Subject Description Form

Subject Code	CSE30313
Subject Title	Machine Learning Practice in Smart Mobility
Credit Value	3
Level	3
Pre-requisite	One basic mathematics subject* and one basic computer programming subject^ *AMA2007 Intermediate Calculus and Linear Algebra / AMA2111 Mathematics I / AMA2131 Mathematics for Engineers / AMA2308 Mathematics for Engineers / AMA2707 Intermediate Calculus and Linear Algebra / AMA290 Engineering Mathematics ^AMA2222 Principles of Programming / AMA2222A Principles of Programming / COMP1011 Programming Fundamentals / COMP1012 Programming Fundamentals and Applications / ENG2002 Computer Programming
Objectives	This subject aims to help students to learn the basic concepts in smart mobility, fundamentals in machine learning, and to obtain hands-on experience in developing smart mobility applications using emerging machine learning methods. Emphasis will be given to increase students' interest in smart mobility-related research on real-world scenarios.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) Understand the general concepts of smart mobility. (b) Apply emerging quantitative and machine learning technologies/ skills in smart mobility applications and develop solutions to smart mobility problems by applying the engineering research process. (c) Develop active learning, self-learning, and peer learning skills through project-based research inquiries. (d) Develop professional skills such as professional communication, teamwork, and time management.
Subject Synopsis/ Indicative Syllabus	This subject covers the following contents: 1. <u>Smart Mobility Concepts (1 week)</u> Overview of the concepts of smart mobility, emerging technologies in the era of big data analytics and urban informatics, and the state-of-the-art progress in smart mobility development in both Hong Kong and the rest of the world. This section mainly achieves the learning outcome (a).

	2. Review of Quantitative Methods (2 weeks) Review of the basic theory of optimization and statistical methods. This section mainly achieves the learning outcome (b). 3. Practical Implementation of Machine Learning Methods (4 weeks) Understand and implement existing machine learning algorithms such as classification, regression, detection, and clustering with Jupyter Notebook; describe and analyze the performance of machine learning models; understand the practical implications in smart mobility. This section mainly achieves the learning outcome (b). 4. Hands-on Projects (6 weeks) Project-based learning for hands-on projects that cover different perspectives in smart mobility, such as emerging mobility services and crowd-sensing. The hands-on projects particularly achieve the learning outcomes (b)(c)(d). Both projects are designed for students with and without machine learning backgrounds, and one example of the hands-on project is as follows: • Autonomous driving with mAVs: this task challenges students to develop a framework that can automatically control mAVs to drive along the roads. The project requires the skills to write computer programs to control the mAVs, to formulate road lane detection algorithms as object detection and classification problems, and to collaborate with teammates in different backgrounds. mAVs: mini-sized autonomous vehicles
Teaching/Learning Methodology	The subject is delivered using both lectures and projects. The lectures are used to explain basic concepts and theories in smart mobility and related machine learning applications. The projects are used to train students to integrate the previously learned subjects with hands-on experience, and to familiarize the students with state-of-the-art machine learning methods and research questions in smart mobility. Students need to complete a set of assignments during the lectures, and the course project progress report, demonstration, as well as presentation are used to evaluate the project outcomes.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Assignments	20%	✓	✓		
2. Test	30%	✓	✓		
3. Course Project	50%	✓	✓	✓	✓
Total	100%				

Student must pass the course project and achieve a passing overall score / grade to pass the subject.

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Students will be assessed with continuous assessment. The continuous assessment consists of a set of assignments (20%), test (30%) and one course project (50%).

Each assignment is designed to cover a particular aspect of quantitative skills and machine learning methods.

The course project will be carried out in a group, but the performance of each student will be assessed individually. The performance assessment is based on progress updates, project demonstration, and oral presentation.

Student Study Effort Expected

Class contact:	
▪ Lecture	26 Hrs.
▪ Tutorials / Project meeting	13 Hrs.
Other student study effort:	
▪ Reading and studying	20 Hrs.
▪ Assignments	20 Hrs.
▪ Course Project	40 Hrs.
Total student study effort	119 Hrs.

Reading List and References

(1) Goldsmith, S., & Crawford, S. (2014). The responsive city: Engaging communities through data-smart governance. John Wiley & Sons

(2) Bishop, B. (2006). Pattern Recognition and Machine Learning. Springer.

	(3) Hong Kong Smart City Blueprint: https://www.smartcity.gov.hk/ (4) Transport Department: https://www.td.gov.hk/en/home/index.html (5) Sidewalk Labs Toronto https://www.sidewalktoronto.ca/documents/