

## **PATTERN CLASSIFICATION FOR BIO-MEDICAL APPLICATIONS (MI720 - 1)**

### **Course Objectives:**

Pattern Recognition(PR) techniques are widely used for medical and biological applications since a long time. The objective of this new elective course is first to make student familiar with general approaches such as Bayes Classification, Nearest Neighbor Rule, Neural Networks and later to concentrate on more often used modern classification techniques such as Support Vector Machines and Multiclassifiers for solving Bio-Medical problems. The Invited speakers will share their research experience with these problems. The students will also learn through reading and discussing different application papers.

### **Online Contents:**

#### **COURSE OUTLINE**

- 1: Introduction to Pattern Classification. Definitions.
- 2: Applications: How to use MATLAB for Pattern Classification Applications
- 3: Introduction to Statistical Pattern Recognition. Bayes Rule. Maximum Likelihood Classification. Special Cases.
- 4: Maximum Likelihood Parameter Estimation
- 5: Nearest Neighbor Classification
- 6: Linear Discriminant Functions
- 7: Support Vector Machines
- 8 : Neural Networks as a tool for Pattern Classification. Multilayer Perceptron and Back-propagation
- 9: Decision Trees and Hierarchical Classification
- 10: Ensemble Classifiers; Bagging, Boosting, Component Classifiers
- 11: Clustering Algorithms
- 12: Performance Analysis
- 13: Applications in Bio-Informatics
- 14: Applications in Medicine

### **Face to face contents:**

#### **INSTRUCTOR:**

Prof. Dr. Neşe Yalabık, Room no: 201

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Office Hours: Tuesdays 14:30-16:30

#### **COURSE CONDUCT:**

There will be one midterm and one take-home final. A few homeworks will be given. Each student will do( in groups if they want) a term project and will read an application paper. Papers and the projects will be presented in class.

#### **BACKGROUND REQUIREMENTS:**

A strong background in math, geometry, probability and statistics is essential. At least one programming language like C and familiarity to MATLAB or a similar tool is necessary.

#### **Text Book:**

**R.O. Duda, P.E. Hart, and D.G. Stork, 'Pattern Classification' New York: John Wiley, 2001**

**References:**

**R. Schalkoff** *'Pattern Recognition: Statistical, Structural and Neural Approaches'*, Wiley, 1991?

**S.Theodoridis, K. Koutroumbas** *'Pattern Recognition'*, Elsevier, 2003

**A. Webb** *'Statistical Pattern Recognition'* Wiley, 2002

**L. I. Kuncheva** *'Combining Pattern Classifiers: Methods and Algorithms'*Wiley, 2004.

**Grading Policy:**

Midterm: 25 %

Project: 25 %

Final: 35 %

Paper presentation: 5%

Homeworks: 10 %