

CE 599 – Data Science for Transportation

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**Office Hours: Wed 9:00 am- 11:00 pm and
online by appointment**
Office hour zoom link: TBA

Units: 4
Term: Fall 2022
Schedule: Wed 2:30-5:50 pm
Location: KAP 150
Teaching Assistant: N/A

Catalogue Course Description

Investigating, analyzing, and incorporating different data sources, case studies, and statistical tools to explore road transportation issues.

Expanded Course Description

The objective of this course is to introduce concepts, techniques, and tools for transportation data science and analysis. This course provides students with the knowledge and analytical skills to cope with exploratory data analysis and data mining in the field of land transportation and logistics. Topics to be covered include descriptive statistics and data visualization, regression analysis, panel data, structural equation modeling, and logistic regression. The data sets used in this course are selected from a wide range of data sources and case studies in various aspects of transportation planning, safety, and economics in order to support a practical understanding of the modeling techniques.

Learning Objectives and Outcomes

The complexity, diversity, and random nature of transportation problems requires a broad analytical approach. It is critical to learn a wide range of analytical methods and data science techniques to describe the transportation problems, evaluate the alternatives and policies, and propose solutions for the problems. The necessary skills students need to learn to be able to define, model, and solve transportation problems are:

- Distinguish different sources of transportation and other related data sources
- Collect and combine different data sources to address transportation problems
- Formulate statistical models and perform required statistical tests in R
- Interpret, analyze, and visualize different types and categories of data
- Formulate a transportation related scenario and develop a collaborative research term paper

The learning objectives will be assessed using assignments, homework, exams, and the paper

Prerequisite(s): None

Co-Requisite(s): None

Concurrent Enrollment: None

Recommended Preparation: Data analysis experience such as statistics on the level of CE 408, ISE 220, or PPD 303 is recommended, but not required. Previous coursework in transportation is not required, but exposure introductory transportation at the level of CE 471 or PPD 360 would be beneficial.

Course Notes

All the course materials including assignments, lecture slides, homework, solutions, and scores will be posted on the class Blackboard website.

Technological Proficiency and Hardware/Software Required

Software requirements for this course is R and RStudio, which is available free, and Microsoft Excel.

Readings and Supplementary Materials

Washington, S.P., Karlaftis, M.G., Mannering, F.L., "Statistical and Econometric Methods for Transportation Data Analysis", 2nd Edition, *CRC Press*, 2011.

Textbook may be purchased in the USC Bookstore.

Description and Assessment of Assignments

The following components are used to assess the outcomes:

Homework (15%): At the end of each topic, homework will be available and they are due one week from the assignment date, unless otherwise indicated. Students are expected to complete all homework on time. Late assignments are accepted only for up to 24 hours after the due date with a 20% penalty. Homework must be electronically submitted to Blackboard, clearly handwritten or typed and show all work. Many students choose to type up written answers but handwrite mathematical answers. Homework should be solved independently. If there is any evidence of cheating, relevant University policies and regulations will be applied. Homework will be graded based on organization, neatness, accuracy, and effort.

Class Assignments (15%): Class activities are evaluated using class assignments. Class assignments will be assigned during the class and are due by end of the class day. Time is allotted during each class period to discuss and solve the class assignment questions. Late assignments are accepted only for up to 24 hours after the due date with a 20% penalty. Grades will be based on the involvement in these class activities and the quality of the solutions. They are open-book.

Research Paper (20%): Students will be required to complete a group research paper. The topic can be chosen from a list of proposed research topics. Students are also welcome to suggest their own topic title, but the instructor must approve this. Some examples of research topics include: "Impacts of COVID-19 Pandemic on Daily Travel in the U.S.: A Big-Data Analysis approach", "Statistical Analysis of Alternative Fuel Vehicle Sales in California", "Quantifying the Impact of COVID-19 on Air Pollution in major U.S. Metropolitan Areas", "Shared Mobility and Public Transit: A Data-driven Case Study of Los Angeles Metro Area", and "Heavy-vehicle Crash Rate Analysis: A Comparison Between Interstate Highways in Los Angeles County and Orange County". Project tasks and timeline are available later in the class. Grades are assigned based on the project tasks and details will be discussed with you in the class. Students will receive feedback on each task. The final research report shall be in the style of an academic paper (3500-5000 words) with citations and is due on the last week of the class. All the groups will present their research findings and share their results with the rest of the class. All the members of the group are required to participate in the final research presentation.

Mid-Term Exam (25%): There will be one open-book midterm exam held during our regularly scheduled class time on Wednesday, October 5th, 2:30-5:50 pm. Students need access to a computer with required software. In case the midterm exam is missed, an official, acceptable, and verified excuse must be presented to be able to make up the exam as early as possible. This excuse must be recorded within 24 hours. An unexcused failure to take the exam will result in a zero for the exam.

Final Exam (25%): The final exam is take home and mandatory held on Friday, December 9th, 2:00-4:00 pm. The final exam is not cumulative, though the nature of the material is. Students need access to a computer with required software. There will be absolutely no exceptions to the final exam's date and time, so plan accordingly. The date and time for the final exam are dictated by the University (see <https://classes.usc.edu/term-20221/finals/>).

Grading Breakdown

Final grades will be calculated as follows:

Assignment	% of Grade
homework	15%
Class Assignments	15%
Research Paper	20%
Mid-Term Exam	25%
Final Exam	25%
TOTAL	100%

Grading Scale

Course final grades will be determined using the following scale:

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
95-100	90-94	87-89	83-86	80-82	77-79	73-76	70-72	67-69	63-66	60-62	59 and below

This scale is presented for the sake of completeness. Courses in which students earn grades below a C cannot be presented for credit toward graduation in a USC graduate program, though the course grade remains part of the students graduate GPA.

Assignment Rubrics and Grading

The rubric for oral presentation of the research paper as well as the research paper outline including the tasks and timeline will be provided during the class. Grades will be posted on class web page within two weeks after each assignment submission.

Additional Policies

Students are expected to assist in maintaining a classroom environment, which is conducive to learning. In order to assure that all students have an opportunity to gain from time spent in class, unless otherwise approved by the instructor, students are prohibited from using cellular phones and MP3 players in class, laptops for nonrelated class activities, or engaging in any other form of distraction. Inappropriate behavior in the classroom shall result in, minimally, a request to leave class. Attendance is not required but will be monitored throughout the semester. Each student is required to be on time. Incidences of excessive absence will be dealt with in a manner consistent with University policy and procedures.

Course Schedule: A Weekly Breakdown

*This schedule serve as a guideline. It may be changed at the instructor's discretion

	Topics/Daily Activities	Data Sources	Readings	Deliverables
Week 1 Aug 24	Introduction - Review of the rules - Intro to data analysis and transportation	NA	NA	NA
Week 2 Aug 31	Descriptive statistic - Summarizing data	Fleet and household data from the National Household Travel Survey (NHTS)	Text book-Chapter 1	HW1 is assigned
Week 3 Sep 7	Descriptive statistic - Measures +Project discussion	Fleet and household data from the National Household Travel Survey (NHTS)	Text book-Chapter 1	HW1 is due HW2 is assigned Project task 1 is assigned
Week 4 Sep 14	Descriptive statistic - Data visualization +Writing workshop	Infrastructure and energy data from the Bureau of Transportation Statistics and the National Renewable Energy Laboratory (NREL)	Text book-Chapter 1	HW2 is due
Week 5 Sep 21	Inferential statistic - Fundamentals of regression model	Trip, socioeconomic, and emission data from California Household Travel Survey (CHTS) and National Renewable Energy Laboratory (NREL)	Text book-Chapter 3	Project Task 1 is due HW3 is assigned Project Task 2 is assigned
Week 6 Sep 28	Inferential statistic - Manipulating regression model	Trip, socioeconomic, and emission data from California Household Travel Survey (CHTS) and National Renewable Energy Laboratory (NREL)	Text book-Chapter 3	HW3 is due
Week 7 Oct 5	Midterm Exam	Refer to the midterm exam description above		Project Task 3 is assigned
Week 8 Oct 12	Inferential statistic - Categorical predictors in regression model	Trip, socioeconomic, and emission data from California Household Travel Survey (CHTS) and National Renewable Energy Laboratory (NREL)	Text book-Chapter3	Project Task 2 is due
Week 9 Oct 19	Inferential statistic - Panel data summary	Crash data from Caltrans Performance Measurement System (PeMS)	Text book-Chapter 6	Project Task 3 is due HW4 is assigned Project Task 4 is assigned
Week 10 Oct 26	Inferential statistic - Panel data modeling	Crash data from Caltrans Performance Measurement System (PeMS)	Text book-Chapter 6	HW4 is due
Week 11 Nov 2	Inferential statistic - Principles of logistic regression	Freight data from the National Household Travel Survey (NHTS)	Text book-Chapter 12	Project Task 4 is due HW5 is assigned Project Task 5 is assigned
Week 12 Nov 9	Inferential statistic - Logistic regression modeling	Freight data from the National Household Travel Survey (NHTS)	Text book-Chapter 12	HW5 is due
Week 13 Nov 16	Inferential statistic - Logistic regression modeling	Freight data from the National Household Travel Survey (NHTS)	Text book-Chapter 12	Project Task 5 is due
Week 14 Nov 23	Thanksgiving Holiday			

Week 15 Nov 30	Research Paper Presentations			Project Final Draft is due
Week 16 Dec 9	Final exam	Refer to the final exam description above		

Statement on Academic Conduct and Support Systems

University Policies on Scientific Misconduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Technical Blackboard and Zoom Assistance

<https://keepsteaching.usc.edu/>

Campus Support and Intervention

<https://campussupport.usc.edu/>

Kortschak Center for Learning and Creativity

<https://kortschakcenter.usc.edu/>

USC Libraries

<https://libraries.usc.edu/covid-19-library-support-online-teaching-and-research>

USC writing Center

<https://dornsife.usc.edu/writingcenter>

Student Health Counseling Services - (213) 740-7711 – 24/7 on call

engemannshc.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call

suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 – 24/7 on call

engemannshc.usc.edu/rsvp

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) | Title IX - (213) 740-5086

equity.usc.edu, titleix.usc.edu

Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic, which may be specified in applicable laws and governmental regulations.

Bias Assessment Response and Support - (213) 740-2421
studentaffairs.usc.edu/bias-assessment-response-support

Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

The Office of Disability Services and Programs - (213) 740-0776
dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710
studentaffairs.usc.edu/ssa

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101
diversity.usc.edu

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu

Non-emergency assistance or information.