DERS TANITIM BİLGİLERİ (İNGİLİZCE)

Course Information :

Course Name	Code	Semester	Theory (hours/ week)	Application (hours/ week)	Lab (hours/ week)	National Credit	ECTS
Machine Learning	**ECON 484**	**Spring 2026**	**3**			**3**	**5**
Prequisites	A basic understanding of statistics and a willingness to work with data are essential. While advanced calculus is not required, students are expected to be comfortable with logical reasoning and basic Python programming (or a strong desire to learn it through AI tools). Most importantly, you must be prepared to use GitHub for all assignments.						
Course Language	English						
Couse Type	Elective						
Mode of Delivery (face to face, distance learning)	Hybrid / Project-Based. Lectures focus on 'Analytic Strategy' rather than just theory. Students will participate in 'Live Code Reviews' and 'Decision Defense' sessions. We use a hands-on approach where the classroom transforms into a data lab.						
Learning and Teaching Strategies	**End-to-End Pipeline:** Students will learn to manage the entire machine learning process, from cleaning "messy" real-world data to making business decisions. **AI-Assisted Learning:** Use of LLMs (like ChatGPT) is permitted and encouraged for coding. However, students must document their prompts and be able to defend every line of your code. **Transparency via GitHub:** Student grade is not based on your final result, but on your "Commit History." This course values student progress and the "why" behind your errors more than a perfect (but unexplained) model. **Flipped Classroom:** Students will review baseline codes on GitHub before class, so they can focus on "Critical Thinking" and "Failure Analysis" during lecture hours.						
Instructor(s)	Bora GÜNGÖREN bora.gungoren@atilim.edu.tr						
Course Objective	Machine learning is treated not merely as a collection of algorithms, but as an iterative process of data-driven decision-making. The primary focus of this course is to move beyond 'model training' and address the challenges of collecting, cleaning, and representing data under various assumptions. The objective is to equip students with the ability to design end-to-end machine learning pipelines using real-world economic and business data. Rather than memorizing specific models, students will develop an analytical mindset to justify which approach is meaningful under specific business						

	constraints. The course emphasizes reproducibility, data versioning, and the critical interpretation of model outputs within a managerial or economic context.
Learning Outcomes	Upon the completion of this course, the student will be able to: • Define machine learning as an iterative analysis and experimentation process for data-driven decision-making, independent of specific algorithms. • Critically evaluate machine learning outputs or models based on the data used, underlying assumptions, evaluation metrics, and testing methods. • Apply and compare a core set of machine learning approaches within a specific problem context, providing justifications for their suitability. • Analyze the impact of feature engineering, transformation, and selection when working with various data types (numerical, categorical, text, temporal). • Identify and manage constraints such as missing data, noise, and inconsistency in real-world datasets to design applicable analysis workflows. • Develop a professional discipline for traceability by establishing clear links between datasets, experiments, and results. • Interpret and communicate model outputs clearly within the context of an economic or managerial decision."
Course Content	1. Machine Learning: From Algorithms to Processes: Introduction to the end-to-end ML pipeline; defining the problem, the target variable, and the business goal. 2. Data Hygiene and Pre-processing: Techniques for data collection, cleaning, and handling "messy" real-world data; managing missing values and outliers. 3. Feature Engineering and Representation: Working with different data types (numerical, categorical, text, and temporal); the impact of feature selection and transformation on model outcomes. 4. Core Predictive Models and Comparative Use: Implementing a limited set of fundamental models (Linear/Logistic Regression, kNN, etc.) to understand why specific approaches succeed or fail in different business contexts. 5. Dimension Reduction and Feature Selection: Understanding when and why to use strategies like PCA or NMF; analyzing information loss vs. model simplicity. 6. Working with Unstructured Data: Introduction to text processing, Regex, and basic vectorization for business insights (e.g., customer reviews or logistics reports). 7. Experiment Design and Evaluation: Moving beyond simple "accuracy"; choosing the right metrics, avoiding data leakage, and ensuring reproducibility. 8. Model Interpretation and Decision Context: Translating model outputs into actionable economic or managerial insights; understanding the limits and failures of a model. 9. Collaborative AI and Ethical Usage: Integrating LLMs (e.g., ChatGPT) as coding assistants; documenting prompts and decision-making logs
References	1. Bishop. CM. 2006. Pattern Recognition and Machine Learning. Springer.

	2. Murphy, KP. 2012. Machine Learning: A Probabilistic Perspective. MIT Press. 3. Kelleher, A, Kelleher, A. 2019. Machine Learning in Production: Developing and Optimizing Data Science Workflows and Applications. Addison Wesley. 4. Burkov, A. 2019. The Hundred-Page Machine Learning Book. (Free E-Book)

Course Schedule :

Monday 15:30 – 18:20; 211 İB

Office Hours :

Available upon request, online.

Weekly Course outline

Week	Topic	Business Context	Student Tasks & GitHub Deliverables (Pre-work & Assignments)
1	**Course Intro**		Create GitHub repo.
2	**Intro: ML Process** **Lab: Tools & AI**	Target Definition Analytical Control	Write a README defining a business problem (e.g., Lead Scoring). First commit of "Decision Log" template. Prompting an LLM to generate a basic data structure.
3	**Data Hygiene**	"Garbage In/Out"	Clean a "dirty" logistics dataset. Document why specific rows/outliers were removed.
4	**Representation**	Feature Impact	**Task:** Transform categorical variables (e.g., flight delays, product types). Compare results of different encodings.
5	**Baseline Models**	Transparency	**Task:** Run a simple Linear Regression. Document the "Baseline Performance" to beat in future weeks.
6	**Distance (kNN)**	Similarity Search	**Task:** Implement kNN for customer segmentation. Experiment with different 'k' values and log the changes.
7	**Probabilistic**	Sentiment & Risk	**Task:** Text classification on customer reviews using Naive Bayes. Create a simple "Word Cloud" of failures.
8	**Midterm Period**	**Strategy Defense**	**Midterm:** Presentation of the "Problem-Data-Baseline" triangle. No complex models yet, just process integrity.
9	**Dimension Red.**	Hidden Patterns	**Task:** Apply PCA to a high-dimensional financial dataset. Document the "Information Loss" vs. "Simplicity" trade-off.
10	**Non-Linearity**	Complexity Cost	**Task:** Implement SVM or Decision Trees. Defend why a non-linear model is (or isn't) necessary for this data.
11	**Clustering**	Market Segments	**Task:** Unsupervised grouping of logistics hubs or stores. Justify the number of clusters chosen.
12	**Metrics**	Cost of Error	**Task:** Calculate Precision/Recall for a "Fraud Detection" case. Explain the "Business Cost" of a False Positive.
13	**Leakage & Ethics**	Future Bias	**Critical Review:** Audit your own previous work for

Week	Topic	Business Context	Student Tasks & GitHub Deliverables (Pre-work & Assignments)
			"Data Leakage" (e.g., using future data in training).
14	**Final Defense**	**End-to-End Pipeline**	**Final Project:** Finalize the GitHub repo with a full commit history and a "Technical Memo" for a manager.

Assesment methods

Course Activities	Number	Percentage %
Attendance **(mandatory after add-drop week)**	12	%10
Assignments (**programs and/or reports, submissions through Github**)	At least 4	%40
Midterm Exam **(in-class, short duration, with discussion questions)**	1	%20
Final Project **(a program, with a report, submissions through Github)**	1	%30
Total	18	100
Percentage of semester activities contributing grade success	18	100
Percentage of final exam contributing grade success		
Total	18	100

Attendance :

Attendance after add-drop period is mandatory. Students are required to attend at least %70 of classes. Typical excuses such as health reports should be communicated with the instructor.

Use of Programming Languages :

Course discussions are language-independent. Some examples will be visualized through Knime.

Assignments will be primarily based on Java, Python or R code unless there is a specific requirement. Students are expected to have a fundamental understanding of programming language. Some limited guidance is available.

Use of Github :

All student work except in-class exams will be submitted through Github. Use of Github is a modern, widely used and well documented way to share code and datasets. It also allows easy tracking of source code, including finding out where it has been copied and pasted from. Therefore ECON majors are expected to be able to use it. **As Github use is mandatory, all work submitted in other ways will be automatically disqualified and graded as zero.**

Use of Third Party Code Examples and Tutorials :

Most, if not all, of class homework assignments will require students to use programming libraries. These libraries are in all cases well documented and there are several online examples and tutorials for these libraries. In case a student finds useful code snippets, and simply copies and pastes the code, **this is allowed**. However, students are **required to give a reference** to the example or tutorial they have used inside the code, as a comment.

Use of ChatGPT and Similar LLM Tools :

Use of AI tools in preliminary work, homework assignments and final project **is allowed**, as long as students **report how these tools have been used** (questions asked and answers gotten, problems with answers, how students modified AI output in their work, etc.)

Course Category: Major Area Courses

Workload and ECTS Calculation

Activities	Number	Duration (Hours)	Total Work Load
Course Duration (Including Exam Week: 16 x Total Hours)	14	3	42
Laboratory			
Application			
Specific practical training (if any)			
Field Activities			
Study Hours Out of Class (Preliminary work, reinforcement, etc)	13	3	39
Presentation / Seminar Preparation			
Projects	1	30	30
Homework assignment	4	6	24
Midterms (Study duration)	1	25	25
Final (Study duration)			
Total Workload			160

Matrix of the Course Learning Outcomes Versus Program Outcomes

Program Outcomes	Contribution Level*				
	1	**2**	**3**	**4**	**5**
1 Deepen and develop advanced level and current knowledge in economics to an expert level based on the competencies of the economics education and acquire the skills make original thoughts, views, and contributions to science.					x
2 To comprehend the interaction between economics and related fields; to achieve original results by using expert knowledge in analysis,and evaluation of new and complex ideas.					x
3 To acquire high level skills in applied methods in economics and to be able to systematically follow new theoretical developments in applied economics.					x
4 To be able to apply existing techniques to an original research idea.					x
5 To find a new scientific method.					x
6 To broaden the knowledge of economics by publishing scientific articles related to economics in national or international refereed journals and to publish these articles in a scientific ethical way.					x
7 To be able to identify, participate in, organize and lead activities, such as panels, workshops and conferences, that aim to develop solutions for novel and interdisciplinary problems.			x		
8 To follow pioneering and innovative theories and methods in economics, to be able to use them in analysis and research and to be able to contribute to the process of becoming an information society.					x
9 To be able to analyze the relationships and processes in economics and to develop functional and effective communication networks.			x		
10 To make some scientific contributions to projects aiming to increase the productivity in business.					x
11 To be able to share his/her work and to criticize works of others by using academic networks in economics efficiently.					x

1: Lowest, 2: Low, 3: Average, 4: High, 5: Highest