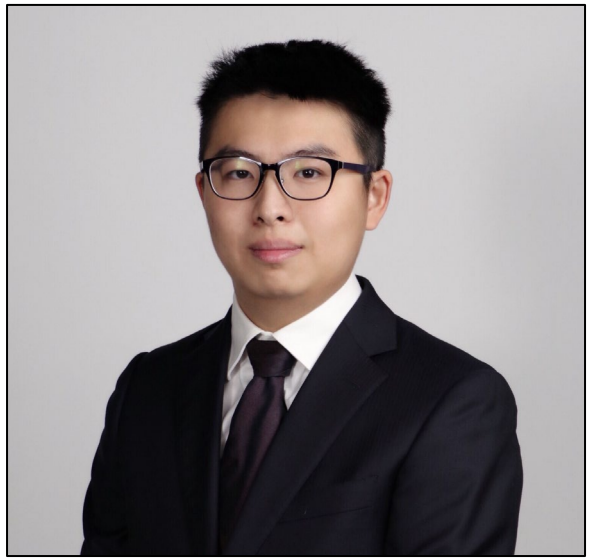
Group B-5 | Optimizing Campus Timetables with the Texas A&M Digital Twin: Integrating Spatial-Temporal Insights and Multi-Modal Transportation

COA SHOWCASE



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The Texas A&M Campus Digital Twin aims to create a high-fidelity virtual replica of the university's physical environment, capturing real-time data on buildings, classrooms, transportation systems, and student movement. This powerful tool enables advanced simulation and analysis of campus operations, facilitating more informed and efficient decision-making. By modeling both spatial layouts and temporal patterns, the digital twin supports complex optimization tasks, particularly in managing logistical challenges like course scheduling. This project addresses the critical challenge of optimizing course timetabling to ensure efficient classroom use while minimizing student commuting time. Unlike traditional scheduling methods that often overlook the complexities of travel across large campuses, this approach integrates spatial-temporal correlations, accounting for the physical distances between classrooms and the time required to move between them. A key advancement is the integration of multi-modal transportation options, reflecting the variety of ways students travel on campus. Indoor routes include corridors, elevators, and stairs, while outdoor options range from walking and e-scooters to bicycles and buses, each offering different speeds and travel times. By factoring in these transportation choices, the model more accurately captures the real-world dynamics of how students move across the campus, ensuring that travel times between classes are realistic and feasible. By using a mixed integer programming (MIP) framework, the project optimizes classroom utilization and course schedules while ensuring that students can efficiently commute between classes within the allotted breaks. The MIP model aligns classroom availability, scheduling constraints, and transportation modes to minimize commuting time, factoring in real-world campus dynamics. This comprehensive approach not only improves the efficiency of resource allocation but also enhances the student experience by reducing commuting stress and making the schedule more student-friendly. The Texas A&M Campus Digital Twin showcases how spatial-temporal data and transportation modes can be combined to tackle complex challenges in higher education. This project demonstrates the potential of digital twin technology in tackling operational challenges in campus, providing a data-driven, adaptive solution for course scheduling at Texas A&M.