Multimedia Tools and Applications (2024) 83:66691–66723
https://doi.org/10.1007/s11042-024-18193-0

Classifying victim degree of injury in road traffic accidents: a novel stacked DCL-X approach

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Received: 15 June 2023 / Revised: 28 September 2023 / Accepted: 5 January 2024 /
Published online: 24 January 2024

Abstract

Road Traffic Injuries are one of the world's leading cause of death, with greatest burden falling on nations with lower and moderate incomes. They are consistently ranked in top 10 leading causes of mortality worldwide for persons of all ages. The biggest advantage of classifying victim degree of injuries in road accidents can pave a way for safer roads and reduced accident rates. This article employs California based SWITRS dataset to propose a novel approach namely Stacked DCL-X model for classifying "$victim\_degree\_of\_injury$". It classifies injuries that might take place due to collisions occurring between vehicles and near by pedestrians, obstacles etc. on roads. To verify the superiority of our proposed model, several Machine Learning algorithm-based classification models are stacked together to classify "$victim\_degree\_of\_injury$". A total of 1 27 000 accidents are considered from SWITRS dataset when determining the "$victim\_degree\_of\_injury$". Machine Learning classifiers implemented in this article includes XGBoost, CatBoost, LightGBM, Decision Tree, Random Forest, Gradient Boosting and Stacked DCL-X. In addition, the algorithm used at feature selection step is Harris Hawk Optimization algorithm, a Nature Inspired Algorithm to select the best features. Prediction results shows that the proposed Stacked DCL-X model provides good stability, fewer hyper-parameters, and highest accuracy under different levels of training data volume. The values of Accuracy, Mean Square Error, and ROC-Auc in Stacked DCL-X model are 87.52, 0.5677 and 97.43, respectively. Moreover, confusion matrix and evaluation metrics of the proposed model provides better results than state-of-the-art classifiers. Statistical analysis has also been performed using Friedman's rank test on different datasets to ensure the superiority of our proposed Stacked DCL-X model. The findings of this study would be helpful in classifying the "$victim\_degree\_of\_injury$". These findings are highly significant in smart city projects to effectively establish timely proactive strategies and improve road traffic safety.

Keywords Victim degree of injury · Nature inspired algorithm · Harris hawk optimization algorithm · Stacking · Stacked DCL-X algorithm

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