

NU-302: R&D Project

**Summary REPORT**

**On**

**Landslide Susceptibility Mapping using Machine Learning Techniques**

# **Submitted to: Submitted on:**

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# **Problem Statement**

Landslide pose a serious risk to human life and the natural environment. Susceptibility to landslides arises due to a combination of local topography, geology, climate, vegetation, and anthropogenic, factors. A landslide susceptibility map identifies areas which are subject to landslides and is measured from low to high. Coupling machine learning algorithms with spatial data types for landslide susceptibility mapping is one of the active research areas.

Humanity have faced various challenges through-out history, and invented many technologies to do overcome them. But one of the areas Human Race is still trying to overcome are the Problems caused by natural disasters. This summary is going to summarize how humanity can be able to predict landslides, and hence take necessary actions in order to prevent the damages causes by the same.

Landslides have been increasing comparatively to its frequency in historic times. This increase is due to various man-made mega structures, which not only reduces the soil fertility, but also the ground strength to be able to hold these mega structures. Several other factors contributing to this increase also include, underground tunnels, mining, over-grazing of cattle, weather changes, as well as making structures on weak lands.

These all factors not only contribute, but also cost a huge amount to implement those ideas individually, and when a landslide occurs, not only these, but also other nearby structures, properties, and ecosystem of that area gets damaged, which is termed as collateral damage.

**An Idea towards Collecting Data**

Now as previously discussed, a landslide does not occur only due to one factor. It depends on various factors, such as:

1. Rainfall
2. Soil Texture
3. Slope
4. Lithology
5. Elevation
6. Geology
7. Altitude
8. Natural Differential Vegetation Index (NDVI) etc.

Now to predict the landslides in a given particular area, we need to first accumulate the previous year datasets of the mentioned points.

These Layers are also known as Thematic layers. Landslides in a given area show dependencies on these thematic layers, and thus familiarization with these topics and their relationship with landslides is necessary before moving forward in this direction.

# **Use Of Thematic Layers**

Mentioned above are the thematic layers, which will be used in this summary, and there are three ways to get their relationship with respect to landslides:

1. First method is by using optimization methodologies and algorithms,
2. Second is by assigning respective layer with their mean square error, with respect to the line, used for predicting landslides.
3. Third is by applying multi-linear regression, and using this machine learning algorithm to calculate coefficients of respective thematic layers.

# **Objectives**

1. Intensive study of various datasets and shape files of various thematic layers, which can also be considered as the factors define different aspects of a landslide.
2. These thematic layers, can be listed as:
   1. Fault Zone areas,
   2. Water Body Network,
   3. Soil type,
   4. Elevation Information,
   5. Relative elevation information,
   6. Rainfall,
   7. Weather Information of that area, etc., are some of them.
3. A function is to be defined, which will be equivalent to the summation of the product of a thematic layer info of a given point or area, along with the weightage assigned to that given thematic layer.
4. This function calculated above, will then be used for mapping through codding using technologies like:
   1. Gee (Python Library)
   2. ArcGIS Pro (Professional tool for Geographic Information System maps manipulation)
   3. Folium (Included in Python Library)