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# Analyze the Impact of Landslide Using High-D Tool

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## ABSTRACT

Landslides are geological hazards caused when masses of rock, earth, and debris flow down a steep slope. Landslides are depended on different climatic conditions. These climatic conditions include Intense Rainfall, Snow Fall, and earthquake. Microfocus High-D is a tool used for Interactive Data Visualisation. Here we analyze the data from different countries such as NZ and AUS, etc.. The objective of the study is regions specific data analysis for selected nations. The study focus on the parameters such as Trigger point, Landslide size, Causalities, and Economic loss.

***Keywords :***— Lanslide, High-D Tool, Earthquake

## I. INTRODUCTION

Landslides are depended on different climatic conditions. These climatic conditions include Intense Rainfall, Snow Fall, and earthquake. These are the indicators for landslides development. Landslide causes tremendous economic and human loss. Thus, these climatic conditions act as a trigger point to landslides. So we need to keep a watch on these trigger points to reduce these socio-economic losses.

There is a need for various Landslide prediction techniques and their practical implementation to reduces these losses.

## II. METHODOLOGY

Microfocus High-D is a tool used for Interactive Data Visualisation. It aims at providing the power of the parallel coordinates visualization technique easily and cost-effectively. It helps to provide an interactive visualization solution that turns data into knowledge. It also helps to extract insights from visual patterns. High-D has been created with researchers, business professionals, and home users in mind, to improve communicative tasks involving structured data.

It aims at providing the power of the parallel coordinates visualization technique easily and cost-effectively. Nevertheless, it comes with an extended set of features, including Data Sources and Parallel coordinates.

### *A. Data Sources*

- Support for most usable tabular and spreadsheet formats (Excel, Open Document, CSV, tab-delimited, Access...)
- Direct connectivity to common relational databases (Oracle, MySQL, SQL Server, ..)
- Interoperability with specialized applications like Microsoft Project

### *B. Dataset Inputs*

Datasets of Landslides happening across all over the World Consisting of:

- Unique ids of Landslide
- Date and Time at which it occurred
- Trigger Point of Landslide
- Type of Landslide
- Casualties
- Economic Loss
- Latitude
- Longitude
- Population
- Distance

## III. CREATION AND ACCESS OF DATA WAREHOUSE

All Data-warehouse is created with 3 Data-marts of three different countries, AUS, USA, and New Zealand. Reports, OLAP, and dashboard are approaches used to access this data warehouse. We use information in "Global Landslide Data warehouse" using this approach in prediction of the decision of landslide occurrence in the near future.

Conversion of Data warehouse into the form which we need is not a hard job. We can easily convert into form, which we need with the help of a different tool such as Pentaho, clover ETL, etc..

### A. *RealTime Update*

With the help of meteorological departments of these countries, we will update the "Global Landslide Data warehouse" with regular intervals with the help of real-time Inputs.

B. Process of High-D

Visualizations are done in High-D in the form of parallel coordinates, Scatter plot matrix, parallel coordinates matrix, distributions, table lens, scatter plot, multidimensional scaling, treemap, cartoplot. Visualization appropriate for the data set are:

1. Parallel Co-ordinates:
   - Alpha transparency to avoid overplotting

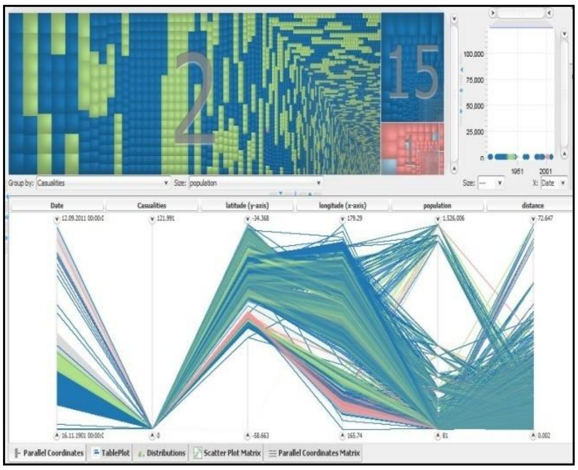
- Curved parallel coordinates to overcome cross-over issues
- Support for axis with categorical values
- Interactive reordering of the axes
- Customizable scales with predefined alignment schemes
- Embedded range slider for visual filtering

2. Distributions view
   - Distributions view that corresponds to the chosen settings in the Configuration and Axes panel
   - For each axis, items are grouped into bins; that width is proportional to the number of values.
3. TreeMap:
   - The TreeMap view shows how values are distributed for each variable.
   - It helps to find out the best products and countries for both export and import.

## IV. RESULT AND ANALYSIS

Fig. 1. Social Impact of Earthquake NZ and Aus

The above figure shows the impact of the earthquake on casualties where it is clearly seen their frequency of 15 or more than 15 casualties have been recorded when landslides occurred trigger due to earthquake.



Measure Economic loss occurs are

a) Erosion
b) Groundwater change
c) Material Properties loss.

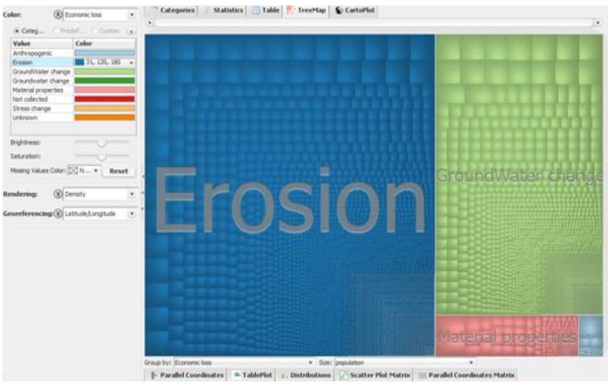



Fig. 2. Economic Impact of Earthquake in NZ and Aus

It has been seen from the above figure that the impact of the earthquake on economic loss is more in terms of Soil Erosion, which is followed by groundwater level change and then Material property. The legends shown on the left had sideshows various economic losses in multiple colors.

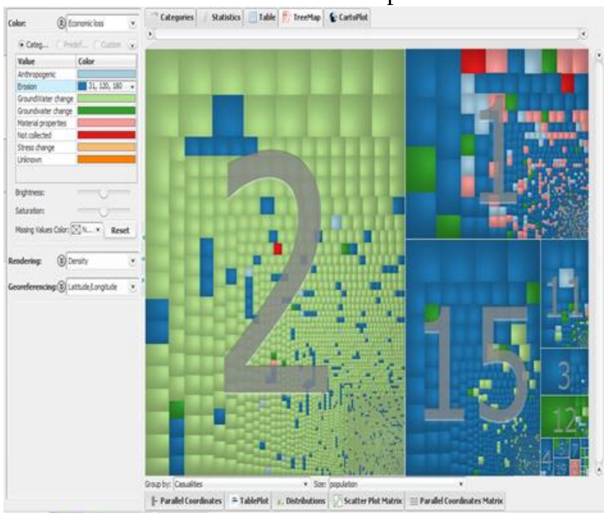


Fig. 3. Economic Impact of Rainfall in NZ and Aus

It has been seen from the above figure that the impact of the earthquake on economic loss is more in terms of Groundwater Change, which is followed by Soil Erosion and then Material property etc. The legends shown on the left had sideshows various economic losses in various colors.

Landslides cause tremendous economic loss. Thus, these climatic conditions act as a trigger point to landslides. So we need to keep a watch on these trigger points to reduce these economic losses.

There are following types of economic loss caused by Landslides

1. Anthropogenic loss:

It is a loss which occurs due to landslides which causes severe effects on biophysical, biodiversity, natural resources such as Oil wells and ecosystem. This can cause loss approximately in the scale of Rs. 100000-5000000 due to the loss of natural resources.

2. Material Properties loss:

It is a loss in materials, which includes buildings, monuments, structure, belongings, personal stuff which caused due to landslides, which can be triggered by rainfall, snowfall, or earthquake. This can cause loss approximately in a scale of Rs. 2 Cr-7Cr due to loss of buildings or monuments, which are sometimes invaluable.

3. Groundwater Change:

There is a change in groundwater deposits, accounting of all inflows, outflows, and change in storage due to landslide. Due to this, there can be scares of water in surrounding areas resulting in drought. USA and Australia are facing severe issues of drought in a couple of years and landslide triggered water level change is one of a cause of it.

4. Erosion:

Soil erosion is one of the deadliest results of the landslide, which can be triggered by rainfall, snowfall, and earthquake. Landslides can cause severe soil erosion. For example: on the date of 30-07-2017, a landslide caused a 10 km surface of soil erosion in USA, which affected nearly 9800 people.

1. Understanding the soil structure of the landslide affected area will help to check soil erosion and groundwater level. It will help to take preventive measures such as Deep Root Planting in affected areas.

2. Government of USA, Australia, and NZ should keep watch on the soil structure regularly to analyze the change in patterns with the help of satellite imaging so that warning signals can be predicated.

3. Geometric Sensors should be planted in areas where Landslides are predicted.

4. Installation of drainage pipes for rainwater, slope drainage in hilly areas are some of the measures which will help to transport water easily through these channels instead of going into the soil. To minimize the earthquake-triggered landslide, Casualties, Planting of slopes of hilly areas that are vulnerable to landslide with deep-rooted trees and shrubs.

Each affiliation must include, at the very least, the name of the company and the name of the country where the author is based (e.g., Causal Productions Pty Ltd, Australia).

An email address is compulsory for the corresponding author.

## V. CONCLUSIONS

The Landslides are depended on different climatic conditions. These climatic conditions include Intense Rainfall, Snow Fall, and earthquake. These acts as indicators for landslides development. Landslides cause tremendous economic and human loss. Thus, these climatic conditions act as a trigger point to landslides. So we need to keep a watch on these trigger points to reduce these social losses. We can clearly see in the graph, casualties that happened due to earthquake-triggered landslide in Eastern Australia, and entire New Zealand are more as compared to rainfall. In fact, as per the data mart, rain and earthquake are frequent activities in New Zealand and Australia. To minimize the earthquake-triggered landslide, Casualties, Planting of slopes of hilly areas that are vulnerable to landslide with deep-rooted trees and shrubs. Installation of drainage pipes for rainwater, slope drainage in hilly areas are some of the measures which will help to transport water easily through these channels instead of going into the soil. Use of High tension wires to cover the mountain areas to avoid falling of Rock during landslides. Reinforcement of floor slabs and external walls in the existing building.

## ACKNOWLEDGMENT

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