Course Specifications

Valid as from the academic year 2020-2021

Capita Selecta in Soft Computing (C001719)

Course size   (nominal values; actual values may depend on programme)

Credits	6.0	Study time	165 h	Contact hrs	45.0 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 2)	Dutch	Gent	project	15.0 h
			lecture	30.0 h

Lecturers in academic year 2020-2021

Cornelis, Chris	WE02	lecturer-in-charge

Offered in the following programmes in 2020-2021	crdts	offering
Master of Science in Teaching in Science and Technology (main subject Mathematics)	6	A
Master of Science in Computer Science	6	A
Master of Science in Mathematics	6	A

Teaching languages

Dutch

Keywords

Fuzzy relations, fuzzy relational calculus, fuzzy topology, rough sets, machine learning

Position of the course

The concept of a relation is fundamental, in a sense that sometimes science is described as the discovery of relations between objects, systems and structures. In this course we will give an overview of the recent developments in the classical relational calculus and its extension to imprecise relationships, the so-called fuzzy relational calculus. In parallel to defining and studying the theoretical concepts, we will illustrate them in a number of practical contexts, including machine learning. The term soft computing refers to a collection of models for representing and processing imprecise information. We will focus on two of them in particular, namely fuzzy set theory and rough set theory.

Contents

1. Classical relational calculus
1.1 Basic concepts
1.2 Operations
1.3 Classical images
1.4 New images and their properties
1.5 Special relations
1.6 Classical composition
1.7 New compositions and their properties
1.8 Application: formal concept analysis and rough set theory, and their use for machine learning and data analysis

2. Fuzzy relational calculus
2.1 Basic concepts
2.2 Operations
2.3 Classical fuzzy images
2.4 New images and their properties
2.5 Approximate equality and similarity
2.6 Classical fuzzy composition
2.7 New compositions and their properties
2.8 Application: fuzzy rough set theory, and their use for machine learning and data analysis

2.9 Other applications, for example in recommender systems, temporal reasoning, ...
3. Introduction to fuzzy topology

Initial competences

A positive attitude w.r.t. a mathematical approach. Basic notions of fuzzy set theory are introduced at the start of the course.

Final competences

1 The students should be familiar with fuzzy relational calculus and its applications.
2 They should be capable of initiating independent research in this area.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, project

Extra information on the teaching methods

The learning material is provided in English.

Learning materials and price

The learning material is electronically available (free of charge), using the Ufora website.

References

E.E. Kerre, Fuzzy Sets and Approximate Reasoning, Xian Jiaotong University Press, 1998.
E.E. Kerre, Introduction to the Basic Principles of Fuzzy Set Theory and Some of its Applications, Communication and Cognition, 1993.
S. Vluymans, Dealing with Imbalanced and Weakly Labelled Data in Machine Learning using Fuzzy and Rough Set Methods, PhD thesis, 2018.

Course content-related study coaching

Students can ask questions during lectures or via e-mail.

Evaluation methods

continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Examination methods in case of periodic evaluation during the second examination period

Examination methods in case of permanent evaluation

Participation, assignment

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible

Extra information on the examination methods

Project: individual or in group, in which the theory is applied to a specific application domain, with written report and oral presentation
Participation: presence and participation in discussions during class, preparing and presenting selected exercises on the blackboard

Calculation of the examination mark

The project counts for 10 points out of 20, just like the participation. A student should obtain at least 50% for each part to be able to pass.

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