Computational Intelligence and Machine Learning for Urban Drainage Infrastructure Asset Management

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Abstract : The rapid physical expansion of urbanization coupled with aging infrastructure presents a unique decision and management challenges for many big city municipalities. Cities must therefore upgrade and maintain the existing aging urban drainage infrastructure systems to keep up with the demands. Given the overall contribution of assets to municipal revenue and the importance of infrastructure to the success of a livable city, many municipalities are currently looking for a robust and smart urban drainage infrastructure asset management solution that combines management, financial, engineering and technical practices. This robust decision-making shall rely on sound, complete, current and relevant data that enables asset valuation, impairment testing, lifecycle modeling, and forecasting across the multiple asset portfolios. On this paper, predictive computational intelligence (CI) and multi-class machine learning (ML) coupled with online, offline, and historical record data that are collected from an array of multi-parameter sensors are used for the extraction of different operational and non-conforming patterns hidden in structured and unstructured data to determine and produce actionable insight on the current and future states of the network. This paper aims to improve the strategic decision-making process by identifying all possible alternatives; evaluate the risk of each alternative, and choose the alternative most likely to attain the required goal in a cost-effective manner using historical and near real-time urban drainage infrastructure data for urban drainage infrastructures assets that have previously not benefited from computational intelligence and machine learning advancements.