Technology
Arts Sciences
TH Köln

Course Manual CI

Computational Intelligence

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General information

Long name	Computational Intelligence
Approving CModule	CI_MaTIN
Responsible	Prof. Dr. Rainer Bartz Professor Fakultät IME
Valid from	summer semester 2021
Level	Master
Semester in the year	summer semester
Duration	Semester
Hours in self-study	78
ECTS	5
Professors	Prof. Dr. Rainer Bartz Professor Fakultät IME
Requirements	vector functions, gradient
Language	German, English if necessary
Separate final exam	Yes

Literature

Domschke W., Drexl A.; Einführung in Operations Research; Springer

Zell, A.: Simulation Neuronaler Netze; Oldenbourg

Nauck, D. et al.: Neuronale Netze und Fuzzy-Systeme; Vieweg

Eiben, A.E., Smith, J.E.: Introduction to Evolutionary Computing; Springer

Gerdes, I. et al.: Evolutionäre Algorithmen; Vieweg

Grosse et al.: Taschenbuch der praktischen Regelungstechnik, Fachbuchverlag Leipzig

Final exam

Details	written exam
Minimum standard	roughly 50%
Exam Type	EN Klausur

− Lecture / Exercises

Learning goals

Goal type	Description
Knowledge	Optimization strategies - classification of problems - gradient algorithms - simplex algorithm - multiobjective optimization and Pareto approach
Knowledge	Artificial neural networks - artificial neurons - neural network structures - training algorithms
Knowledge	Fuzzy logic - fuzzification - inference - defuzzification
Knowledge	Evolutionary algorithms - genome representations - selection mechanisms - recombination operators - mutation operators
Skills	The students acquire fundamental knowledge on theory and applications of computational intelligence
Skills	The students know about typical classes of optimization tasks and how to map a specific problem to those classes
Skills	They know the simplex algorithm and can transform problems into the standard form to find the solutions
Skills	The students can classify artificial neural networks and determine their applicability for specific tasks
Skills	They can vary the parameters of neural networks and rate their impact on the results
Skills	They can classify training algorithms and understand the backpropagation algorithm

Special requirements

none

Accompanying material	Compendium with course contents (in engl. language) Exercises and solutions (in engl. language)
Separate exam	No

Skills	They know about the fuzzy logic approach, can apply it to specific problems and justify the resulting system behavior
Skills	The students know how evolutionary algorithms work and can distinguish the variants
Skills	They can transform a problem specification into a representation appropriate for an evolutionary algorithm
Skills	They can rate selection strategies and define suitable algorithms
Skills	The students can solve linear problems with the use of the simplex algorithm
Skills	They can apply artificial neural networks to solve problems of modeling and classification
Skills	They can define fuzzy logic systems to solve imprecise and vague tasks
Skills	They can solve difficult problems heuristically using evolutionary algorithms

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Lecture	2
Exercises (whole course)	1
Exercises (shared course)	0
Tutorial (voluntary)	0

− Practical training

Learning goals

Goal type	Description
Knowledge	Application of artificial neural networks to a classification task
Knowledge	Variation and multiobjective optimization of neural network parameters
Knowledge	Fuzzy-based closed loop control of a system with two inputs
Skills	The students are familiar with tools supporting computational intelligence
Skills	The students can vary system parameters, perform test series, and evaluate, present and discuss the results
Skills	The students are able to understand, present, analyze and discuss scientific publications
Skills	The students are able to solve problems in small teams
Skills	They can tackle optimization tasks in a structured and systematic way
Skills	They can rate the behavior of a system with regard to objectives and study and improve the behavior through parameter variations
Skills	They are able to cope with international scientific publications, understanding, presenting and discussing them in their context

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Practical training	1
Tutorial (voluntary)	0

Special requirements

none

Accompanying material	Specification of the lab tasks (in engl. language), Electronic documentation of the tools to be used
Separate exam	No