Tamkang University Academic Year 114, 2nd Semester Course Syllabus

Course Title	MACHINE LEARNING FOR TRANSPORTATION ANALYTICS	Instructor	HUNG-CHI LIU
Course Class	TLTXB2P DEPARTMENT OF TRANSPORTATION MANAGEMENT, 2P	Details	◆ General Course ◆ Selective ◆ One Semester ◆ 3 Credits
Relevance to SDGs	SDG9 Industry, Innovation, and Infrastructure SDG10 Reducing inequalities SDG11 Sustainable cities and communities		

Departmental Aim of Education

Ⅰ. To obtain professional transportation knowledge.

Ⅱ. To familiarize with execution of transportation practices.

Ⅲ. To master oral expression and teamwork.

Ⅳ. To capture basic skills of system analysis.

Ⅴ. To emphasize professional transportation ethics.

Subject Departmental core competences

A. To obtain basic knowledge of transportation management.(ratio:20.00)

B. To familiarize with practice-oriented professional skills.(ratio:20.00)

C. To be capable of oral expression and teamwork.(ratio:20.00)

D. To obtain basic ability of system analysis.(ratio:20.00)

E. To build transportation ethics, care for humanity, and global visions.(ratio:20.00)

Subject Schoolwide essential virtues

1. A global perspective. (ratio:10.00)

2. Information literacy. (ratio:30.00)

3. A vision for the future. (ratio:5.00)

4. Moral integrity. (ratio:5.00)

5. Independent thinking. (ratio:20.00)

6. A cheerful attitude and healthy lifestyle. (ratio:5.00)

7. A spirit of teamwork and dedication. (ratio:20.00)

8. A sense of aesthetic appreciation. (ratio:5.00)

Course Introduction	This course introduces transportation data analytics and machine learning with a strong emphasis on hands-on analysis using the R programming language. Students learn how to process, analyze, and model transportation data through weekly lab sessions, focusing on real-world datasets.

The correspondences between the course's instructional objectives and the cognitive, affective, and psychomotor objectives.

Differentiate the various objective methods among the cognitive, affective and psychomotor domains of the course's instructional objectives.

I. Cognitive : Emphasis upon the study of various kinds of knowledge in the cognition of the course's veracity, conception, procedures, outcomes, etc.
II.Affective : Emphasis upon the study of various kinds of knowledge in the course's appeal, morals, attitude, conviction, values, etc.
III.Psychomotor: Emphasis upon the study of the course's physical activity and technical manipulation.

No.	Teaching Objectives	objective methods
1	Understand the structure and characteristics of transportation data and common analytical workflows. Use the R programming language to clean, visualize, and explore transportation datasets. Apply fundamental machine learning methods to transportation-related problems. Interpret and evaluate model results with attention to practical and policy implications. Develop and present a data-driven transportation analysis through a final project.	Cognitive

The correspondences of teaching objectives : core competences, essential virtues, teaching methods, and assessment

No.	Core Competences	Essential Virtues	Teaching Methods	Assessment

1	ABCDE	12345678	Lecture, Discussion, Practicum, Experience	Study Assignments, Discussion(including classroom and online), Practicum, Report(including oral and written)

Course Schedule

Week	Date	Course Contents	Note
1	115/02/23 ~ 115/03/01	Introduction	
2	115/03/02 ~ 115/03/08	Transportation Data / Lab: Introduction to R and RStudio	
3	115/03/09 ~ 115/03/15	Data Quality and Preprocessing / Lab: Data Cleaning	
4	115/03/16 ~ 115/03/22	Exploratory Data Analysis and Visualization / Lab: Exploratory Analysis and Visualization with ggplot2	
5	115/03/23 ~ 115/03/29	Spatial and Temporal Transportation Data / Lab: Basic Spatial and Temporal Data Handling in R	
6	115/03/30 ~ 115/04/05	Fundamentals of Machine Learning for Transportation Applications / Lab: Data Splitting, Cross-Validation, and Performance Metrics in R	
7	115/04/06 ~ 115/04/12	National Holiday	
8	115/04/13 ~ 115/04/19	Term Project Presentation	
9	115/04/20 ~ 115/04/26	Linear Regression for Transportation Demand Modeling / Lab: Linear Regression in R	
10	115/04/27 ~ 115/05/03	Classification Methods for Transportation Problems / Lab: Logistic Regression and Decision Trees in R	
11	115/05/04 ~ 115/05/10	Ensemble Learning and Nonlinear Models / Lab: Random Forest Models for Transportation Data	
12	115/05/11 ~ 115/05/17	Gradient Boosting and Advanced Tree-Based Models / Lab: Gradient Boosting Models in R	
13	115/05/18 ~ 115/05/24	Unsupervised Learning and Travel Behavior Segmentation / Lab: k-means and DBSCAN Clustering in R	
14	115/05/25 ~ 115/05/31	Time Series Models for Traffic and Demand Forecasting / Lab: Time Series Forecasting in R	
15	115/06/01 ~ 115/06/07	Final Project Presentation 1	
16	115/06/08 ~ 115/06/14	Final Project Presentation 2	

17	115/06/15～ 115/06/21	Flexible Teaching Week for Teachers	
18	115/06/22～ 115/06/28	Flexible Teaching Week for Teachers	

Key capabilities	self-directed learning Information Technology Problem solving Interdisciplinary
Interdisciplinary	STEAM course (S:Science, T:Technology, E:Engineering, M:Math, A field:Integration of Art and Humanist) Competency-based education 'competency exploration' sustained competency or global issues STEEP (Society, Technology, Economy, Environment, and Politics)
Distinctive teaching	
Course Content	Computer programming or Computer language (students have hands-on experience in related projects) Logical Thinking AI application
Requirement	
Textbooks and Teaching Materials	Self-made teaching materials:Presentations, Labs Using teaching materials from other writers:Textbooks
References	
Grading Policy	◆ Attendance： 10.0 % ◆ Mark of Usual：40.0 % ◆ Midterm Exam： 20.0 % ◆ Final Exam： 30.0 % ◆ Other〈 〉： %
Note	This syllabus may be uploaded at the website of Course Syllabus Management System at https://web2.ais.tku.edu.tw/csp or through the link of Course Syllabus Upload posted on the home page of TKU Office of Academic Affairs at http://www.acad.tku.edu.tw/CS/main.php. ※"Adhere to the concept of intellectual property rights" and "Do not illegally photocopy, download, or distribute." Using original textbooks is advised. It is a crime to improperly photocopy others' publications.