Toward Developing Decision Support Systems for Future Mobility

The rapid evolution of transportation technologies requires the development of intelligent Decision Support Systems (DSS) to efficiently manage and optimize future mobility systems, such as Advanced Air Mobility (AAM) and Unmanned aircraft system Traffic Management (UTM). To account for the complexities of emerging mobility technologies, including unmanned aerial vehicles, this study explores three key research pillars–*big data analytics, multi-agent systems, and physics-guided machine learning*–for developing advanced DSS in the air traffic domain. The integration of advanced big data analytics, multi-agent systems, and machine learning techniques is primarily studied for intelligent DSS that can help human operators make informed decisions across various air traffic applications. In addition, the primary focus of physics-guided machine learning is to combine a data-driven model and a physics-based model systematically, thereby addressing the limitations of existing works. Therefore, this research provides a comprehensive framework for enhancing the efficiency, safety, and adaptability of DSS for future mobility, paving the way for next-generation smart transportation systems.