

Course Title: General Rough Sets and Learning of Science

Instructor: A Mani

Credits: 2

The purpose of the course is to equip researchers with non-intrusive or minimalist or contamination-free methods for formally handling vagueness in the context of knowledge representation in human reasoning/learning and analysis of data. The course will be biased towards science education throughout including motivation for knowledge representation, vague reasoning, attribute reduction (of a specific kind), rule discovery, decision-making and contamination avoidance.

1. Prerequisites
 - a. Set Theory and Relations
 - b. Algebras and Partial Algebras
 - c. Lattices
 - e. Partially Ordered Sets

Reading Material:

1. chapters 1-3 of M. Dunn and G. Hardegree "Algebraic Methods in Philosophical Logic" Oxford Logic Guides 2011
- 2 B. Davey and H. Priestley: "Introduction to Lattices and Order" 2nd Edition Oxford

Reading Material (for the following):

1. I. Duntsch and G. Gediga: Rough Set Data Analysis, Methodos: 2002
 2. P. Pagliani and M. K. Chakraborty: "Geometry of Approximation" Springer, 2008
 3. Z. Pawlak: Theoretical Aspects of Reasoning with Data, Kuwer, 1991
 4. L. Polkowski: Approximate Reasoning by Parts, Springer, 2011
 5. A Mani, I Duntsch and G. Cattaneo (Eds): Algebraic Methods in Rough Sets, 2019
 6. J. Seibt et. al Handbook of Mereology, Philosophia Verlag, 2017
- + Number of Papers and Surveys

2. Data Representation

- a. Information Tables,
- b. Decision Tables,
- c. Others
- e. Issues

3. General Rough Sets Basics-1

- a. Motivation, Concrete, Abstract, and Granular Approaches.
- b. Approximations, Related Properties
- c. Semantic Domains
- e. Overview of Applications -1, Reducts,

4. General Rough Sets -2

- a. Granularity-1
 - b. Mereology-1
 - c. Overview of Applications-2
- Formalizing Reasoning vs Aiding Learning Process

5. Activity

- a. Granularity and Teaching,
automating feedback for students
automating evaluation
- b. Formal Concept Analysis (FCA)
- c. FCA and Rough Sets: Divergence, Reasons for Limited Adoption of FCA
- e. Decision Making-1

6. General Rough Sets-3

- a. Granularity-2
 - b. Mereology-2
 - c. Connections between contaminated Rough Sets and Probability/Subjective Probability
 - e. Three-way Decision Making
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