

Subject Description Form

Subject Code	BRE368
Subject Title	AI and Data Analytics for Smart Construction
Credit Value	3
Level	3
Pre-requisite /Co-requisite/ Exclusion	Nil
Objectives	This subject is intended to: 1. Equip students with the ability of using data analytics AI and machine learning in building engineering and management. 2. Enable the students to appreciate the AI and Data Analytics (DA) basis and the applications of the main models and methods used in the analysis of problems in the built environment. 3. Provide students an understanding of data-driven or AI-supportive building development and optimized operation of efficient building systems as a part of the integrated system of building fabric, building space, occupants, building services and controls. 4. Introduce applications of various digital construction technologies that can benefit from AI and DA.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Apply AI and DA tools to building and construction data. b. Apply AI and DA modelling tools to analyze problems in the built environment. c. Understand the data-driven decision-making process for practical construction engineering and management issues. d. Evaluate appropriateness of digital technologies in building construction, maintenance and operations.

Subject Synopsis/ Indicative Syllabus	This multi-faceted subject encompasses technologies in building construction, maintenance and operations. Combined with tools from AI and DA, the subject enables better strategic decisions for designers and building managers to consider the building in the context of smartness and future needs. 1. Introduction to AI and DA • Theoretical background of AI and DA • Advanced technologies for data collection and analysis • AI tools and applications. • Required knowledge and skill sets for AI and DA • Concept of data-driven decision making and problem solving 2. Machine learning • Machine learning theory, e.g., mathematical models for machine learning (regression, classification, clustering etc.) • Machine learning tools and applications. 3. AI and DA applications on construction applications • Computer Vision and Real-Time Video Analytics • Predictive Risk Modeling • Scheduling and Resource Allocation • Automated Take-Offs and Document Ingestion • Scope & Defect Detection • Multi-Criteria Optimization for Design Optimization
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Teaching/Learning Methodology	The concept, theory and applications of AI and DA in construction will be delivered through lectures. Tutorials will provide hands-on exercises on AI and DA tools to learn how to apply these tools with given data. Through a group project, students will explore the use of AI and DA tools for practical problem solving in construction. Students will be also required to study online learning materials.							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
			a	b	c	d		
	1. Individual Assignments (Tutorials)	30	√	√	√	√		
	2. Individual Assignments	30	√	√	√	√		
	3. Individual project	40	√	√	√	√		
	Total	100%						
	*Students must pass all components to pass the subject Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Individual Assignments and Individual Project will constitute 60% and 40% of the overall work of the subject, respectively. Students are expected to demonstrate their understanding of the concepts and methodologies of the subject through assignments, projects and presentations, on both the principles and practical applications.							
Student Study Effort Required	Class contact:							
	• Lecture					26 Hrs.		
	• Tutorial					13 Hrs.		
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	Other student study effort:							
	• Self-study, assignments, e-learning					40 Hrs.		
	• Individual project					40 Hrs.		
	Total student study effort					119 Hrs.		

Reading List and References

- Rafael Sacks, Chuck Eastman, Ghang Lee, Paul Teicholz (2018) BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers, 3rd Edition. Wiley.
- Zacharias Voulgaris and Yunus Emrah Bulut (2018) AI for Data Science: Artificial Intelligence Frameworks and Functionality for Deep Learning, Optimization, and Beyond First Edition, Technics Publications
- Bock, T., & Linner, T. (2016). Construction Robots Elementary Technologies and Single-Task Construction Robots. In Construction Robots: Elementary Technologies and Single-Task Construction Robots (p. I). Cambridge: Cambridge University Press.
- MATLAB Onramp (about 2hrs):
<https://www.mathworks.com/learn/tutorials/matlab-onramp.html>
- <https://www.coursera.org/learn/machine-learning/home/welcome>
- https://www.mathworks.com/solutions.html?s_tid=gn_sol