Digital Transformation of Transportation Infrastructure Projects using LiDAR Technology and Artificial Intelligence.

Advancements in sensor technology and computing power have made large amounts of data readily available to cities, municipalities, and transportation agencies. One form of sensor data that has recently gained popularity in the field of transportation engineering is mobile Light Detection and Ranging (LiDAR) data. In a single survey pass, while travelling at roadway speeds, a mobile LiDAR scanning system is capable of creating a detailed 3D representation of surrounding transportation infrastructure. Just like other forms of big data, processing LiDAR datasets and extracting useful information from them is extremely challenging. To overcome these challenges, The Nektar Group has been developing state-of-the-art algorithms that employ principles of machine learning and Artificial Intelligence (AI) to automate the extraction of multiple features from LiDAR data. The algorithms work on automatically and efficiently querying hundreds of millions of points within the dataset and segmenting each point into specific urban design elements and roadside features. To date, this research program, which is funded by the Canadian National Research Council (NRC), has involved developing multiple deep neural networks using hundreds of millions of training data points. Those models are being phased into use on several transportation projects including work with the City of Edmonton and many other Engineering Consultants and Contractors. This includes major projects such as the City of Edmonton's Valley Line West LRT Expansion Project. Results of the machine learning and AI models are delivered to clients in Nektar's Cloud-Based Data Management platform. This provides consultants, contractors, and transportation agencies with instant access to a digital representation of the roadway corridor and its features. As a result, project participants are able to virtually conduct site visits and inspect infrastructure elements. The segmented features are also used as the basis of developing 3D CAD models of existing conditions to support the roadway design process. Other uses range from inventory of assets (i.e. trees, signs, poles) along roadway corridors to more effective public engagement, and advanced sight distance and utility conflict assessments. This research has represented a breakthrough in the Nektar Group's efforts to support the digital transformation of consulting and construction activities on transportation infrastructure projects.