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Land Slide Detection System

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Abstract

Landslides can be caused by earthquakes, rainfalls and human activity among other reasons and are responsible for multi hazards. The main challenge is in detecting landslides is there is no physical sensors that would detect Landslides directly. We develop a complete system for landslide detection within minimum time in various areas using sensor network. We are also doing predictive analysis for saving lives in landslide. To improve accuracy and performance, we implemented a model called hidden markov model for recognition of landslide. Sensor network will capture data like soil displacement, rainfall, moisture level in soil etc. and used for prediction of landslide. The system will take this data for analysis purpose and send alert if landslide is detected or recognized. Our system is also showing real time reading of monitoring of area. Continuous monitoring by sensor and collected data will be used for predictive analysis. The experimental result shows that, our approach gives more accurate result in landslide detection.

Keywords*: Sensor network, rainfall monitoring, landslide detection, event detection, Hidden Markov model.*

1. Introduction

Since from 1990 Remote Sensing Techniques have been used in landslide research and for this purpose different spatial and spectral resolution imagery have been employed. The irregular boundaries and surface textures of landslides mean that they often produce features that can be enhanced in remote sensing [4]. Events occurred due to environmental activities sometimes may turned to disasters which creates heavy damage to mankind as well as economy disturbance relationship between the temporal probability of triggering events (e.g., earthquakes and rainfall) and the density of landslides caused by them, it is essential to prepare so-called event-based landslide inventories [2], [3] .Landslides occur frequently in India causing large threat to human life. For multi-hazards like landslides, they are not like earthquakes which have strong signals that can be much easier caught by dedicated sensors [1].

The data mining process is to extract information from a data set and transform it into an understandable structure for further use. Aside from the raw analysis step, it involves database and data management aspects, data pre-processing, model and inference considerations, interestingness metrics, complexity considerations, post-processing of discovered structures, visualization, and online updating. The development of sensor networks and data mining gives us the capability of quick capture, processing, and transmission of critical disaster data in real-time from inaccessible sites, incurring minimum maintenance as well. India faces rainfall-induced landslides every year with a large threat to human life.

We are using Hidden Markov model for landslide detection system.

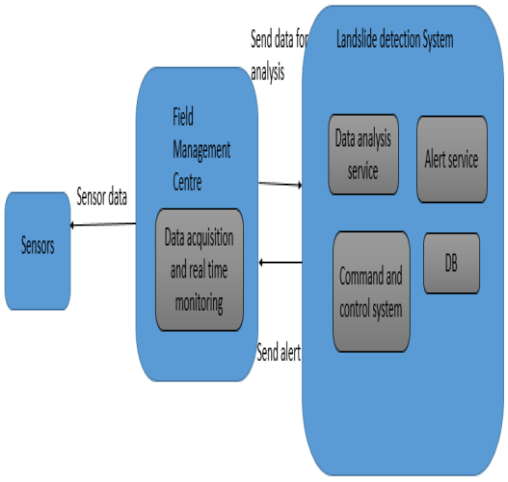
- A hidden Markov model (HMM) is a statistical Markov model in which the system being modelled is assumed to be a Markov process with unobserved (hidden) states. A HMM can be presented as the simplest dynamic Bayesian network.

- A hidden Markov model can be considered a generalization of a mixture model where the

hidden variables (or latent variables), which control the mixture component to be selected for each observation, are related through a Markov process rather than independent of each other.

A landslide is suddenly occurring phenomenon, and its causative factors can be accumulated rainfall, moisture and pore pressure saturation in the soil, or a steep slope angle, among others. This research focuses on sensor networks for detecting landslides; we have collected extensive data regarding the rainfall, moisture, pore pressure, and movement in the earth. We will forecast the weather such as rainfall condition and conclude the displacement of the soil because of the rain and set this value as a threshold. If there is a displacement in the soil the sensor will detect and check whether the soil grip has been loosed and crosses the threshold value and pre-predict the landslide occurrence.

The sensors sense the data like moist, soil, displacement, pressure etc. from the environment and provide it to the field management center. This section does real time monitoring and data acquisition. This particular data is send for further analysis to the land slide detection system. This system uses the hidden markov model and k-means algorithm for calculating the appropriate time of landslide occurrence. This data is provided to the alert system and hence the alert signal is send to human.



Landslide detection system has been previously implemented using data reduction and energy minimization in Sensor Networks for landslide detection. a complex heterogeneous network of 20 wireless probes with each probe consisting of four different types of sensors to measure rainfall, moisture, pore pressure, and movement, all of which have been in continuous operation for more than two years in the equatorial forests of Kerala, India. Each probe runs on solar power and the frequency of sensor data measurements from the probes is dynamically and adaptively throttled in real time, based on climatic conditions to minimize the total energy consumption. Thus the disadvantage was landslide detection is been shown but after a vast time that is not enough to save human kind. We have also seen that we come to know about the landslide once it has occurred. The government tried experimenting on it but they couldn't achieve it as they could not do it before it could occur they were trying to achieve.

2. Literature Review

May 2014 IEEE paper proposed data reduction and energy minimization in Sensor Networks for landslide detection. a complex heterogeneous network of 20 wireless probes with each probe consisting of four different types of sensors to measure rainfall, moisture, pore pressure, and movement, all of which have been in continuous operation for more than two years in the equatorial forests of Kerala, India. Each probe runs on solar power and the frequency of sensor data measurements from the probes is dynamically and adaptively throttled in real time, based on climatic conditions to minimize the total energy consumption. The probes also work together to identify who among them is sensing the maximum parameter, after which all other sensors are switched off for a predetermined duration. To detect landslides by object-based image analysis using criteria based on shape, color, texture, and, in particular, contextual information and process knowledge, candidate segments must be delineated properly. Here, optimal segments were used in a knowledge-based classification approach with the thresholds of diagnostic parameters derived from K-means cluster analysis, to detect landslides. Another paper stated that Landslides are an illustrative example of multi-hazards, which can be caused by earthquakes, rainfalls and human activity among other reasons. Detection of landslides presents a significant challenge, since there are no physical sensors that would detect landslides directly. A more recent approach in detection of natural hazards, such as earthquakes, involves the use of social media. We propose a multi-service composition

approach and describe LITMUS, which is a landslide detection service that combines data from both physical and social information services by filtering and then joining the information flow from those services based on their spatiotemporal features [1].

3. Conclusion

We will be implementing, a multi-sensor network for monitoring landslides. The network with all of our techniques has proved its validity by delivering warning to the local community during heavy rains. Our system is being extended to other landslide prone areas and is also being adapted for flood, avalanche, and other environmental monitoring applications with suitable modifications

4. References

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