Rutgers University
The State University of New Jersey
Department of Economics - CCAS
Spring 2025

Class Information

Course Title:	Applied Data Mining & Machine Learning (ADM&ML) Economics 50:220:422:92/MS in Data Science 56:219:531:92
Instructor:	Dr. I-Ming Chiu
Office:	ARMITAGE 435, Phone: (856) 225-6012
E-mail address:	ichiu@camden.rutgers.edu
Class Meeting:	ATG-101 (Armitage Hall), 6:00-8:50 pm, Tuesday
Office Hours:	1:00-3:00 pm, Tuesday or by appointment
Course Description:	In our current era, a deluge of new data is rapidly generated through various human activities such as daily emails, social network postings, and transactions on platforms like S&P 500. The pressing question becomes: how can we harness this vast volume of data to unveil patterns, extract valuable insights, and predict what may happen? The solution lies in the realm of "Data Mining & Machine Learning (DM & ML)." DM & ML involves the application of mathematical and statistical algorithms to unearth patterns within extensive datasets, transforming them into decision-making information and generating new knowledge. This course introduces a range of learning algorithms, both supervised and unsupervised, covering topics like the linear regression model, logistic regression model, K Nearest Neighbors, Support Vector Machines, Naïve Bayes, Association Rules, and K-Means Clustering, among others. To reinforce theoretical understanding, each topic is accompanied by comprehensive case studies, ensuring that students acquire practical, hands-on experience. The overarching objective of this course is to furnish students with contemporary data analytical tools, addressing the high demand for these skills in the job market. To explore the potential rewards associated with data science-related positions, please follow the link below: https://www.glassdoor.com/Salaries/us-data-scientist-salary-SRCH_IL.0,2_IN1_KO3,17.htm
Main Readings:	**Fred Nwanganga & Mike Chapple, Practical Machine Learning in R, 1st edition, Wiley Publishing 2020 (book abbreviation: PMLR).** **Ethem Alpaydin, Introduction to Machine Learning, 4th edition, MIT Press 2020 (book abbreviation: IML).**

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Recomd Readings: Brett Lantz, Machine Learning with R, 4th edition, Packt Publishing 2019 (ISBN: 978-1-80107-132-1; book abbreviation: MLR).

Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, An Introduction to Statistical Learning/with Applications in R (Python), 2nd edition, Springer 2021 (book abbreviation: ISLR).

Max Bramer, Principles of Data Mining, 4th edition, Springer 2020. (book abbreviation: PDM).

Brad Boehmke & Brandon M Greenwell, Hands-on Machine Learning with R, CRC 2019. (book abbreviation: HMLR).

Other References: Hadley Wickham & Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, O'Reilly Media 2017.

Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, and Vipin Kumar, Introduction to Data Mining 2nd edition, Pearson 2018.

Computing: All the computations will be done using an open source statistical software R. It can be downloaded at http://www.r-project.org. You're encouraged to download and use RStudio at the following site, which is a very user-friendly IDE (integrated development environment) for R. https://www.rstudio.com/products/rstudio/

R Installation: https://www.youtube.com/watch?v=Icawuhf0Yqo (for Mac)
https://www.youtube.com/watch?v=DCsJD5t4cFM (for PC)

Class Material: Data, handouts, assignments, and additional readings will be posted on Canvas website.

Online Learning: https://www.datacamp.com/ (Learn Data Science online)

Useful Websites: https://bookdown.org/f_lennert/introduction-to-r/ (Learn R)

https://www.analyticsvidhya.com/ (Machine Learning)

Spring '25 Calendar: https://camden.rutgers.edu/registrar/catalogs-calendars/2024-2025#spring

Grading: **Contributions to Final Grade**

- DataCamp courses	10%
- Take-home problems	25%
- Midterm Exams (2)	40%
- Final Exam or Project	25%
- Attendance/Participation (extra credit)	5%

Grading Policy: Term grades will be based on the final distribution of the above grading weights.

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Exam Preparation: The exam questions will be drawn from three sources: (i) homework assignments, (ii) course lectures, and (iii) reading material.

Class Attendance: Class attendance is essential for learning achievement. When missing a class, it would cost you more time to learn on your own. I strongly recommend the following steps for your successful learning: (1) attend every class and take notes; (2) review everything you learn from the class immediately, never put it off; (3) ask questions and participate in class discussions.

Academic Conduct: Make up exams will be given **only upon prior notice**. I request prior knowledge of any expected absence from an exam. If this is not feasible, you can document a valid reason for missing the exam. Unexcused absence on any exam will result in a grade of zero. Dishonesty in seeking an excused absence or in the examination process will result in a grade of zero on the exam involved and in university discipline. More detailed information can be found at the following site: https://academicintegrity.rutgers.edu.

Disability Services: Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation:

https://ods.rutgers.edu/students/documentation-guidelines. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form at https://webapps.rutgers.edu/student-ods/forms/registration.

Here is the link to the Office of Disability Service: https://success.camden.rutgers.edu/disability-services

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Course Outline:

Topic 0	What is Data Mining & Machine Learning (a brief introduction)
Topic 1	Introduction to Computing Using R
Topic 2	Mathematical and Statistical Fundamentals
Topic 3	The Familiar Linear Regression Model
Topic 4	K-Nearest Neighbors (KNN)
Midterm Exam 1	Date: TBA
Topic 5	Naïve Bayes
Topic 6	Decision Trees & Ensemble methods using Random Forest
Topic 7	Logistic Regression Model
Topic 8	Linear Model Selection and Regularization
Midterm Exam 2	Date: TBA
Topic 9	Support Vector Machines (SVM)
Topic 10	Dimension Reduction (focus on PCA) & Clustering PCA: Principal Components Analysis
Topic 11	Introduction to Neural Networks
Topic 12	Association Rules (aka Market Basket Analysis)

Final Exam/Project	6:00-9:00 pm, Tuesday, May 13, 2025