

An Assessment of Filter-Based Feature Ranking Algorithm in Landslide Susceptibility Mapping

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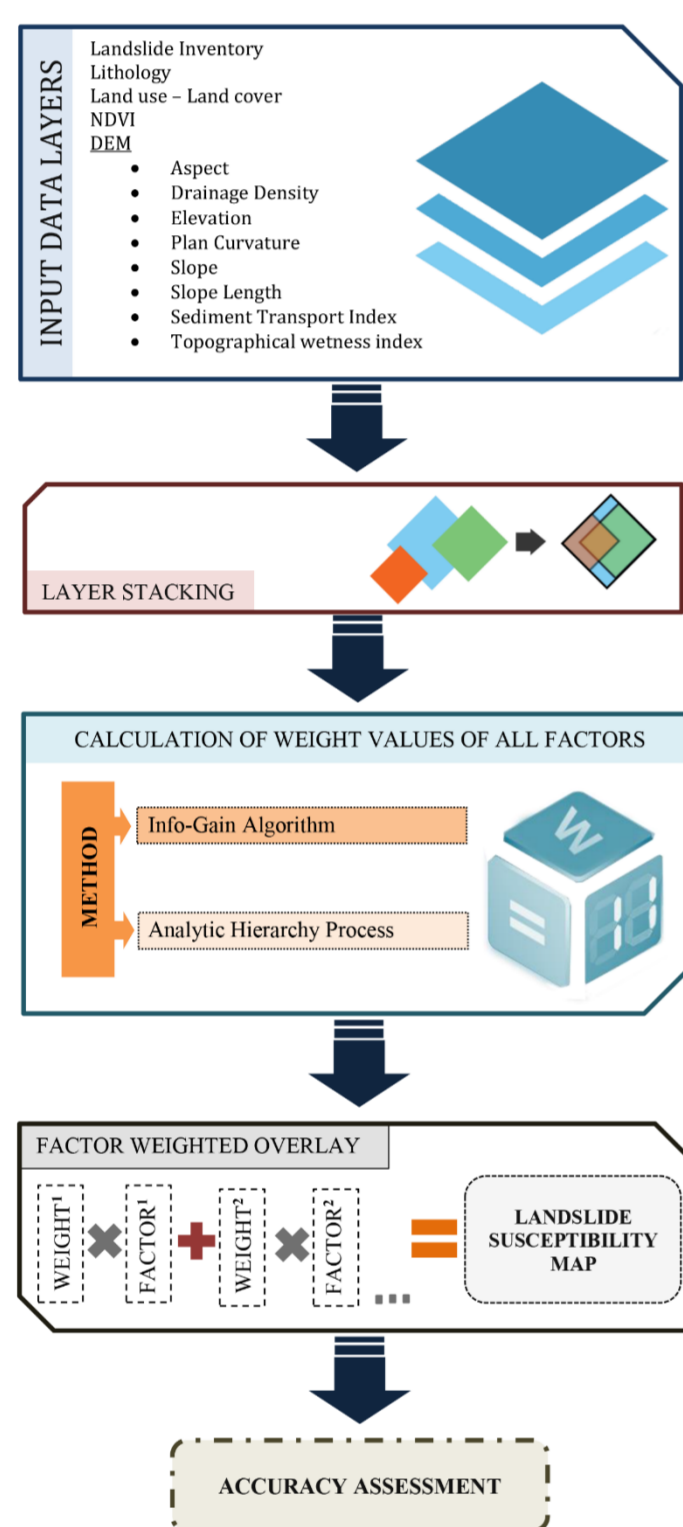
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Introduction

In Turkey, landslides have been the most effective disasters after the earthquakes. In this respect, landslide susceptibility maps are important sources for disaster plans and mitigation studies. The production of landslide susceptibility maps requires considering many conditioning factors related to landslides.

Determination of factor weights for landslide susceptibility mapping problem should be performed by some intelligent approaches instead of personal choices when a large number of factors are available. In this study, the quality of factors and their effects on the production of landslide susceptibility maps were assessed using **Info-Gain** weighting methods. On the other hand, expert based AHP method was used as a benchmark method to compare and validate the performances of the landslide factor weights.

All weighted factor sets were tested on factor-weighted overlay method for producing landslide susceptibility maps. The quality of susceptibility maps was assessed using overall accuracy measure and success rate curve analysis. Results showed that the weights determined by Info-Gain method outperformed the conventional AHP method by about 4%.



Methodology

In order to develop a strategy of feature weighting for the assessment of landslide susceptibility, eleven thematic maps associated with slope, aspect, lithology, land use/cover, NDVI, drainage density, elevation, plan curvature, slope length, sediment transport index (SPI) and topographical wetness index (TWI) were utilized.

The methodology applied in the study;

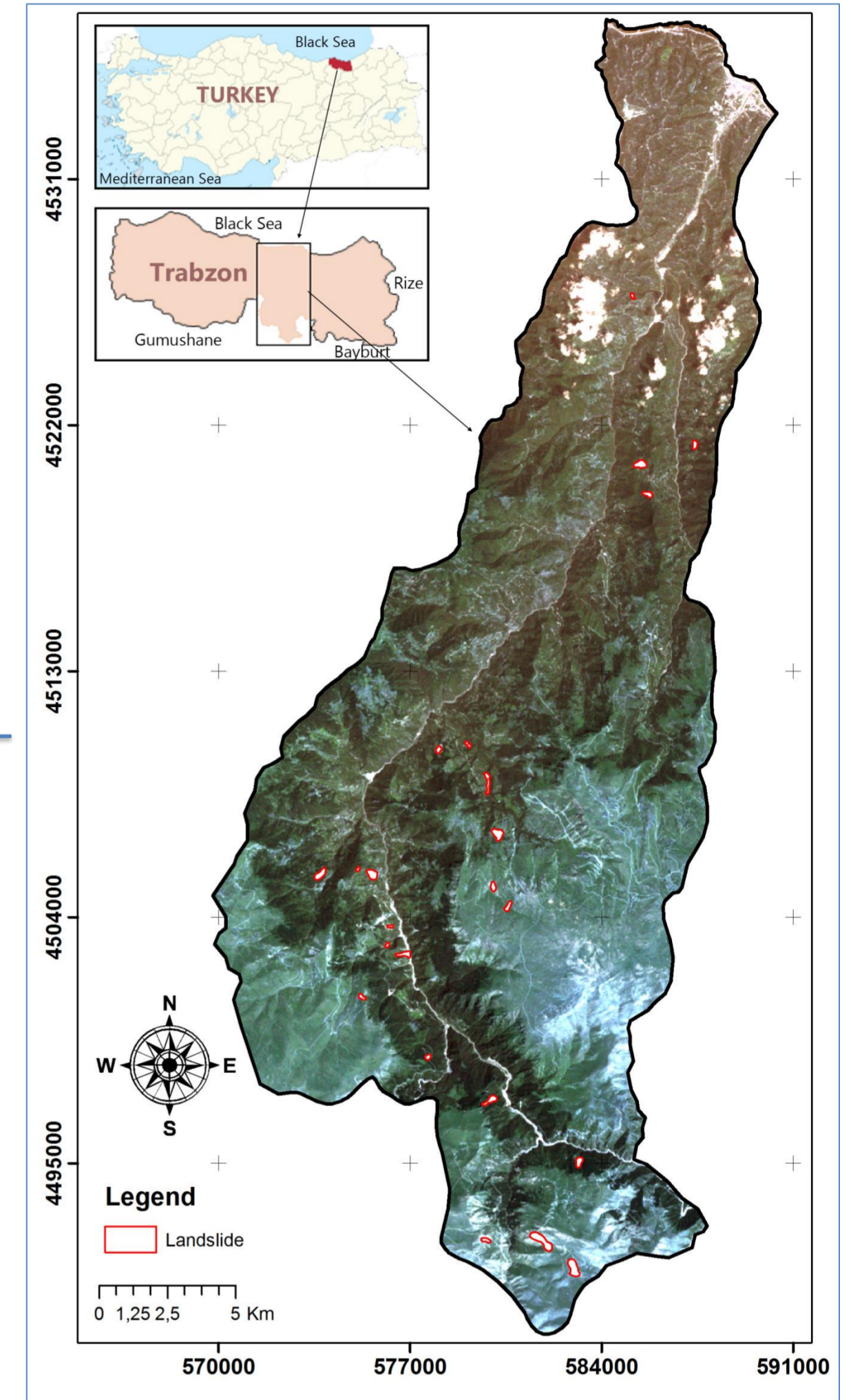
First; the landslide inventory map was produced and the all causative factors were determined.

Second ; the landslide-related parameters considered in this study were stacked to compose a multi-layer image.

Third ; expert based AHP method and feature selection based Info-Gain were used to determine the factor weights.

Fourth; the factor-weighted overlay is used to obtain landslide susceptibility map.

Finally, the accuracy statistics (i.e., overall accuracy) and success rate curve were calculated using the test data sets to analyze the results produced by factor-weighted overlay method.



Study area, Arakli district of Trabzon, Turkey

The Arakli district located in the Black Sea region of Trabzon Province, Turkey was selected as a study area. Climate conditions, geologic, and geomorphologic characteristics of the region make it suitable for landslide activity.

Results

-In order to calculate the factor weights for each parameter Info Gain and AHP algorithms were used and calculated weights are listed in Table.

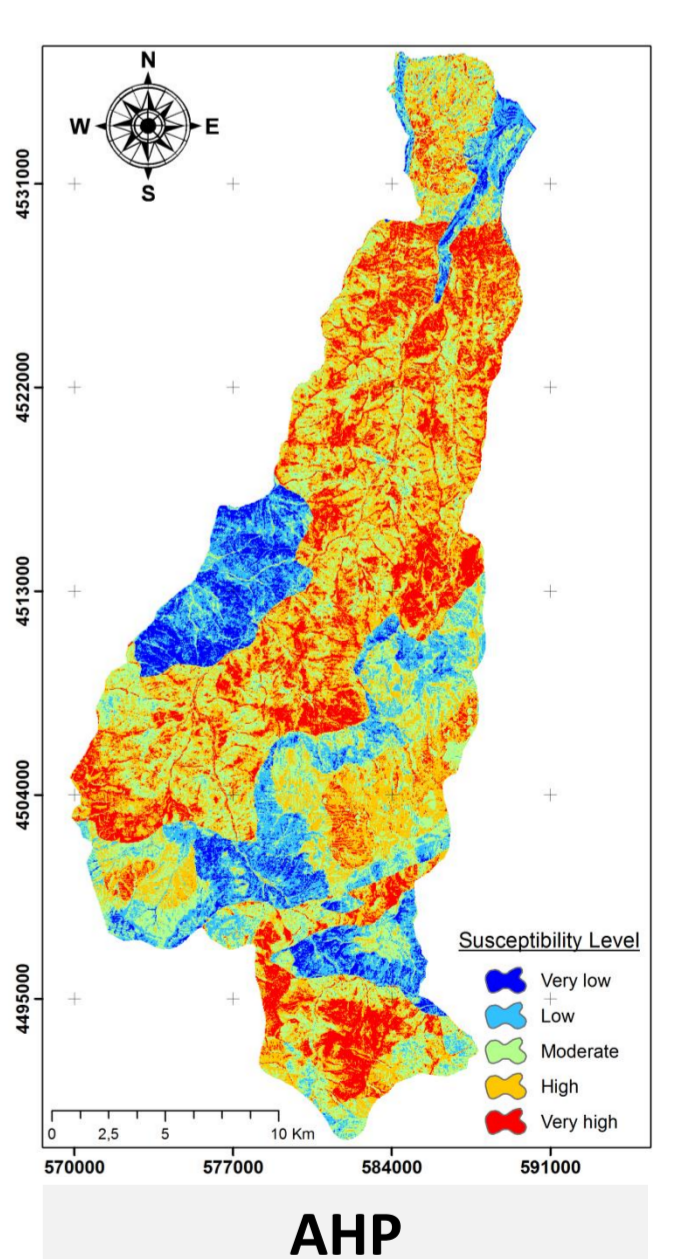
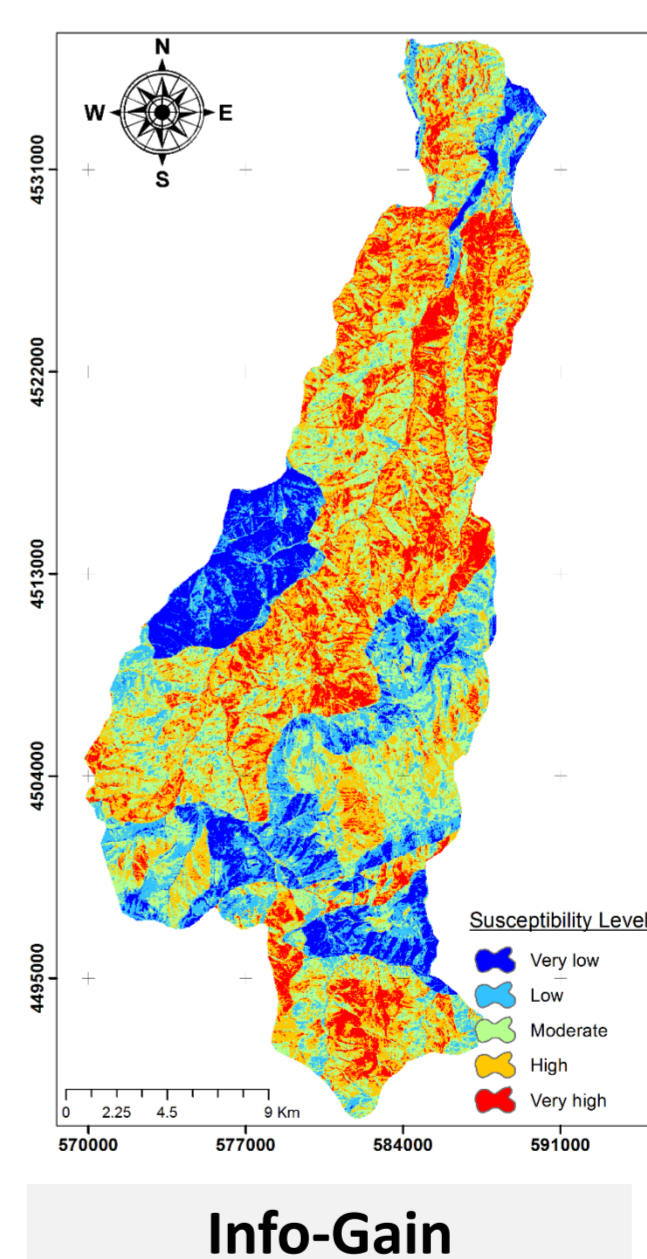
-The results were analyzed, it was observed that the highest weight was assigned to the lithology, slope and aspect for Info-Gain method. For AHP method, it was seen that the highest weights were assigned to the lithology, slope and LULC factors.

-All landslide susceptibility maps produced by factor-weighted overlay method were reclassified into five susceptibility classes as **very low, low, moderate, high and very high** using natural break classification.

-The quality of susceptibility maps was assessed using overall accuracy measure and success rate curve analysis.

Table Factor weight results obtained from Fisher, Chi-square and AHP

Factor	Info-Gain	AHP
Aspect	0.2069	0.0767
Dra.density	0.0353	0.0287
Elevation	0.0583	0.0159
LULC	0.0398	0.1369
Lithology	0.2555	0.2477
NDVI	0.0571	0.0759
Pln. Curv.	0.0074	0.0237
Slope	0.2253	0.2349
Slope Leng.	0.0336	0.0398
SPI	0.0317	0.0196
TWI	0.0491	0.1002



Discussions & Conclusions

- The success rate curves of the two approaches were calculated by comparing the landslide training data with the susceptibility map and it was found that 30% of the study area having a higher susceptibility zone included approximately **81%** of observed landslides for Info-Gain, and **78%** for AHP.
- The overall accuracy values were calculated as **84.41** and **88.40** for AHP and Info-Gain methods, respectively.
- When the results of methods were analyzed, feature weighting algorithms Info-Gain method clearly outperformed the AHP method.
- Landslide susceptibility map based on **Info-Gain feature weighting algorithm** produced the highest prediction accuracies when compared to AHP .

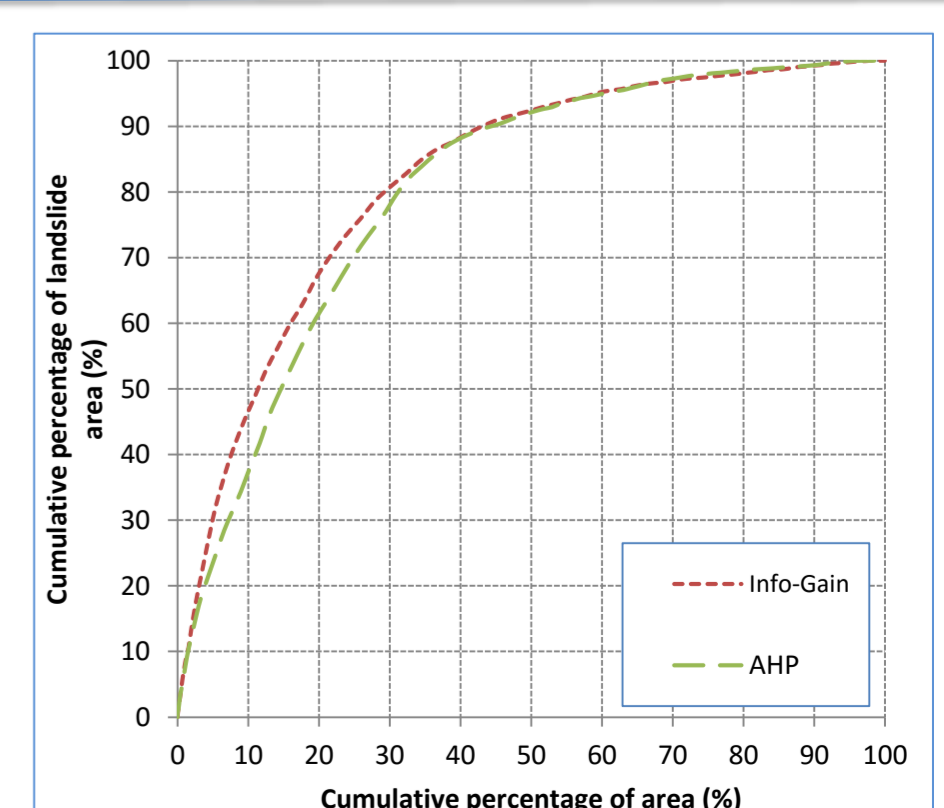


Figure Success rate curves of landslide susceptibility maps