

AN INTEGRATED APPROACH WITH GIS AND REMOTE SENSING FOR LANDSLIDE HAZARD ZONATION

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ABSTRACT :

Landslides attain specific significance because of their widespread occurrence resulting in great miseries to public due to both, direct and indirect consequences. Their occurrence becomes more vexatious because of unpredictability in both time and space. For the safety of life and property, we need to overcome the problem of geohazards and hence Hazard Zonation is necessary. The Landslide Hazard Zonation of an area aims at delineating the landslide potential zones and at ranking them in order of the degree of hazard from landslides.

An integrated approach of remote sensing and Geographical Information Systems (GIS) is highly useful in evaluation, management and monitoring of natural hazards. Routine use of remote sensing data and its analysis of a hazard prone area help in monitoring the changes in surfacial feature. The digital image processing techniques enable the user to get the desired information in a more reliable, quicker and easier way. The goal of this study is to generate a landslide zonation map using GIS (Geographic Information System) and remote sensing based methods. Use of satellite imagery has been incorporated in mapping the lineaments as a result of which are projected to better characterize the landslides of the Chamoli area in the NW Himalayas. The repeat pass remotely sensed images can be compressed using the wavelet decomposition and the reconstructed images are obtained. The application of wavelets necessarily reduces the speckle noise and redundancies associated with the satellite images. Difference and ratio maps are then obtained from the wavelet reconstructed repeat pass images and based upon proper threshold values, changes associated with the lineaments can be well established. Based upon the changes in lineaments and using the image map, the landslides in the study area have been determined. Using GIS module, integration of the past landslide data, lineaments and the geological information have been attempted to evaluate the risk in the study area.

A novel approach based on a simple and efficient algorithm is proposed to generate a landslide susceptibility map from satellite imagery, DEM (Digital Elevation Model) and existing toposheet map of the area. The landslide distributions are mapped by extraction of features from the satellite images. In order to analyze landslide susceptibility efficiently, the landslide distribution map and the other existing maps are digitized and processed with the help of integration of terrain information by GIS on a medium scale (1:50,000). Five categories of controlling factors for landslides as aspect of slope, geology, road cutting, topographical index and landuse are defined, because those factors are said to have relevance to landslide characteristics and are easy to obtain their sources. Aspect of slope and topographical index are calculated from DEM. Geology, road network, vegetation etc. are extracted from the geological map. Each category is divided into 4 to 6 classes by its unit or value. The weight value for landslide susceptibility is calculated from the density of the area of landslide blocks in each class.

Finally, a map divided into five susceptibility zones is produced using the weight value of all controlling factors using the method of multi objective decision making process and then each susceptibility zone is evaluated by comparing with the distribution of each controlling factor class.

The project goal includes:

- 1) Successful lineament detection on satellite imagery and producing a tectonic map.
- 2) Emphasis has been given on the spatial edge detection techniques.
- 3) Landslide data are plotted as per there geographical location and effort has been made to find their relationship with the major thrusts and faults and the stress pattern of the area.
- 4) For better visual interpretation, DEM has been constructed.

BIO-DATA :



SANGRAM GANGULY.

Sangram Ganguly is a final year Masters student in the Department of Exploration Geophysics, Indian Institute of Technology, Kharagpur, India. He did his bachelors from the same university in the field of Exploration Geophysics. His broad interest goes to the field of Image Compression, Classification, seismic signal processing, Remote Sensing and applied Image Processing techniques. He has been to the University of Pisa, Italy last year for

his summer internship and his work was mostly related to the image compression and coding issues. He also pursued his summer project under the able guidance of Prof. Doug Gray (Department of Electrical and Electronics engineering, University of Adelaide) in the field of repeat pass SAR change detection and applied image processing issues.



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Rohit Kumar is a Fourth year Masters student in the Department of Exploration Geophysics, Indian Institute of Technology, Kharagpur, India. He did his bachelors from the same university in the field of Exploration Geophysics. His broad interests goes to the field of Geographical Information Systems, seismic signal processing, Remote Sensing and Image Processing techniques. He has been to Indian Institute of Technology, Roorkee ,for his summer internship and his work was mostly related to the Geographical Information Systems and landslide hazard management .