

# Syllabus - Machine Learning in Economics

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## Summary

This course provides an overview of uses of machine learning in economics. Through a combination of theoretical lectures, hands-on programming examples in Python, and discussions of applications in social science research, students will gain an understanding of myriad machine learning techniques. Starting from supervised learning methods the course will discuss how to make use of text as a data source for research. Additionally, students will explore unsupervised learning approaches like word embeddings and topic modelling, as well as delve into the analysis of images as data. The course concludes with an introduction to deep learning, covering multilayer perceptron models, convolutional neural networks, recurrent neural networks, and transformers. By the end of the course, students will be equipped with the skills and knowledge to effectively apply machine learning techniques in their own research.

## Topics

- 1. Introduction Machine Learning in Economics**
  - a. Course Overview
  - b. Why Machine Learning
  - c. Prediction vs Inference
- 2. Supervised Machine Learning**
  - a. Fundamentals of Supervised Machine Learning
  - b. Gradient Descent
  - c. Supervised Machine Learning Algorithms
  - d. Boosting, Bagging, Kernels, and Ensemble Methods
  - e. Examples of Supervised Machine Learning in Economics
- 3. Natural Language Processing**
  - a. Dictionary methods and Regular Expressions
  - b. Text Tokenization
  - c. Stemming and Lemmatization
  - d. Part of Speech Tagging and Dependency Parsing
  - e. Sentiment Analysis
  - f. Examples of NLP in Economics
- 4. Unsupervised Machine Learning**
  - a. Fundamentals of Unsupervised Machine Learning
  - b. Unsupervised Machine Learning Algorithms
  - c. Word and Sentence Embeddings
  - d. Topic Models
  - e. Examples of Unsupervised Machine Learning in Economics
- 5. Image as Data**
  - a. Fundamentals of Image Processing
  - b. Supervised Machine Learning for Images
  - c. Unsupervised Machine Learning for Images
- 6. Deep Learning**
  - a. Multilayer Perceptron Models
  - b. Convolutional Neural Network
  - c. Recurrent Neural Networks
  - d. Transformers