Chapter 15
AI-Based Economic Models for Evaluating Vehicle Safety Costs and Benefits

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ABSTRACT

This research focuses on artificial intelligent efficient models for the analysis of risks and asset values of vehicles applying globalization, feature reduction, and time series methods. The research concerns the increasing pressure to evaluate economic effects of protective features in a constantly changing car environment. Normalization normalizes disparate data, creating a common framework on which to evaluate cost and benefit variables. Defined subspaces eliminate noise and unnecessary data by outlining the strength of predominant features thus enabling a reduction of computational load and data models. The countless models of time series look at the past and present data to provide future long-standing trends in safety paying as well as the economic consequences. The given framework provides a clear understanding of evaluating the cost-effectiveness of the proposed measures, including the rates of accident reduction, insurance cost, and the costs of adoptive technologies.

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I. INTRODUCTION

Recent innovations in artificial intelligence (AI) have spurred great change in many fields, particularly in the automotive industry with emphasis on safety. The incorporation of AI in economic models provides new technique for the assessment of vehicle safety costs and benefits. This research points to possible ways and means whereby AI can be harnessed to generate effective risk to return and economic loss frameworks relating to safety assets. Hence, (Pandey, B. K., & Pandey, D., 2025) research intends to enhance a stable methodological framework for cost-benefit assessment by using data normalisation, feature reduction using PCA, and time series models to embrace more dynamism in the automotive market. Data normalization (Bikis, A. et al., 2025). is a major influence to harmonisation of different data with the aim of making them similar to each other in as much as possible and process reduces bias, ensures removal of rater inconsistencies (Sheela, M. S. et al., 2025), and the development of a standard procedure for evaluating safety related variables (Satheesh, N. et al., 2025). By transforming data (Kumar, M. S. et al., 2025) to be structured and uniform, the model can easily tackle and decode complex interactions between costs and benefits and safety consequences.

Some of the advantages attributed to dimensionality reduction particularly PCA include reduction of the computational complexity since only main features together with omitted noise are considered from extensive datasets. But, more importantly, work reallocates not only improves model efficiency but also targets the factors most relevant to economic assessments in the proper manner. In particular, because of PCA, the model can analyze a large number of high-dimensional data sets which are easy to comprehend and analyze by the stakeholders. The next set of models that enhance the framework are the time-series models (Konapure, C. G. et al., 2025) that examine and then predict trends in past and current data patterns. Models are particularly useful in comprehending the implications that safety characteristics have on the basic economic parameters such as the frequency of accidents and insurance costs, as well as on the utilization of sophisticated technical applications. (Singh, S. et al., 2025a) allows main interested subjects government agencies, producers and end-consumers – make correct decisions in questions of safe operation and the choice of economical materials (Pandey, B. K. et al., 2024b). Consequently, (Singh, S. et al., 2025b) research highlights the effectiveness of developing AI-based methods to deal with the economic problems of vehicle safety.

Figure 1 gives an indication of major Areas of Value Propositions where AI could be implemented in the automotive industry. These advantages are outlined in four primary areas:

- *Improved Safety:* In so doing, AI improves vehicle safety, by supporting innovations such as the Advanced Driver Assistance Systems (ADAS), accurate and instant identification of risks, and preventive vehicle maintenance. Such systems decrease the number of accidents and enhance the general level of safety for people on the roads as they are helpful for a driver in cases of possible or real emergencies.
- *Enhanced Driver Experience*: AI also applies the ingenuity to such areas as voice control commands, and intelligence infotainment systems, and intelligent navigation. Such enhancements positively contribute to comfort and satisfaction and also make the entire drive fun and less complicated.
- *Cost Savings*: It enables a company to cut expenses linked with aspects such as maintenance, fuel usage, and insurance. Predictive analytics also assist the manufacturers and consumers to budgets since problems require little repair or replacement.