Research Project Name: Characterizing and Mitigating Community-level Compound Algorithmic Biases for Data-driven Road Infrastructure Decision-making
Recipient/Grant (Contract) Number: Florida A&M University; Stony Brook University
Center Name: Rural Safe Efficient Advanced Transportation (R-SEAT) Center
Research Priority: Improving Mobility of People and Goods
Principal Investigators (s): Anil Yazici, Susu Xu, Ruwen Qin
Project Partners: -
Research Project Funding: $66,932 (Federal request); $30,434 (Non-Federal cost share)
Project Start and End Date: 6/1/2024 to 5/31/2025
Project Description: Efficient road infrastructure maintenance, ranging from fixing cracks/potholes to repairing traffic signs, is critical to increasing ride comfort and traffic safety and reducing operation costs. In recent years, government agencies increasingly rely on the open e-government systems to acquire real-time data of road infrastructure conditions from community residents, due to their low-cost, timely, and transparent natures, for optimizing maintenance strategies. These data are often multi-modal and shared by people in active or passive manner: (1) in active e-government platforms, community residents can directly call in or send request via websites to report observed road infrastructure problems (e.g., 311 or City Connect programs), or (2) people can install mobile software on individual smart devices that automatically collect and share data in the back end while moving around the neighborhood. Such multi-modal humancentric crowdsensing data are further analyzed and utilized to train statistical or machine learning models for estimating road infrastructure conditions and commonly used to help the government agencies optimize allocations of maintenance resources in the U.S., Finland, and other countries. However, a major challenge is the sensing biases in the data that can cause inefficient maintenance decision-making. Previous studies indicate that community status would significantly impact the levels of civic engagement in multi-modal e-government systems. The disparities in community status may lead to distinct qualities of crowdsensed data and thus introduce sensing biases to the data (e.g., under-reporting and over-reporting). These sensing biases further activate and amplify the inherent algorithmic bias in data-driven infrastructure modeling, leading to under-estimation of the urgency and severity of maintenance demands. The biased estimations of road infrastructure conditions will finally lead to inefficient road maintenance service. Existing studies mainly focus on understanding the engagement in single-mode e-government system or addressing algorithmic biases regardless of sensing biases, but none of them have yet to quantitatively reason the generation and propagation of the coupled social-algorithmic biases in multi-modal e-government systems and mitigate them jointly. This project aims to reason and mitigate community-level compound social-algorithmic biases generation and propagation in human-centric e-government systems for promoting efficient road infrastructure maintenance decision-making.

US DOT Priorities: This project aligns with the USDOT the strategic area of Transformation
Outputs: A generalizable bias mitigation strategy to enhance civic engagement in long term and to improve algorithmic robustness to systematical biases.
Outcomes/Impacts: E-government systems that promote efficient road infrastructure maintenance decision-making.
Final Research Report: N/A