Course Specifications

General Information

Course name	Pattern Recognition
Course number	ITCS4336
Faculty	
Department	
Course type	Major Needs
Course level	4
Credit hours (theoretical)	3
Credit hours (practical)	0
Course Prerequisites	

Course Objectives

1 - The fundamentals of pattern recognition.

2 - Choosing an appropriate features and pattern classification algorithm for a pattern recognition problem.

3 - Implementation of the pattern classification algorithms using modern computing tools.

Intended Learning Outcomes

Knowledge and Understanding	* a1. Show a critical understanding of the principles of pattern recognition. * a2. Understand concepts, trade-offs, and appropriateness of the different feature types and classification techniques. * a3. Understand the essential mathematics relevant to computer science. * a4. Demonstrate basic knowledge and understanding of a core of analysis, algebra, applied mathematics and statistics. * a5. Use high-level programming languages. * a6. Know and understand the principles and techniques of a number of application areas informed by the research directions of pattern recognition. * a7. Understand the nature and inherent difficulties of the pattern recognition problems.
Intellectual Skills	* b1. Select a suitable classification process, features, and proper classifier to address a desired pattern recognition problem. * b2. Define traditional and nontraditional pattern recognition problems, set goals towards solving them, and observe results. * b3. Perform comparisons between (algorithms, methods, techniques...etc). * b4. Perform classifications of (data, results, methods, techniques, algorithms. etc.). * b5. Identify attributes, components, relationships, patterns, main ideas, and errors * b6. Restrict solution methodologies upon their results.
Professional Skills	* c1. Demonstrate algorithm implementation skills using available tools and resources. * c2. Use appropriate programming languages and design methodologies. * c3. Evaluate systems in terms of general quality attributes and possible tradeoffs presented within the given problem.
General Skill	* d1. Demonstrate efficient IT capabilities. * d2. Manage tasks effectively. * d3. Manage ones own learning and development, including time management. * d4. Search for information and adopt life-long self-learning. * d5. Communicate effectively by oral, written and visual means. * d6. Work effectively as an individual and as a member of a team.

Course Contents

1 - Scope of pattern recognition: Numerical, syntactic and structural. Components of numerical pattern recognition system: Process description, feature analysis, classifier design, cluster analysis.
2 - Process description: Syntactic, numerical, contextual, fuzzy, rule based.
3 - Feature analysis: Preprocessing, feature extraction
4 - Classification: Bays decision theory, two category classification, classifiers, discriminate functions, and decision surfaces, the Bays classifier.
5 - Clustering: Data description and clustering, clustering criteria, hierarchical clustering.
6 - Applications.

Teaching and Learning Methods

1 - Lectures
2 - Exercises
3 - Projects

Students Assessment

Assessment Method	TIME	MARKS
Mid-Term Exam	6th week	30
Projects and/or Assignments	12th week	20
Final Exam	16th week	50

Books and References

Essential books	R. O. Duda, P. E. Hart and D. Stork, Pattern Classification, 2nd. Edition, Wiley 2002.
Recommended books	C. Bishop, Pattern Recognition and Machine Learning, Springer 2006.

Knowledge and Skills Matrix

Main Course Contents	Study Week	Knowledge and Understanding	Intellectual Skills	Professional Skills	General Skill
Scope of pattern recognition: Numerical, syntactic and structural	1-2	a1, a2, a4, a5	b1,b2,b3, b5, b6		d3-d5
Process description: Syntactic, numerical, contextual, fuzzy, rule based.	3-5	a1, a2, a4	b1-b3, b5, b6		d3-d5
Feature analysis: Preprocessing, feature extraction.	6-8	a1, a2, a6, a7	b1-b3, b5, b6	c1-c3	d1-d6
Classification: Bays decision theory, two category classification, classifiers, discriminate functions, and decision surfaces, the Bays classifier.	9-11	a1-a7	b1-b6	c1-c3	d1-d6
Clustering: Data description and clustering, clustering criteria, hierarchical clustering.	11-13	a1-a3, a5-a7	b1-b3, b5, b6	c1-c3	d1-d6
Applications.	14-15	a1, a2, a6, a7	b1-b6	c1-c3	d1-d6