UNIVERSITY OF SKÖVDE

TRANSLATION FROM SWEDISH

COURSE SYLLABUS

Computational Intelligence A1N

6 credits

Course code: VP702A
Version number: 6
Valid from: 1 July 2022
Ratified by: Curriculum Committee for Engineering Science
Date of ratification: 6 December 2021

1. General information about the course

The course is provided by the University of Skövde and is named Computational Intelligence A1N (Datorintelligens A1N). It comprises 6 credits and is a second-cycle course. The level of progression is A1N.

The course is a part of the main field of study in Virtual Product Realization. It can also be a part of the main field of study in Informatics. The disciplinary domain of the course is Technology.

2. Entry requirements

A Bachelor's degree equivalent to a Swedish kandidatexamen of 180 credits, within the main fields of integrated product development, production engineering, automation engineering, mechanical engineering or information technology (or the equivalent).

A further requirement is proof of skills in English equivalent of studies at upper secondary level in Sweden, known as the Swedish course English 6. This is normally demonstrated by means of an internationally recognized language test, e.g. IELTS or TOEFL.

3. Course content

Computational Intelligence (CI) deals with methods and algorithms intended to solve NP-hard problems. Many problems in the real-world are ill-posed and therefore cannot be efficiently solved using deterministic methods. CI methodologies can be broadly classified into neuro, fuzzy and evolutionary techniques. These techniques emulate natural and biological systems to find approximate solutions in a reasonable time. CI also has a significant overlap with the fields of artificial intelligence and data-mining, where the focus is on discovering patterns and knowledge from data through machine learning.

This course will firstly introduce methodologies which fit the traditional definition of CI, namely: Artificial Neural Networks, Fuzzy Computation and Evolutionary Computation.

We will also learn to apply selected topics in machine learning, namely: supervised learning which includes Classification and regression trees, k-Nearest Neighbors, Neural Networks and Random Forests and Unsupervised learning which includes k-Means and Hierarchical Clustering.

Desirable Prerequisites are basic knowledge of vector and matrix operations and programming knowledge.

4. Objectives

After completed course the student should be able to:

- describe various computational intelligence methodologies and discuss the advantages and shortcomings of each,
- mathematically formulate problems to be solved using these methodologies,
- understand the effect of parameters and tune them to improve performance of the methods,
- apply machine learning algorithms various datasets,
- identify problem types and recommend methods that can be used,
- write computer programs for implementing some of the methodologies,
- use software tools, online programming libraries and source codes to quickly solve problems and
- read, understand and explain research articles concerning soft computing.

5. Examination

The course is graded A (Excellent), B (Very good), C (Good), D (Satisfactory), E (Sufficient) or F (Fail).

The examinations of the course consist of the following modes of assessment:

- **Written assignment**
  2 credits, grades: G/U
- **Laboratory assignment**
  1 credit, grades: G/U
- **Seminar assignment**
  1 credit, grades: G/U
- **Project presentation**
  2 credits, grades: A/B/C/D/E/F (determines the final grade)

Students with a permanent disability who have been approved for directed educational support may be offered adapted modes of assessment.

6. Types of instruction and language of instruction

The teaching is comprised of seminars/group discussions, presentations, laboratory sessions, lectures, project work and supervision.

The teaching is conducted in English.

7. Course literature and other educational materials

Sunith B. *Compendium: Computational Intelligence*. University of Skövde.

Reference literature

Deb, K. (2002). *Multi-objective optimization using evolutionary algorithms*. John Wiley & Sons. ISBN 978-0-471-87339-6.

Engelbrecht, A. P. (2007). *Computational Intelligence: An Introduction*. (2nd Ed.) John Wiley & Sons. ISBN 978-0-470-03561-0.

Hastie, T., Friedman, J., & Tibshirani, R. (2009). *The elements of statistical learning*. New York: Springer. ISBN 978-0-387-84858-7.

Rojas, R. (1996). *Neural networks: A systematic introduction*. New York: Springer. ISBN 978-3-642-61068-4.

8. Student influence

Student influence in the course is ensured by means of course evaluation. The students are informed about the results of the evaluation and potential measures that have been taken or are planned, based on the course evaluation.

9. Additional information

Further information about the course, as well as national and local governing documents for higher education, is available on the website of the University of Skövde.