

TARET IP

Training in advanced remote technologies

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Objectives

Focus of TARET

- To provide an intensive training in Telerobotics and Advanced Control as part of the MARE curriculum
- To mediate fundamentals, applications and experiences by an interdisciplinary approach in combination with "learning by doing" phases
- To foster transnational cooperation and exchanges between students and teachers of European universities, encourage efficient and multinational teaching

Expectations

- attract students from several European universities
- require at least some prerequisites in mathematics, informatics, electronics and mechanics
- act as a forum for technology enhanced learning
- support for the Bologna process
- Language of instruction English

Partners

- Carinthia University of Applied Sciences (Austria)
- Blekinge Institute of Technologies (Sweden)
- University of Technologies Ilmenau (Germany)
- University Maribor (Slovenia)
- Transylvania University of Brasov (Romania)
- National Technical University "Kharkov Polytechnical Institute,, (Ukraine - not financed from LLL)

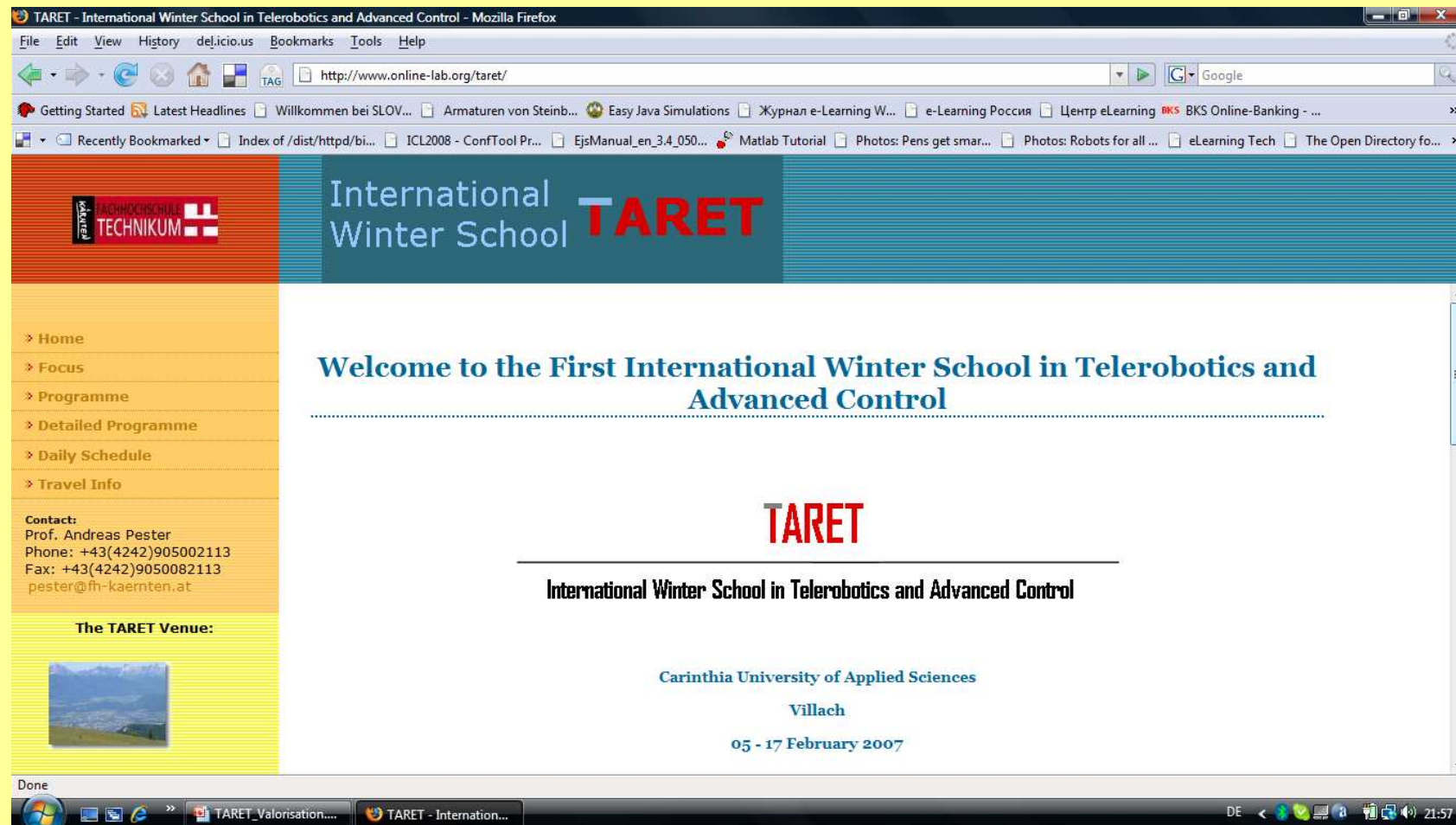
Statistics

- 31 participating students from 7 universities
- 8 participating professors from 5 universities
- 72 lesson hours and practical work
- 2 visits to companies
- 2 guest lectures (Agency of economical promotion, Europass)

Organization

- Phase 1
 - Preparation of e-books and lab work, choice of participants, organizational work
- Phase 2
 - Self study of the material – local assessments
- Phase 3
 - Entrance test, lectures, midterm test, lab work, evaluation
- Phase 4
 - Essays, overall marking, evaluation, dissemination

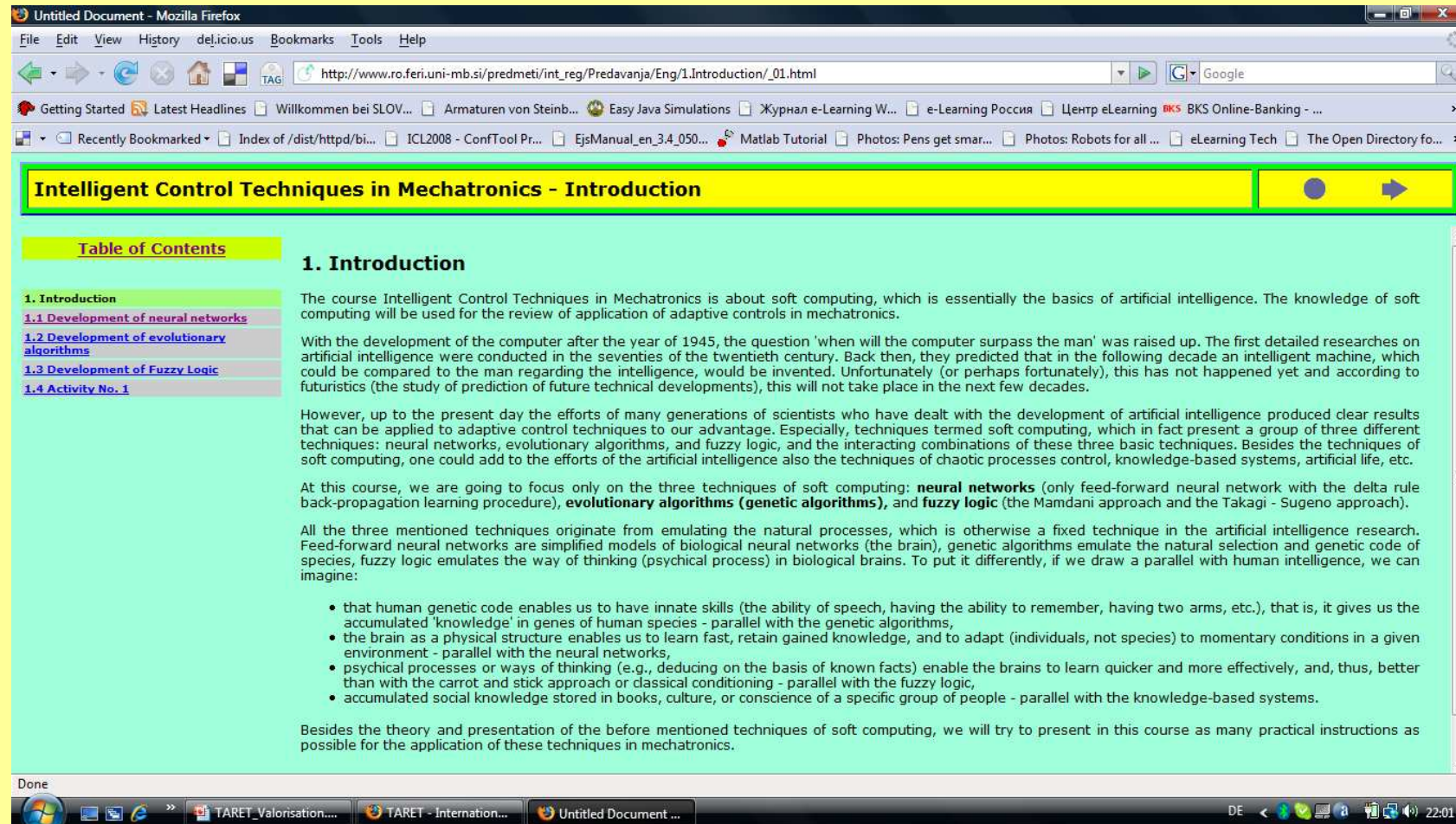
Web-site



Use of ICT

- Didactical approach
 - Blended learning – eBooks and web-based tests
 - F2f – lessons, discussions, lab work
- Teleconferencing
 - Kick-off meeting, working meetings, preparation of TARET 2

E-book



The screenshot shows a Mozilla Firefox browser window with the address bar containing the URL: http://www.ro.feri.uni-mb.si/predmeti/int_reg/Predavanja/Eng/1.Introduction/_01.html. The page title is "Intelligent Control Techniques in Mechatronics - Introduction".

Table of Contents

- 1. Introduction
- 1.1 Development of neural networks
- 1.2 Development of evolutionary algorithms
- 1.3 Development of Fuzzy Logic
- 1.4 Activity No. 1

1. Introduction

The course Intelligent Control Techniques in Mechatronics is about soft computing, which is essentially the basics of artificial intelligence. The knowledge of soft computing will be used for the review of application of adaptive controls in mechatronics.

With the development of the computer after the year of 1945, the question 'when will the computer surpass the man' was raised up. The first detailed researches on artificial intelligence were conducted in the seventies of the twentieth century. Back then, they predicted that in the following decade an intelligent machine, which could be compared to the man regarding the intelligence, would be invented. Unfortunately (or perhaps fortunately), this has not happened yet and according to futuristics (the study of prediction of future technical developments), this will not take place in the next few decades.

However, up to the present day the efforts of many generations of scientists who have dealt with the development of artificial intelligence produced clear results that can be applied to adaptive control techniques to our advantage. Especially, techniques termed soft computing, which in fact present a group of three different techniques: neural networks, evolutionary algorithms, and fuzzy logic, and the interacting combinations of these three basic techniques. Besides the techniques of soft computing, one could add to the efforts of the artificial intelligence also the techniques of chaotic processes control, knowledge-based systems, artificial life, etc.

At this course, we are going to focus only on the three techniques of soft computing: **neural networks** (only feed-forward neural network with the delta rule back-propagation learning procedure), **evolutionary algorithms (genetic algorithms)**, and **fuzzy logic** (the Mamdani approach and the Takagi - Sugeno approach).

All the three mentioned techniques originate from emulating the natural processes, which is otherwise a fixed technique in the artificial intelligence research. Feed-forward neural networks are simplified models of biological neural networks (the brain), genetic algorithms emulate the natural selection and genetic code of species, fuzzy logic emulates the way of thinking (psychical process) in biological brains. To put it differently, if we draw a parallel with human intelligence, we can imagine:

- that human genetic code enables us to have innate skills (the ability of speech, having the ability to remember, having two arms, etc.), that is, it gives us the accumulated 'knowledge' in genes of human species - parallel with the genetic algorithms,
- the brain as a physical structure enables us to learn fast, retain gained knowledge, and to adapt (individuals, not species) to momentary conditions in a given environment - parallel with the neural networks,
- psychical processes or ways of thinking (e.g., deducing on the basis of known facts) enable the brains to learn quicker and more effectively, and, thus, better than with the carrot and stick approach or classical conditioning - parallel with the fuzzy logic,
- accumulated social knowledge stored in books, culture, or conscience of a specific group of people - parallel with the knowledge-based systems.

Besides the theory and presentation of the before mentioned techniques of soft computing, we will try to present in this course as many practical instructions as possible for the application of these techniques in mechatronics.

Academic recognition

- CUAS, UM – full recognition as part of the curriculum – 7 ECTS
- TU Ilmenau, Brasov – recognition as additional specialization – 7 ECTS
- BIT, Kharkiv – subject of free choice – 7 ECTS
- Porto – no recognition
- Europass mobility for all participants

Evaluation

- Self evaluation with questionnaire
 - Pros
 - ⑦ Practical learning, unique lab equipment
 - ⑦ Intercultural learning
 - ⑦ Team work in international groups
 - ⑦ Instruction in English
 - Cons
 - ⑦ Too much participants (in particular in the lab)
 - ⑦ Too high workload
- Expert evaluation by professors and external

Disseminaton

- Local newspapers
- Reports on ICBL, REV, ICL, educa online Berlin (round table discussions)
- Report on the IEEE Austria General meeting 2007
- Report to the IAOE board
- Report to the local government as on of the sponsors
- Report to the commission of international cooperation in the association of universities of applied sciences Austria and in CUAS