<table>
<tr><td>Course title</td><td>Neural Networks</td></tr>
<tr><td>Course number</td><td>COMP 609</td></tr>
<tr><td>Credit hours (lecture and lab)</td><td>3 (3 + 0)</td></tr>
<tr><td>ECTS (weekly contact and self-study load)</td><td>6 (3 + 3)</td></tr>
<tr><td>Prerequisites/co-requisites by course number and name</td><td>None</td></tr>
<tr><td>Prerequisites by topic (other than the formal prerequisites above)</td><td>None</td></tr>
<tr><td>Level and type (compulsory, elective)</td><td>Masters' elective course</td></tr>
<tr><td>Year of study and semester</td><td>Any</td></tr>
<tr><td>Catalogue description</td><td>Perception, back propagation, and adaptive neural networks. Transformation by layered networks, statistical neuro-dynamics, associative memory and neural learning. Supervised, unsupervised, reinforcement and deep learning. Applications to functional approximations, signal filtering, pattern recognition, data mining, etc.</td></tr>
<tr><td>Objectives</td><td>This course introduces students to the concepts of neural networks. The concepts of neural networks and the knowledge of supervised learning, computation and dynamical systems, reinforcement learning, and unsupervised learning using neural networks are introduced and their role in applications. The students are introduced to the of toolboxes and libraries in tools such as MATLAB and Python.</td></tr>
<tr><td>Intended learning outcomes</td><td>Upon successful completion of this course, students will be able to:
<table>
<tr><th>No</th><th>Intended learning Outcome (ILO)</th><th>PLO*</th></tr>
<tr><td>1</td><td>Demonstrate understanding of the role of neural networks in engineering, artificial intelligence, and cognitive modeling.</td><td>1, 3</td></tr>
<tr><td>2</td><td>Solve problems using supervised learning in neural networks</td><td>3, 4</td></tr>
<tr><td>3</td><td>Demonstrate understanding of computations and dynamical systems using neural networks.</td><td>1, 3</td></tr>
<tr><td>4</td><td>Solve problems using reinforcement learning in neural networks.</td><td>3, 4</td></tr>
<tr><td>5</td><td>Solve problems using unsupervised learning in neural networks.</td><td>3, 4</td></tr>
<tr><td>6</td><td>Demonstrate understanding of basic deep learning principles.</td><td>1, 3</td></tr>
<tr><td>7</td><td>Apply neural network techniques in selected applications</td><td>2, 5, 6</td></tr>
<tr><td>8</td><td>Use neural networks toolboxes and libraries in under MATLAB</td><td>2, 4</td></tr>
</table>
(*) The Program learning outcome (PLOs) are listed in the appendix</td></tr>
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Teaching and learning methods	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 Neural Networks. • The student carries out a term project for solving a problem using Neural Networks techniques. • The student develops a professional report for the term report. • The student presents the term project in class.
Learning material type	Textbook, class handouts, some instructor keynotes, selected YouTube videos, and access to a personal computer and the internet.
Resources and references	A- Required book(s), assigned reading and audio-visuals: 1. Simon, O. "Haykin, Neural Networks and Learning Machines." (2009). B- Recommended book(s), material and media: 2. Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. Deep learning. MIT press, 2016.
Topic outline and schedule	

Week	Topic	ILO	Resources
1	Introduction, McCulloch-Pitts networks	1	1
2	Perceptrons	1	1
3	Regression and least mean square algorithm	1, 2	1
4-5	Multilayer perceptrons	1	1
6-7	Radial-basis function networks	6	1
8-9	Support vector machines	2	1
10	Unsupervised learning and self-organization	4, 5	1
11-12	Boltzmann machines and deep networks	6	1
13	Convolutional networks	7	1
14	Recurrent networks	7	2
15	Term Project Presentations	3, 7, 8	2

Evaluation tools

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment tools:

Assessment tool	Mark	Topic(s)	Time
Homework assignments	10%	Programming	W1-W14
Midterm exam	30%	Applications	W8
Term project report and presentation	20%	Practical and presentation aspects	W3-W15
Final exam	40%	All material	W16
Total	**100%**		

Student requirements

The student should have a computer and internet connection.

Course policies

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

Additional information

None