

UTC Project Information	
Project Title	MPC-543 – Big Transportation Data Analytics
University	University of Utah
Principal Investigator	Xiaoyue Cathy Liu
PI Contact Information	Assistant Professor Civil & Environmental Engineering Phone: (801) 587-8858 Email: cathy.liu@utah.edu ORCID: 0000-0002-5162-891X
Funding Source(s) and Amounts Provided (by each agency or organization)	USDOT, Research and Innovative Technology Administration \$40,000 Utah Department of Transportation \$50,000
Total Project Cost	\$90,000
Agency ID or Contract Number	69A3551747108
Start and End Dates	November 15, 2017 to July 31, 2022
Brief Description of Research Project	<p>The world of Big Data is moving fast. There are several private sector Big Data vendors using data from vehicle probes, and from Wi-Fi, cellular, and Bluetooth data traces to synthesize transportation information such as vehicle speeds and origin-destination travel flows. In addition, Utah Department of Transportation (UDOT)'s Traffic Operations Center recently just purchased HERE traffic probe data to assist traffic management and road network performance assessment. UDOT also possesses Big Data in the form of Performance Measurement System (PeMS), that has been archived since 2008. This historic data set should be mined to learn new things about the direct and proximate causes of traffic volume change and travel reliability. There is also an urging need to develop analytical approaches that leverage existing historic data to reveal methods for estimating traffic, with the potential to reduce the burden of the annual traffic count program.</p> <p>UDOT maintains an annual traffic count program which requires the acquisition of hundreds of short-duration counts each year. This traffic count effort represents a significant cost to UDOT, while also exposing UDOT staff to the dangers inherent to being exposed to traffic. The proposed research will seek to determine whether statistical modeling and/or machine learning methods might be employed to partially or fully supplant the short-duration traffic count program and, in doing so, reduce the effort, cost, and staff exposure of UDOT's traffic count program.</p>
Describe Implementation of Research Outcomes (or why not implemented)	The research team recommends that UDOT identify a staff position with a ML skill capability who can monitor the use and acceptance

<p>Place Any Photos Here</p>	<p>of ML for estimating hourly and daily traffic volumes for the state’s highways across different functional classes. There is interest in this topic at the federal level as it is acknowledged that these techniques may ultimately provide DOTs with the tools to accurately estimate traffic volumes at relatively low cost. This research has shown a path toward making this a reality and ongoing sponsored federal research endorses these techniques. UDOT should actively monitor the research in this area and be prepared to put research into practice using the techniques evaluated in this research, or other techniques that might obtain federal approval in the future.</p>
<p>Impacts/Benefits of Implementation (actual, not anticipated)</p>	<p>Hourly traffic volume processes more valuable information than AADT for micro-level operational analysis. However, to estimate hourly traffic volume at a new location with high accuracy can be quite challenging. In this study, XGBoost is proved to be capable of training large-scale dataset with high computational efficiency. Feature importance analysis further verifies the relevance of the proposed spatial dependency feature, accounting for 13.8% of the total importance among all features. In addition, spatial analysis shows that the proposed spatial dependency feature demonstrates its superiority for densely clustered regions.</p>
<p>Web Links</p> <ul style="list-style-type: none"> • Reports • Project Website 	<ul style="list-style-type: none"> • MPC Research Report • Project Data – data generated during the course of the project