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CORRECTION

Correction to: Integrating the Particle Swarm Optimization (PSO) with machine learning methods for improving the accuracy of the landslide susceptibility model

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The original published version of the above article contained errors in the Abstract and the Study Area section, along with the Fig. 1 image. The proper Abstract, Study Area section and Fig. 1 are as follows [Bold text used to highlight corrected area]:

Abstract

Landslide is one of the serious concerns due to which, the safety and sustainability of hilly areas across the globe, become vulnerable. Therefore, preparing of landslide susceptibility maps (LSMs) with the sound methods is a preliminary task for the safe and sustainable land use planning and design. In this research, Particle Swarm Optimization (PSO) was integrated with the pre-existing machine learning techniques such as Artificial Neural Network (ANN), Radial Basis Functional Neural Network (RBF-net), Reduced Error Pruning Tree (REPTree), Random Tree, Multivariate Adaptive Regression Splines (MARS) and M5tree to increase their efficiency and accuracy of prediction of landslide susceptibility in **upper catchment of Meenachil river of Kerala**. For the advancement of the ongoing research, a total of 189 landslide locations were analysed and datasets were obtained. To prepare LSMs, 70% of the total datasets was utilized for training and the rest 30% was used for the validation purposes. In this research, methods like: ROC, Precision, Proportion Incorrectly Classify, Mean Absolute Error (MAE), Root Mean Square Error (RMSE) and Taylor diagram were applied for the validation of the models. Based on the prior pieces of literature, a total of twelve landslide conditioning factors (LCFs) were chosen. However, none of them found to be possessing multi-collinearity. It is challenging to select features from a dataset through optimization. In this regards PSO is effective because, it is straightforward with efficient universal optimization techniques. The PSO algorithm has updated and optimized the weights of models, and as results, the efficiency of the used models in predicting landslide susceptibility has increased. Nearly, 13% of the study area is very highly susceptible to landslide. The area under the curve (AUC) value of the Random Tree-PSO integrated model is the highest, 86.38% for the training dataset and 88.05% for the validation dataset. According to the sensitivity analysis elevation is most sensitive factor (0.285) and curvature is very less sensitive factor (0.115). As a result, it can be concluded that, of all the models evaluated, it is the most suitable for predicting a landslide tragedy.

Study area

In this research study, we considered **upper catchment of Meenachil river of Kerala (Fig. 1). It lies in the Western Ghats. The total area of upper catchment of Meenachil**

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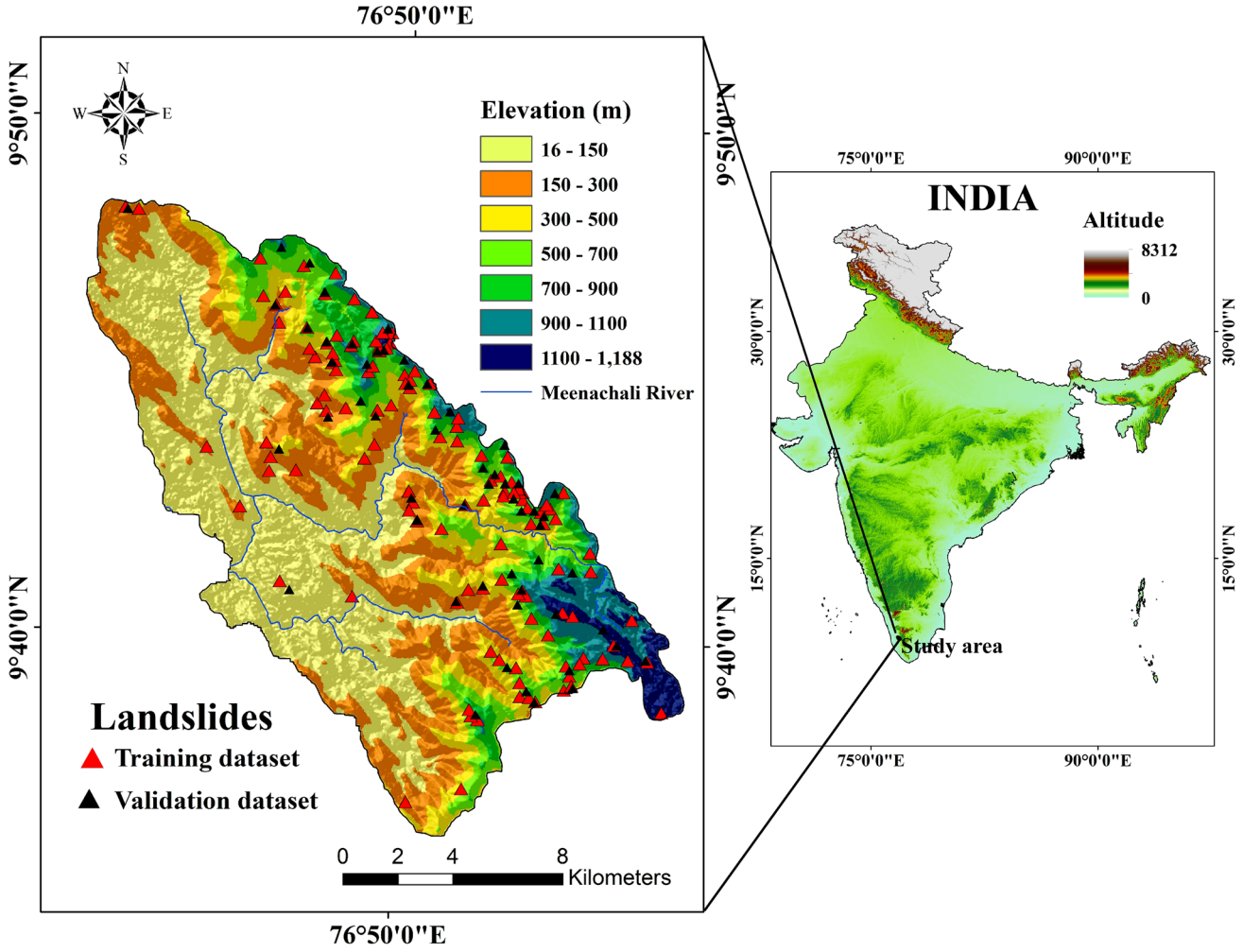

Fig. 1 Location of the study area

River is 216.46 sq. km. The study area is located between the geographical coordinates: $9^0$36′00” N to $9^0$49′00” N and $76^0$45′0″ E to $76^0$55′0″ E. The highest elevation in the study area is 1188 m. Mainly, the study area consists of four soil textural classes: sandy loam, foothills gravelly lateritic, foothills gravelly and mountain forest gravelly. Mountain forest gravelly is the most commonly found soil texture in the area and it occurs in the midland and hilly areas. Five lithological classes have been found in the study region i.e. Dharwar group, unclassified granite, quilon & warkalli bed, alluvium and charnockites respectively. Land use/land cover classes in present study area consist of five types which are built up area, cropped land, fellow land, vegetation cover and water bodies. Most of the part of the study area is covered by vegetation. The western portion of the study area is frequently affected by landslides. For managing the loss substantiated by the landslides, it becomes extremely important to implement appropriate strategies. A comprehensive assessment of landslide susceptibility is among the most effective and reliable methods for the management of landslide induced losses by making aware the people who are living in the areas of high landslide susceptibility.

The original article has been corrected.