

STUDY GUIDE

FUZZY SYSTEMS

Organised by

University of Vaasa





1. IDENTIFYING DATA.	
· Course Name.	<i>Fuzzy Systems</i>
· Coordinating University.	<i>University of Vaasa</i>
· Partner Universities Involved.	-
· Course Field(s).	<i>Information, Communication and Automation Technology</i>
· Related Study Programme.	<i>Industrial Systems Analytics, Master of Science</i>
· ISCED Code.	<i>0618</i>
· SDG.	<i>SDG 4: Quality Education SDG 9: Industry, Innovation and Infrastructure SDG 11: Sustainable Cities and Communities</i>
· Study Level.	<i>Master (M) and Doctorate (D)</i>
· Number of ECTS credits allocated.	5
· Mode of Delivery.	<i>Online self-Study</i>
· Language of Instruction.	<i>English</i>
· Course Dates.	<i>15th of January 2024 – 15th of May 2024</i>
· Precise Schedule of the Lectures.	<i>There is no fixed timetable for lectures. The deadline for the project work will be by the end of April. The deadline for the exam is mid-May. Every Friday there will be optional interactive online sessions to discuss the topics and exercises. Dates for these sessions will be announced in Moodle.</i>
· Key Words.	<i>Fuzzy sets; fuzzy logic; probabilistic approach; uncertainty; pattern recognition; image processing.</i>
· Catchy Phrase.	<i>Fuzzy Systems: where logic and uncertainty meet!</i>
· Prerequisites and co-requisites.	Required: <i>-Some programming experience. Particularly, knowing basic programming concepts and techniques. -Able to write simple functions and algorithms in at least one programming language. -Enrolled at any of the EUNICE partner universities -English B2</i>





	<p>Recommended: Depending on the application area the student chooses for the project work, familiarity with at least one of the following might be beneficial, but not needed (all necessary knowledge will be revised during the class): mathematical logic, probability theory, control theory, image processing, data analysis.</p>
<p>• Number of EUNICE students that can attend the Course.</p>	<p>18 students in total</p> <p>BTU, IPV, KAU, PUT, UC, UMONS, UNICT, UOP UPHF: 2 each UVA: Check Peppi</p>
<p>• Course inscription procedure(s).</p>	<p>Enrolment via the EUNICE website</p>

2. CONTACT DETAILS.

• Department.	Digital Economy Research Platform
• Name of Lecturer.	Luca Ferranti
• E-mail.	luca.ferranti@uwasa.fi
• Other Lecturers.	-

3. COURSE CONTENT.

Fuzzy sets, fuzzy logic and fuzzy numbers
 Type-1 and Type-2 Mamdani and Sugeno inference systems
 Learning fuzzy models from data
 Applications of fuzzy methods to data analysis, control theory and image processing.
 Mathematical foundations of fuzzy logic

4. LEARNING OUTCOMES.

After having passed the course the student is able to:

Describe the basic concepts of fuzzy sets and fuzzy logic.
 Explain how fuzzy sets and fuzzy logic differ from traditional set theory and logic.
 Explain how fuzzy methods compare to other probabilistic approaches to model uncertainty.
 Apply fuzzy methods to model and solve various engineering problems such as pattern recognition, systems control and image processing.
 Implement simple fuzzy algorithms from scratch and use existing popular tools.
 Critically read scientific publications applying fuzzy methods and reproduce the experiments.

5. COURSE ORGANISATION.



LEARNING RESOURCES AND TOOLS.

Video recordings, lecture slides, exercises hands-out, other reading distributed during the course

PLANNED LEARNING ACTIVITIES AND TEACHING METHODS.

The course is 5 credits, which corresponds to 135h for the "average student" (which means, it might take more or less for you, depending on your ambitions, background, attitude, etc.). The course workload is roughly divided as follows (not everything is compulsory and may vary depending on how students choose to participate):

prerecorded videos: 10h

interactive discussion sessions: 30h

Exam: 3h

Project work: 27h

independent work: 65h in total

6. ASSESSMENT METHODS, CRITERIA AND PERIOD.

Assessment criteria and methods:

- *Weekly exercises*
- *Exam*
- *Project work*

Evaluation criteria:

- *Correctness of the answers*
- *Clarity of the exposition*
- *Punctuality in meeting the deadlines*

Grading: On a scale of 1-5, or fail (0)

OBSERVATIONS.

Recognition-related issues:

Please contact your home university's International Relations Office if you encounter any issues concerning the recognition of the ECTS at the end of the course. Lecturers are not in charge of the recognition process.

Doctoral students: please contact your supervisor if you wish to have these ECTS in your transcript.

7. BIBLIOGRAPHY AND TEACHING MATERIALS.

All necessary materials to complete the course will be provided by the professor.





Optional materials will be recommended for those who want to deepen their understanding.

