu, R., Ling, P., *et al.*: ‘A landslide displacement prediction research based on optimization parameter ARIMA model under the inducing factors’, *Geomatics Inf. Sci. Wuhan Univ.*, 2017, **42**, (4), pp. 531–536.
- Conte, E., Donato, A., Troncone, A.: ‘A simplified method for predicting rainfall-induced mobility of active landslides’, *Landslides*, 2016, **14**, (1), pp.1–11.
- Wu, X., Zhan, F.B., Zhang, K., *et al.*: ‘Application of a two-step cluster analysis and the apriori algorithm to classify the deformation states of two typical colluvial landslides in the three gorges, China’, *Environ. Earth Sci.*, 2016, **75**, (2), pp. 146–153.
- Jiayin He, Haijun Qiu, Feihang Qu, Sheng Hu.: ‘ Prediction of spatiotemporal stability and rainfall threshold of shallow landslides using the TRIGRS and Scoops3D models’ *Catena* 197 (2021) 104999
- Xiaoping Sun, Peng Zeng, Tianbin Li, Sheng Wang, Rafael Jimenez, Xianda Feng, Qiang Xu. :’ From probabilistic back analyses to probabilistic run-out predictions of landslides: A case study of Heifangtai terrace, Gansu Province, China’ 280 (2021) 105950 1-16

- Janusz Wasowski, Fabio Bovenga. : ‘Remote Sensing of Landslide Motion with Emphasis on Satellite Multitemporal Interferometry Applications: An Overview’ B978-0-12-396452-6.00011-2.
- Andrea Ciampalini , Federico Raspini, Silvia Bianchini,William Frodella, Federica Bardi, “Remote sensing as tool for development of landslide databases: The case Study of the Messina Province (Italy) geodatabase”,2015.
- Ahmad Nor Ikhwan Masazhar#, Mahanijah Md Kamal “Digital Image Processing Technique for Palm Oil Leaf Disease Detection using Multiclass SVM Classifier” masazhar2017.
- SotiriosA.Tsaftaris,1,* Massimo Minervini,2 and Hanno Scharr3 “Machine Learning for Plant Phenotyping Needs Image Processing” Minervini_TRPLSC2016.
- Shogo Nagano1, 2, Shogo Moriyuki1, Kazumasa Wakamori3, Hiroshi Mineno3, 4, Hirokazu Fukuda1, 4* “Leaf-Movement-Based Growth Prediction Model Using Optical Flow Analysis and Machine Learning in Plant Factory” 2019.
- Mohsen Niaziyan 1,* and Gniewko Niedbała Machine “Learning for Plant Breeding and Biotechnology” agriculture-10-00436
- Efthimia Mavridou, Eleni Vrochidou, George A. Papakostas * , Theodore Pachidis and Vassilis G. Kaburlasos “Machine Vision Systems in Precision Agriculture for Crop Farming” jimaging-05-00089-v2
- Margaret E. Collins* and John E.K. Foreman “THE EFFECT OF SOUND ON THE GROWTH OF PLANTS” Vol. 29 No. 2 (2001) – 8.
- Md. Emran Khan Chowdhury1, Hyoun-Sub Lim2* and Hanhong Bae1te “Update on the Effects of Sound Wave on Plants” Res. Plant Dis. 20(1) : 1-7(2014)
- I. Khait1 , R. Sharon3 , R. Perelman1 , A. Boonman2 , Y. Yovel2,†, L. Hadany1,† , * “The sounds of plants – Plants emit remotely-detectable ultrasounds that can reveal plant stress” eember 28, 2018.
- Jihye Jung1,2, Seon-Kyu Kim3, Joo Y. Kim4, Mi-Jeong Jeong4* and Choong-Min Ryu1 “Beyond Chemical Triggers: Evidence for Sound-Evoked Physiological Reactions in Plants” 30 January 2018doi: 10.3389/fpls.2018.00025 jung2018.
- KATHERINE CREATH, Ph.D. (Optical Science), Ph.D. (Music),1–3 and GARY E. SCHWARTZ, Ph.D “Measuring Effects of Music, Noise, and Healing Energy Using a Seed Germination Bioassay” Volume 10, Number 1, 2004, pp. 113–122,107555304322849039.
- Adnan Zahid1 , Hasan T. Abbas1 , Aifeng Ren1,2, Ahmed Zoha1 , Hadi Heidari1 , Syed A. Shah1 , Muhammad A. Imran1 , Akram Alomainy3 and Qammer H.