AI: PERSONALITY AND EMOTION FOR AI DESIGN

Grado en Computación e Inteligencia Artificial / Bachelor in Computer Science and Artificial Intelligence BCSAI SEP-2025 AIPE-CSAI.2.M.A

Area Computer Science

Number of sessions: 15

Academic year: 25-26

Degree course: SECOND

Number of credits: 3.0

Semester: 2º

Category: COMPULSORY

Language: English

Professor: **LUCIANO DYBALLA**

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Luciano Dyballa is an Assistant Professor at IE University in the School of Science & Technology since 2024. He obtained his Ph.D. in Computer Science from Yale University focusing on machine learning, vision, and computational neuroscience. His research aims at investigating the mechanisms and principles behind real and artificial intelligence, and in bridging the gap between biological and deep neural networks. Prior to Yale, he obtained a B.S. in Chemical Engineering and an M.S. in Computer Science, both from the Federal University of Rio de Janeiro, in Brazil. He has also worked as an engineer, developing software for data mining and natural language processing.

Office Hours

Office hours will be on request. Please contact at:

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SUBJECT DESCRIPTION

This course introduces students to the foundational concepts of cognitive science and deep learning, exploring the intersection between human cognition and artificial intelligence. We will cover how the human brain processes information and how neural networks attempt to replicate aspects of this processing. Key topics include perception, learning, memory, and the basics of neural networks. The course will also delve into more nuanced aspects of human cognition, such as emotion and personality, and examine whether these can be simulated in AI systems. Students will be encouraged to critically analyze whether AI can exhibit human-like intelligence, emotion, and personality, and will discuss the ethical implications of developing AI systems. Through in-class demos and reflective discussions, students will gain a balanced understanding of both the technical and philosophical dimensions of artificial intelligence.

LEARNING OBJECTIVES

- Understand core concepts of cognitive science, including perception, learning, memory, attention, and consciousness
- Understand the keys differences between learning in artificial vs. biological neural networks
- Grasp the foundational principles of neural networks and deep learning through in-class demos
- Explore how AI systems can be designed to simulate human traits such as emotion and personality
- Critically assess the potential of AI to replicate human-level intelligence
- Explore the societal impacts of AI technologies

TEACHING METHODOLOGY

Before each class, students are expected to work on assignments and readings at home. The course lectures will cover both theoretical explanations and practical examples. Many lectures will also include a coding demonstration. Each new technique introduced will be followed by one or more examples. Students need to participate in class to acquire the skills needed to understand, implement, and apply each of the concepts and algorithms covered. Individual assignments will be used throughout the course to assess student progress.

Problem sets will be designed for students to develop intuition behind the theory and to develop the coding skills necessary to implement the algorithms. While students are encouraged to work with others on understanding the lecture material and assignments, all written work (including code) should be your own — plagiarism will not be accepted. If you benefit from hints or solutions received from fellow students or from an outside source, please make sure to acknowledge all of them in your work.

Learning Activity	**Weighting**	**Estimated time a student should dedicate to prepare for and participate in**
Lectures	24.0 %	18.0 hours
Discussions	13.3 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	20.0 %	15.0 hours

Group work	22.7 %	17.0 hours
Individual studying	20.0 %	15.0 hours
TOTAL	100.0 %	75.0 hours

AI POLICY

Generative artificial intelligence (GenAI) tools may be used in this course for some specific tasks/assignments with appropriate acknowledgment. GenAI may not be used for group project submissions nor quizzes or exams. If a student is found to have used AI-generated content inappropriately, it will be considered academic misconduct, and the student might fail the respective assignment or the course. If you are in doubt as to whether you are using GenAI tools appropriately in this course, please discuss it with the professor.

Below is a suggested format to acknowledge the use of generative AI tools, when allowed. Please note that acknowledging AI will not impact your grade.

“I acknowledge the use of [AI systems link] to [specify how you used generative AI]. The prompts used include [list of prompts]. The output of these prompts was used to [explain how you used the outputs in your work]”

If AI was permitted to be used in your assignment, but you have chosen not to include any AI-generated content, the following disclosure is recommended:

“No content generated by AI technologies has been used in this assignment.”

PROGRAM

SESSION 1 (LIVE IN-PERSON)

Session 1: Introduction to Cognitive Science and AI

- What is cognitive science? Key theories of human cognition.
- What is artificial intelligence? Overview of AI history and goals.
- What does it mean for something to be "intelligent"?

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SESSION 2 (LIVE IN-PERSON)

Session 2: Neurons and the Basics of Neural Networks

- Basic neuroscience: How biological neurons work
- Models of artificial neurons
- The perceptron: A simple neural network model

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SESSION 3 (LIVE IN-PERSON)

Session 3: Principles of learning in biological vs. artificial neural networks

- Supervised learning in AI: Training machines using labeled data.
- Pattern recognition
- Hebbian learning

SESSION 4 (LIVE IN-PERSON)

Session 4: Multi-layer perceptrons

- Introduction to feedforward networks (simple neural networks)
- Loss functions and optimization
- Stochastic Gradient Descent
- Backpropagation

SESSION 5 (LIVE IN-PERSON)

Session 5: Developing brains vs. training ANNs

- Development, brain plasticity, nature vs. nurture
- Training deep networks in practice
- Weight initialization, Activation functions, regularization

SESSION 6 (LIVE IN-PERSON)

Session 6: Memory, learning and problem solving

- How do humans learn from limited examples? Theories of inductive reasoning.
- The challenge of generalization in AI: Overfitting, data augmentation, and regularization.
- Why deep networks often require massive amounts of data to generalize.

SESSION 7 (LIVE IN-PERSON)

Session 7: Dimensionality reduction

- Dimensionality reduction
- Latent representation in hidden layers
- Hebbian networks

SESSION 8 (LIVE IN-PERSON)

Session 8: Perception in Humans and Artificial Neural Networks

- How we process visual and auditory information
- Theories of Perception: Bottom-up vs. top-down processing, Gestalt principles, and ecological perception theories.
- Intro to Convolutional Neural Networks

SESSION 9 (LIVE IN-PERSON)

Session 9: Vision

- Intro to CNNs part II
- Adversarial examples in CNNs vs. visual system

SESSION 10 (LIVE IN-PERSON)

Session 10: Language

- Language and Thought
- Human Language Processing
- Introduction to NLP and language models in AI

SESSION 11 (LIVE IN-PERSON)

Session 11: Attention, Bias, Personality & Emotion

- Attention in deep learning
- Intro to Large Language Models
- How AI systems can recognize and simulate personality & emotion
- Bias in AI systems

SESSION 12 (LIVE IN-PERSON)

Session 12: Philosophy of mind vs. AI

- What does it mean to "understand" something?
- The Chinese Room argument and other philosophical critiques of AI.
- Can AI ever be truly intelligent in the human sense?

SESSION 13 (LIVE IN-PERSON)

Final Exam

SESSION 14 (LIVE IN-PERSON)

Group Project presentations

SESSION 15 (LIVE IN-PERSON)

Group Project presentations

EVALUATION CRITERIA

criteria	percentage	Learning Objectives	Comments
Final Exam	40 %		The final exam is worth 40% of the overall grade. You need to score at least 3.5 to pass the overall course, even if you have already passed the course through the other course assessments.
Group Presentation	30 %		The group project includes a written report and an in-class presentation.

Individual work	20 %		Students will be required to turn in selected exercises that will be announced throughout the course.
Class Participation	10 %		This is a highly interactive class, and active participation during lectures is expected, with students encouraged to ask questions and make remarks. Punctuality and class conduct will also be taken into account. Students might be invited to give short presentations and/or solve selected exercises in class.

RE-SIT / RE-TAKE POLICY

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Each student has four chances to pass any given course distributed over two consecutive academic years: ordinary call exams and extraordinary call exams (re-sits) in June/July.

Students who do not comply with the 80% attendance rule during the semester will fail both calls for this Academic Year (ordinary and extraordinary) and have to re-take the course (i.e., re-enroll) in the next Academic Year.

Evaluation criteria:

- Students failing the course in the ordinary call (during the semester) will have to re-sit the exam in June / July (except those not complying with the attendance rule, who will not have that opportunity and must directly re-enroll in the course on the next Academic Year).
- The extraordinary call exams in June / July (re-sits) require your physical presence at the campus you are enrolled in (Segovia or Madrid). There is no possibility to change the date, location or format of any exam, under any circumstances. Dates and location of the June / July re-sit exams will be posted in advance. Please take this into consideration when planning your summer.

- The June / July re-sit exam will consist of a comprehensive exam. Your final grade for the course will depend on the performance in this exam only; continuous evaluation over the semester will not be taken into consideration. Students will have to achieve the minimum passing grade of 5 and can obtain a maximum grade of 8.0 (out of 10.0) – i.e., “notable” in the in the re-sit exam.

- Retakers: Students who failed the subject on a previous Academic Year and are now re- enrolled as re-takers in a course will be needed to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as retakers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained in the retake exam (3rd call) is 10.0.

After ordinary and extraordinary call exams are graded by the professor, you will have a possibility to attend a review session for that exam and course grade. Please be available to attend the session in order to clarify any concerns you might have regarding your exam. Your professor will inform you about the time and place of the review session. Any grade appeals require that the student attended the review session prior to appealing.

Students failing more than 18 ECTS credits in the academic year after the June-July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.

In case you decide to skip the opportunity to re-sit for an exam during the June / July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker and pay the corresponding extra cost. As you know, students have a total of four allowed calls to pass a given subject or course, in order to remain in the program.

BIBLIOGRAPHY

Recommended

- Stuart Russell, Peter Norvig. (2020). *Artificial Intelligence: A modern approach.* 4th edition. Pearson. ISBN 978013461099 (Printed)
- Jay Friedenberg, Gordon Silverman, Michael James Spivey. (2021). *Cognitive Science: An Introduction to the Study of Mind.* 4th edition. SAGE Publications. ISBN 9781544380155 (Printed)
- Marvin Minsky. (2007). *The Emotion Machine.* Simon & Schuster. ISBN 978074327664 (Printed)
- Michael A. Nielsen. (2015). *Neural Networks and Deep Learning.* Determination Press. ISBN 0000000000 (Digital)

  http://neuralnetworksanddeeplearning.com

BEHAVIOR RULES

Please, check the University's Code of Conduct here. The Program Director may provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy here. The Program Director may provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code here. The Program Director may provide further indications.