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Extraction of decision rules using genetic algorithms and simulated annealing for prediction of severity of traffic accidents by motorcyclists

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Abstract-

The objective of this study is to analysis of accident of motorcyclists on Bogotá roads in Colombia. For detection of conditions related to crashes and their severity, the proposed model develops the strategies to enhance road safety. In this context, data mining and machine learning techniques are used to investigate 34,232 accidents by motorcyclists during January 2013 to February 2018. Both the Genetic algorithm and simulated annealing are applied in conjunction with mining rules (support, confidence, lift, and comprehensibility) as per objectives of the problem. The application of a hybrid algorithm allows for the creation and definition of optimal hierarchical decision rules for the prediction of the severity of motorcycle traffic accidents. The proposed method yields good results in the metrics of recall (90.07%), precision (89.87%), and accuracy (90.06%) on the data set. The results increase the prediction by 20–21% in comparisons with the following methods: Decision Trees (CART, ID3, and C4.5), Support Vector Machines (SVMs), K-Nearest Neighbor (KNN), Naive Bayes, Neural Networks, Random Forest, and Random Tree. The proposed method defines 11 rules for the prediction of accidents with material damage, 24 rules with injuries, and 12 rules with fatalities. The variables with the most recurrence in the definition of rules are time, weather and road conditions, and the number of victims involved in the accidents. Finally, the interactions of the conditions and characteristics presented in motorcycle accidents are analyzed which contribute to the definition of countermeasures for road safety.

Index Terms- Accident · Prediction, Genetic algorithm, Simulated annealing, Data mining, Severity

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