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Big Data Applications for the Transport Sector

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Abstract : Today, an unprecedented amount of data coming from several sources, including mobile devices, sensors, tracking systems, and online platforms, characterizes our lives. The term “big data” not only refers to the quantity of data but also to the variety and speed of data generation. These data hold valuable insights that, when extracted and analyzed, facilitate informed decision-making. The 4Vs of big data - velocity, volume, variety, and value - highlight essential aspects, showcasing the rapid generation, vast quantities, diverse sources, and potential value addition of these kinds of data. This surge of information has revolutionized many sectors, such as business for improving decision-making processes, healthcare for clinical record analysis and medical research, education for enhancing teaching methodologies, agriculture for optimizing crop management, finance for risk assessment and fraud detection, media and entertainment for personalized content recommendations, emergency for a real-time response during crisis/events, and also mobility for the urban planning and for the design/management of public and private transport services. Big data's pervasive impact enhances societal aspects, elevating the quality of life, service efficiency, and problem-solving capacities. However, during this transformative era, new challenges arise, including data quality, privacy, data security, cybersecurity, interoperability, the need for advanced infrastructures, and staff training. Within the transportation sector (the one investigated in this research), applications span planning, designing, and managing systems and mobility services. Among the most common big data applications within the transport sector are, for example, real-time traffic monitoring, bus/freight vehicle route optimization, vehicle maintenance, road safety and all the autonomous and connected vehicles applications. Benefits include a reduction in travel times, road accidents and pollutant emissions. Within these issues, the proper transport demand estimation is crucial for sustainable transportation planning. Evaluating the impact of sustainable mobility policies starts with a quantitative analysis of travel demand. Achieving transportation decarbonization goals hinges on precise estimations of demand for individual transport modes. Emerging technologies, offering substantial big data at lower costs than traditional methods, play a pivotal role in this context. Starting from these considerations, this study explores the usefulness impact of big data within transport demand estimation. This research focuses on leveraging (big) data collected during the COVID-19 pandemic to estimate the evolution of the mobility demand in Italy. Estimation results reveal in the post-COVID-19 era, more than 96 million national daily trips, about 2.6 trips per capita, with a mobile population of more than 37.6 million Italian travelers per day. Overall, this research allows us to conclude that big data better enhances rational decision-making for mobility demand estimation, which is imperative for adeptly planning and allocating investments in transportation infrastructures and services.

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