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| Course | Pattern Recognition – 0907542 (3 Cr. – Elective Course) |
| Catalog Description | Basic concepts in pattern recognition. Classifiers, data mining, and knowledge discovery. Basic concepts of decision functions. Linear decision functions, generalized decision functions, and orthogonal functions. Classification by distance functions and clustering. Minimum distance classification. Single prototypes, multi-prototypes, and nearest-neighbor classification. Clustering and clusters: threshold order-dependent clustering algorithm, Max-Min distance method, c-means iterative algorithm (CMI). The ISODATA algorithm. Classification using statistical approaches. A general Bayes classifier. Normally distributed patterns: univariate, multivariate, multiclass multivariate. Estimation of probability density functions. Feature selection: introduction, distance measures, and clustering transformations. Feature selection methods: entropy minimization, and functional approximation. Fuzzy concepts: fuzzy set theory, the extension principle, and fuzzy relations. Fuzzy and crisp classification. Fuzzy clustering: fuzzy c-means iterative algorithm (FCMI), and fuzzy partitioning. Fuzzy pattern recognition. Syntactic pattern recognition: grammar types, selecting primitives, syntax analysis for recognition, and stochastic languages. Introduction to NNs, the McCulloch-Pitts (MP) neuron, Hebb NN, the Perceptron, the ADALINE, and Backpropagation NN and its applications: Pattern classification using Neural Networks (NNs). |
| Prerequisites by Course | Operating Systems (1901473) |
| Prerequisites by Topic | Students are assumed to have good background in mathematics, particularly, calculus and linear algebra. Additionally, the students should have good programming skills, preferably, using Matlab. |
| Textbook | Theodoridis S, Koutroumbas K (2006) Pattern recognition, 3rd ed. Academic Press. |
| References | 1. Pattern Classification (2nd ed.) by Richard O. Duda, Peter E. Hart and David G. Stork, Wiley Interscience, 2001. |
| Course Website | http://www.abandah.com/gheith/?page_id=1110 |
| Facebook group | https://www.facebook.com/groups/196796377198206/ |
| Schedule & Duration | 15 Weeks, 45 lectures, 50 minutes each (including exams) |
| Student Material | Text book, class handouts, some instructor keynotes, and access to a personal computer and the internet. |
| College Facilities | Classroom with whiteboard and projection display facilities, library, and computer laboratory. |

Course Objectives

The objectives of this course are:

1. Introduce students to the techniques used in pattern recognition including preprocessing, feature extraction and selection, training, and classifications.
2. Introduce students to various types of classifiers including Bayes, linear, nonlinear, support vector machines, neural networks, and context dependent.
3. Introduce students to the practical techniques used in developing pattern recognition systems including sample collection, training, and evaluation.
4. Introduce students to the programming techniques and libraries used in pattern recognitions (Matlab case study).

Course Outcomes and Relation to ABET Program Outcomes

Upon successful completion of this course, a student should be able to:

1. Solve simple pattern classification problems using analytical techniques such as Bayes rule [a].
2. Solve a pattern recognition problem by developing an appropriate pattern recognition system [e].
3. Communicate the development of a pattern recognition system through a detailed technical report and a short presentation [g].
4. Use Matlab and its specialized libraries to develop programs for solving pattern recognition problems [k].

Course Topics

- Introduction
- Bayes Classifiers
- Linear Classifiers
- Non Linear Classifiers

Midterm Exam

- Feature Extraction
- Feature Selection
- System Evaluation
- Template Matching
- Context Dependent Classification

Final Exam

Computer Usage

Practical aspects of the course are covered in class and through the term project.

Important Dates

| Date | Event |
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| Sun 1 Feb, 2015 | Classes Begin |
| Mar 15 – Apr 2, 2015 | Midterm Exam Period |
| Tue 24 Mar, 2015 | Term project proposal is due |
| Tue 28 Apr, 2015 | Term project report is due and start of project demonstrations |
| Thu 7 May, 2015 | Last Lecture |
| May 13 – 21, 2015 | Final Exam Period |

Policies

- Attendance is required. Class attendance will be taken every class and the university's policies will be enforced in this regard.
- All submitted work must be yours
- Cheating will not be tolerated
- Open-book exams
- Join the facebook group of this course
- Check department announcements at: <http://www.facebook.com/pages/Computer-Engineering-Department/369639656466107> for general department announcements.

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| Assessments | Exams and term project | |
| Grading policy | Midterm Exam | 30% |
| | Term project report and presentation | 20% |
| | Final Exam | 50% |
| Instructors | Dr. Gheith Abandah , abandah@ju.edu.jo Homepage: http://www.abandah.com/gheith Office Hours: Sun – Wed: 11:00–12:00 | |
| Class Time and Location | Section 1: Sun, Tue, Thu: 10:00–10:50, CPE 001 | |
| Last Updated: | Jan 25, 2015 | |

Program Outcomes (PO)

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| a | An ability to apply knowledge of mathematics, science, and engineering |
| b | An ability to design and conduct experiment as well as to analyze and interpret data. |
| c | An ability to design a system, component, or process to meet desired needs , within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. |
| d | An ability to function on multidisciplinary teams |
| e | An ability to identify, formulate, and solve engineering problems |
| f | An understanding of professional and ethical responsibility. |
| g | An ability to communicate effectively |
| h | The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context |
| i | A recognition of the need for, and an ability to engage in life-long learning |
| j | Knowledge of contemporary issues |
| k | An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice |