Interval data envelopment analysis for modeling driving performance over time

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ABSTRACT

The vast majority of road traffic collisions can be traced back to the human factor and according to the share of road fatalities by road user type, drivers represent the largest share. As a result, better understanding the behavior of different drivers, and a shift towards a more pro-active approach is needed in order to further improve the level of road safety, and meet the European objective to half the number of road fatalities by 2020.

The aim of our study is to evaluate the relative performance of individual drivers, using data from a driving simulator. To this end, 20 drivers completed the test drive of a simulator scenario on five subsequent days, and their driving performance (e.g., speed, acceleration and lateral position) at eight different measurement points along the driving scenario was used for analysis. Within the field of driving simulator research, in contrast to previous studies which are investigated by statistical methods in which the focus is usually on the averages, our study distinguishes itself by focusing on the individual level and determining the interval driving performance index score for each driver.

To do so, as a widely accepted tool for performance monitoring, benchmarking and policy analysis, the concept of composite indicators (CIs), which combine single indicators into one index score, was employed, and the Data Envelopment Analysis optimization methodology and more specifically the interval Multiple Layer Data Envelopment Analysis-based CI model was used in order to take the data range into account. Its application resulted in an upper and a lower bound of the index score for each driver corresponding to the most favorable and unfavorable option, respectively. The index interval instead of the precise index score for each driver highlights the underlying imperfect nature of the indicator data, and provides us with a more credible representation of a driver's overall road safety performance.

References

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