Course title	**Pattern Recognition**
Course number	COMP 618
Credit hours (lecture and lab)	3 (3 + 0)
ECTS (weekly contact and self-study load)	6 (3 + 3)
Prerequisites/co-requisites by course number and name	None
Prerequisites by topic (other than the formal prerequisites above)	None
Level and type (compulsory, elective)	Masters' elective course
Year of study and semester	Any
Catalogue description	Decision Theory, ROC Curves, Likelihood Ratio Test, Linear and Quadratic Discriminants. Template-based Recognition, Feature Extraction, Eigenvector and Multilinear Analysis. Training Methods, Maximum Likelihood and Bayesian Parameter Estimation. Classification techniques: k-nn, LVQ, SVM, decision tree, ANN, CNN, GAN. Clustering techniques: k-means, VQ, dendrogram, gap statistics. Applications: image analysis, computer vision, speech analysis, man and machine diagnostics, person identification, spam filtering, industrial inspection, financial data analysis and forecast, and genetics.
Objectives	This course introduces the concepts, principles, methods, implementation techniques, and applications of pattern recognition. The course put emphasis on Bayesian decision theory, evaluation, clustering, feature selection, classification methods, recognizing structures, and applications. The students are introduced to the use of modern pattern recognition tools.
Intended learning outcomes	Upon successful completion of this course, students will be able to:

No	Intended learning Outcome (ILO)	PLO*
1	Demonstrate understanding of Bayesian Decision Theory and classification methods.	1, 3
2	Apply methods for pattern recognition.	3, 4
3	Select appropriate techniques for addressing recognition problems.	3, 4
4	Implement pattern recognition algorithms.	3, 4
5	Apply pattern recognition techniques in selected applications.	2, 5, 6
6	Use modern data mining toolboxes and libraries.	2, 4

(*) The Program learning outcome (PLOs) are listed in the appendix

<table>
<tr><td>Teaching and learning methods</td><td>Development of ILOs is promoted through the following teaching and learning methods:
The Digital Systems Lab. is open for the students to practice the practical aspects and solve the programming homework assignments.
The student attends the class presentations and participates in the discussions.
The student joins the related online team/group and participates in its discussions.
The student studies the reference material, including books and videos.
The student solves the programming assignments in pattern recognition.
The student carries out a term project for solving a problem using pattern recognition techniques.
The student develops a professional report for the term report.
The student presents the term project in class.</td></tr>
<tr><td>Learning material type</td><td>Textbook, class handouts, some instructor keynotes, selected YouTube videos, and access to a personal computer and the internet.</td></tr>
<tr><td>Resources and references</td><td>A- Required book(s), assigned reading and audio-visuals:
Svensén, Markus, and Christopher M. Bishop. "Pattern recognition and machine learning." (2007).
Duda, Richard O., Peter E. Hart, and David G. Stork. "Pattern classification, ed." W. Interscience (2001).
B- Recommended book(s), material and media:<ol start="3">
Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4. Academic Press, 2008.</td></tr>
<tr><td>Topic outline and schedule</td><td><table>
<tr><th>Week</th><th>Topic</th><th>ILO</th><th>Resources</th></tr>
<tr><td>1</td><td>Introduction to Pattern Recognition</td><td>2, 3</td><td>1, 2</td></tr>
<tr><td>2-3</td><td>Bayesian Decision Theory</td><td>1</td><td>1, 2</td></tr>
<tr><td>4</td><td>Linear Discriminants</td><td>2</td><td>2</td></tr>
<tr><td>5</td><td>Tree Classifiers</td><td>2,4, 6</td><td>2</td></tr>
<tr><td>6</td><td>Parametric Techniques</td><td>2</td><td>2</td></tr>
<tr><td>7</td><td>Non-Parametric Techniques</td><td>2</td><td>2</td></tr>
<tr><td>8-9</td><td>Unsupervised Methods</td><td>2, 4, 6</td><td>1</td></tr>
<tr><td>10-12</td><td>Other Classification Techniques</td><td>2, 4, 6</td><td>1</td></tr>
<tr><td>13-14</td><td>Graphical Models: SSM, HMM, and Bayesian Networks.</td><td>1</td><td>1</td></tr>
<tr><td>15</td><td>Term Project Presentations</td><td>5, 6</td><td>1, 2, 3</td></tr>
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<tr><td>Evaluation tools</td><td>Opportunities to demonstrate achievement of the ILOs are provided through the following assessment tools:
<table>
<tr><th>Assessment tool</th><th>Mark</th><th>Topic(s)</th><th>Time</th></tr>
<tr><td>Homework assignments</td><td>10%</td><td>Theoretical aspects</td><td>W1-W7</td></tr>
<tr><td>Midterm exam</td><td>30%</td><td>Applications</td><td>W8-W14</td></tr>
<tr><td>Term project report and presentation</td><td>20%</td><td>Practical and presentation aspects</td><td>W8-W15</td></tr>
<tr><td>Final exam</td><td>40%</td><td>All material</td><td>W16</td></tr>
<tr><td>Total</td><td>100%</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Student requirements</td><td>The student should have a computer and internet connection.</td></tr>
<tr><td>Course policies</td><td>A- Attendance policies:
Attendance is required. Class attendance will be taken every class and the university polices will be enforced in this regard.
B- Absences from exams and not submitting assignments on time:
A makeup exam can be arranged for students with acceptable absence causes.
Assignments submitted late, but before announcing or discussing the solution can be accepted with 25% penalty.
The project report must be handed in in time.
C- Health and safety procedures:
All health and safety procedures of the university and the school should be followed.
D- Honesty policy regarding cheating, plagiarism, misbehavior:
Open-book exams
All submitted work must be of the submitting student.
Other text or code must be properly quoted with clear source specification.
Cheating will not be tolerated.
E- Available university services that support achievement in the course:
Moodle course page
AI Lab for practicing the practical aspects and solving the programming assignments.
Program announcements Facebook group</td></tr>
<tr><td>Additional information</td><td>None</td></tr>
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