

## MIS356 Statistical Machine Learning Syllabus

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**Ofis Hours** : Make an appointment via email

### Aim of the Course

MIS356 aims to deliver a gentle introduction to both the theory and applications of statistical learning.

### Course Output

A student who passes this course;

- Learns the intuitive the math background of statistical learning,
- Identifies statistical learning and machine learning as AI disciplines,
- Learns the statistical learning terminology,
- Learns to build and fine-tune predictive models,
- Learns clustering,
- Learns inference and the bias-variance tradeoff,
- Performs python programming for classification, regression, and clustering tasks.

### Required Reading

[James, G., Witten, D., Hastie, T., Tibshirani, R., & Taylor, J. \(2023\). \*An introduction to statistical learning: With applications in python\*. Springer Nature.](#)

### Additional Materials

- [Desmos Graphical Calculator](#)
- [3Blue1Brown: Calculus, linear algebra, probability](#), and [neural networks](#) wathclists
- [Google Colaboratory](#)
- [Kaggle Databases](#)

## Tentative Course Outline

- Week 1** : Why learning statistical learning?  
o Data – driven decision – making  
o Value of missing/unknown data  
o Capabilities, limitations, and implications  
Math Camp Session 1: Linear Algebra Essentials
- Week 2** : Math Camp Session 2: Single Variable Differential Calculus  
o Rate of change  
o Formal definition of derivatives  
o Gradient – based local search
- Week 3** : Math Camp Session 3: Multiple Variable Differential Calculus  
o Functions of several variables  
o Gradient ascent/descent algorithms revisited  
o Pitfalls and workarounds
- Week 4** : Introduction to Statistical Learning  
o Inputs: predictors, independent variables, features  
o Outputs: response, dependent variable  
o Functions and models (parametric vs. non – parametric)  
o Model accuracy and error  
o Supervised vs. Unsupervised Learning
- Week 5** : Supervised Learning Workshop 1: Linear Regression vs. KNN – Regression
- Week 6** : Supervised Learning Workshop 1 (cont'd): Model flexibility decisions  
o Underfitting  
o Overfitting
- Week 7** : Supervised Learning Workshop 1 (cont'd): Bias – Variance tradeoff
- Week 8** : Supervised Learning Workshop 2: Logistic Regression vs. SVM
- Week 9** : Supervised Learning Workshop 2 (cont'd): Uneven categories
- Week 10** : An introduction to feature engineering: Managing date – time data
- Week 11** : An introduction to feature engineering (cont'd): Managing missing data
- Week 12** : An introduction to feature engineering (cont'd):  
o Curse of dimensionality  
o Principal component analysis
- Week 13** : Unsupervised Learning Workshop 1: Centroid – based clustering  
o K – means clustering  
o Mutually exclusive data clusters  
o Intersecting data clusters
- Week 14** : Unsupervised Learning Workshop 2: Density – based clustering  
o DBSCAN clustering  
o Mutually exclusive data clusters  
o Intersecting data clusters

## Grading Policy

Occasional ungraded-assignments will not be a grading metric. Their purpose is to maintain better learning.

See [Ankara Bilim University Higher Education Guidelines/Article 38:](#)

Score Intervals	Grades	Scores per Credit
[100, 90]	AA	4.0
(90, 80)	BA	3.5
(80, 70)	BB	3.0
(70, 60)	CB	2.5
[60, 55]	CC	2.0
(55, 50]	DC	1.5
(50, 45]	DD	1.0
(45, 0]	FF	0.0