

COGM-112, COGM-113: Informatics Course Description

Aim of the course

Aim of the course: introduction to cognitive informatics

Learning outcome, competences

knowledge:

- understanding computational principles of artificial intelligence
- understanding computational cognitive modelling
- providing an overall view of the field of cognitive informatics

attitude:

- is capable of cooperation and solving tasks in teams;

skills:

- is able to see causal relationships, can think logically, and can prepare comprehensive reviews;

Content of the course

Topics of the course

1. Introduction to cognitive informatics
 - 1.1. What is cognition in terms of computations, computational cognitive modelling, types of cognitive modelling, what is computational cognitive modelling good for, multiple levels of cognitive modelling, successes and pitfalls of cognitive modelling
 - 1.2. Introduction to symbolic modelling and the problem of symbol grounding
 - 1.3. Introduction to connectionist type modelling and the problem of ‘making sense’
2. Connectionist Modelling
 - 2.1. Curse of dimensions
 - 2.2. What is an artificial neuron and how it transmits information – Activation functions, connection weights, output computation
 - 2.3. Perceptron – McCulloch-Pitts neuronal type, categorizing and approximating neurons
 - 2.4. Learning rules, short term and long term memories
 - 2.5. Segmentation and learning of time series and episodes
3. Learning types: self-organizing learning vs. supervisory training vs. reinforcement learning
 - 3.1. Cognition and brain modelling
 - 3.2. Human behavioral problem: autism
4. Learning and memory and knowledge representation, categories, concepts, Cartesian components
 - 4.1. Orientation, space (hippocampal place cells), metric (entorhinal grid cells), entorhinal boundary cells, entorhinal obstacle cells, mirror neurons, Theory of Mind
5. Network architectures
 - 5.1. Holistic recognition and recognition by components
 - 5.2. The binding problem and the problem of synchronization
 - 5.3. Human behavioral problem: schizophrenia,
 - 5.4. Agnosias, e.g., akinetopisa, prosopagnosia, simultagnosia
6. Classical models of cognition
 - 6.1. The Standard Model of Mind: ACT-R, SOAR, Sigma
 - 6.2. CLARION
7. Summary and outlook: language, control, planning, goal oriented behavior

Learning activities, learning methods:

Lectures and interactive discussions

Evaluation of outcomes

Learning requirements, mode of evaluation, criteria of evaluation:

- Students will be graded on the basis of their individual participation in the class discussion during the different sessions (20% of the mark).

- Students (in groups of 2) will also be asked to write and orally present a review of Sections 1-to-6 at the exam (60% of the mark).
- Each student will be asked to peer-review one of the student presentations and the quality of the peer-review will be marked (20% of the mark).

Reading list

Compulsory reading

- Cognitive Psychology – Scholarpedia
- Cognition – Wikipedia
- Friedenber, Jay, and Gordon Silverman. Cognitive science: An introduction to the study of mind. Sage, 2011. – Parts TBA.
- Cognitive Science – Stanford Encyclopedia of Philosophy -- <https://plato.stanford.edu/entries/cognitive-science/>

Recommended reading list

- Sun, Ron. (2008). "Introduction to computational cognitive modeling". In: R. Sun (Ed.), The Cambridge Handbook of Computational Psychology (pp.3-19). New York: Cambridge University Press. (<http://www.cogsci.rpi.edu/~rsun/folder-files/sun-CHCP-intro.pdf>)
- Palminteri, Stefano, Valentin Wyart, and Etienne Koechlin. "The Importance of Falsification in Computational Cognitive Modeling." Trends in Cognitive Sciences (2017).
- Concept Learning. (2014). In Wikipedia. http://en.wikipedia.org/wiki/Concept_learning
- Semantic network. (2014). In Wikipedia. http://en.wikipedia.org/wiki/Semantic_network
- Cognition and emotions http://www.scholarpedia.org/article/Cognition_and_emotion
- Cognitive psychology http://www.scholarpedia.org/article/Cognitive_psychology
- A Standard Model of the Mind (2017): <http://goo.gl/KF1VPc> (pptx file)
- Prinsloo, M., & Barrett, P. (2013). Cognition: Theory, measurement, implications. Cognition. <http://goo.gl/MnbSRi>