CHALMERS UNIVERSITY OF TECHNOLOGY - rev. 2019
Department of Computer Science and Engineering
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Chalmers DAT300/ GU DIT615: Data-driven support for cyber-physical systems, 7.5 credits - Course period I, 2019/2020

Aim

The course gives an introduction to new cyber-physical systems, such as the smart grid, where data has become very important for adaptive operations and with an increased dependence on information and communication technologies (ICT). Topics in the course are focused on new methods in the intersection of computer science and other domains, to support distributed operations, data-processing and cyber security.

The course is built around seminars where you learn about the design or development of systems, infrastructure and applications, with a focus on distributed algorithms and security. As part of the course, you are expected to complete lab work, i.e. a significant project with relevance to data-driven support for cyber-physical systems . You are also expected to give some presentation, as well as to participate actively in discussions. Through these you will also gain experience at the front connecting research and education in the overlapping domain between ICT and other Areas of Advance, such as Energy, Transportation, Production, Building Futures.

Additionally, this course aims to provide entrepreneurial experiences according to Chalmers' definition including: 1) that students create *value*[*] for others; 2) understand an idea development process; and 3) through these activities have managed uncertainty and reflected on one's own and others' capabilities.

[*]Value may be economical but also ecological, social, mental, physiological etc.
Read more at https://student.portal.chalmers.se/en/chalmersstudies/Pages/Entrepreneurship-education.aspx

Prerequisites

General requirements from a Bachelor's degree are required. You should have taken at least one course in computer programming. We also expect 7.5hp or equivalent in one of the four areas: computer communication, operating systems, computer security, or distributed systems. English is required.

Examiners

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Course support (TA):

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Contents & Organisation

This course is based on experiential learning. It means that i) the students are actively influencing and managing their projects, ii) the course has an explicit focus on the students' capabilities and working methods, iii) the learning activities aim to simulate a real project with real problems as much as possible.

The content is focused on distributed computing and systems, data processing, information and systems security, networking and computer communication in the context of new cyber-physical systems. There are lectures from faculty to give an overview of the areas of the course, and invited presentations from industry to talk about actual systems, as well as presentations by the students themselves, on research topics relating to their projects.

Typically, the lectures include an introduction to the new types of cyber-physical systems, e.g. the smart grid. Open research problems in relation to distributed operations, data-processing and cyber security are discussed, e.g. through lectures on streaming, security and privacy, and communication suitable in this domain. Examples of cyber-physical systems important for society are presented, e.g. the smart grid from both the transmission and distribution perspective. The course includes an introduction to power systems, to give students enough knowledge of terminology to understand technical documents and scientific literature connected to the smart grid, a representative example of cyberphysical system where data has a central role.

Reading

The course is built around seminars, lecture notes and research papers. These are chosen in the first two weeks of the course.

Course homepage

The course homepage is http://www.cse.chalmers.se/edu/course/DAT300/ .

Learning outcomes

On successful completion of the course the student will be able to:

(Knowledge and understanding) List cyber-physical systems, and in particular ICT methods for supporting adaptiveness and cybersecurity based on the students chosen area; discuss current research and development in the area of such cyber-physical systems, in order to meet the requirements of sustainable development in (security, economic and ecological terms).

(Skills and abilities) Design and analyse methods, algorithms, protocols for adaptive and cybersecure distributed cyber-physical systems, such as smart power grid networks; explain complex algorithms and concepts for efficient parallel and distributed computing and data processing; plan and organize a small team project and document the work and the result in a report; relate to idea development through evaluation and selection of ideas, presenting ideas and implementing ideas in relevant context(s); deal with open problems, including handling of uncertainties, limited information, identification and assessments of risks and changes.

(Judgement and approach) Present complex material to a small audience; improve skills in running a small team project, practice technical writing; judge the relevance of the literature in a topic; identify, combine and use own and others' resources, and deal with uncertainty, with the aim of creating value for others.

Examination
The examination is based on the activity in the course: project quality & project report (70% of the grade), team presentation (20%), individual mid-term project report (5%), discussions and answering of questions and future project description (5%).

Grades: Chalmers students: Marks 3, 4 and 5 are given for successful completion of the course activities GU students: Pass and Pass with distinction.

Lecture plan
This project course setup includes a short sequence of introductory lectures given by lecturers and invited talks from the industry, that will prepare the students and allow their project groups to share a wider common background. The students will then choose advanced topics related to their chosen projects, to study a set of problems in depth. These topics are presented by the students to their peers and discussed in the classroom. In addition, the students will write an individual report about their chosen topic and project and a project report with their group.