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## **Morphometrical analysis of Debris flow fans and torrential catchments in mountainous terrain in the northern Colombian Andes by machine learning techniques.**

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Debris flow fans are commonly occupied by urban and rural settlements in mountainous regions such as in the northern Colombian Andes. Those fans are originated by violent surges of high sediment concentration that are then mobilized downstream by strong currents during torrential events highly destructive. Then, characterization and understanding of the dynamics that give rise to fans in tropical and mountainous regions such as Andean zone is a fundamental tool for land use planning. This research focuses on cartography of fans and catchments using digital elevation models in the central and western mountain range of the northern part of the Andean mountain belt. The methodology considered: morphometric measurements of the catchments and fans, lithological aspects of the catchments, type of catchments (torrential or no torrential). Then the correlation between morphometric parameters of fans and catchments is carried out, including relationships with qualitative variables by multivariate statistical analysis and machine learning techniques to find patterns between quantitative and qualitative variables. The results indicate that slope of the fans has a high correlation with Melton index of the catchments and with the slope of the main stream of the catchments. About the qualitative classification of the catchments in torrential and no torrential, it is observed that there are good discriminations for slope of the fan, volume of the deposits(fans), the relationship between the relief of the catchments and other variables. On the other hand, the lithology of the catchments does not have strong influences on the morphometry of the fans.