MACHINE LEARNING AND DATA ANALYTICS FOR CIVIL ENGINEERING APPLICATIONS

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Introduction to machine learning and data analytics in civil engineering: fundamentals, tools, history necessities, machine learning in modern civil engineering; recapitulation of linear regression, logistic regression; supervised algorithms such as k-nearest neighbor, support vector machines, neural networks fundamentals and backpropagation, applications to structural damage detection, soil classification, etc.; unsupervised clustering algorithms such as hierarchical clustering, k-means and DBSCAN, applications on transportation mode inference, level of service of roads; convolutional neural networks introduction and fundamentals, image classification and object detection, applications to camera-based classification and object detection related to structural health monitoring, vehicle detection, etc.; recurrent neural networks, long-short term memory, applications to traffic state prediction (speed/volume), soil strength prediction, rainfall-runoff modelling, etc.; variational autoencoder, generative adversarial networks, applications to sensor data generation and imputation such as traffic sensors, fault diagnostics in structural health monitoring, etc.; map-reduce fundamentals (key-value), interface, algorithms (matrix multiplication, sorting, etc.), relevant tools such as apache pig, hive, spark fundamentals, spark streaming, applications to large-scale traffic trajectory data analysis, building information modelling in construction industry, etc.; large-scale data visualization using Tableau, Power BI; deep learning tools such as keras, pytorch. Students will carry out a project applying the tools/algorithms covered in the course on a topic of their choice of interest.