COURSE SYLLABUS

Embedded and Distributed AI, 7.5 credits

Embedded and Distributed AI, 7,5 högskolepoäng

Course Code:	TEDS22	**Education Cycle:**	Second-cycle level
Confirmed by:	Dean Mar 1, 2021	**Disciplinary domain:**	Technology
Valid From:	Aug 1, 2022	**Subject group:**	DT1
Version:	1	**Specialised in:**	A1F
		Main field of study:	Computer Science

Intended Learning Outcomes (ILO)

After a successful course, the student shall

Knowledge and understanding
- show familiarity with embedded platforms (including laptop GPU's, mobile phones, raspberry PI, NVIDIA Jetson Nano)
- show familiarity with embedded parallel processing architectures and CUDA
- display knowledge of how to fit AI/ML models into embedded platforms and how it changes performance/speed of the models
- display knowledge of choosing right embedded development platforms and tools to perform real-world AI applications

Skills and abilities
- demonstrate the ability to design and implement an embedded and distributed architecture suitable for data gathering of sensor information to derive outcomes by using edge computing facilities
- demonstrate the ability to design and implement a deep-learning architecture suitable for image our sound analysis using GPU facilities

Judgement and approach
- demonstrate the ability to design and implement an image or sound processing deep learning architecture on an embedded platform of choice
- demonstrate the ability to explain the possibilities of extending the embedded platform to a distributed architecture for real world applications

Contents

The course includes the following elements:
- Introduction to Embedded and Distributed AI (architectures, platforms, sensors)
- Introduction to Image processing and computer vision
- Feature engineering and object detection on embedded systems
- Semantic segmentation and real-time processing on embedded systems

- TinyML and applications
- Real-time tracking, 3D reconstruction and SLAM on edge devices
- Transfer learning and mobile applications (using TensorFlowJS and TensorFlowLite)
- IoT applications and using clouds for distributed system development
- Introduction to natural language processing (NLP) and examples by using Google Cloud
- Introduction to cloud computing
- Introduction to CUDA parallel programming
- Introduction to Sensor Fusion
- Introduction to Distributed/Federated Learning

Type of instruction

5 assignments done by individual students and one final project done individually or a group of two students.

The teaching is conducted in English.

Prerequisites

Passed courses at least 90 credits within the major subject Computer Engineering, Electrical Engineering (with relevant courses in Computer Engineering), or equivalent, or passed courses at least 150 credits from the programme Computer Science and Engineering, and completed course Machine Learning, 7,5 credits or equivalent. Proof of English proficiency is required.

Examination and grades

The course is graded 5,4,3 or Fail.

Registration of examination:

Name of the Test	Value	Grading
Final Project[I]	5 credits	5/4/3/U
Assignments	2.5 credits	U/G

[I] Determines the final grade of the course, which is issued only when all course units have been passed.

Course literature

The literature list for the course will be provided one month before the course starts. Detailed literature will be provided at the end of each course module. However, the following references might be supportive as well. It is not mandatory to have any book to pass this course.

TinyML Pete Warden and Daniel Situnayake, Book preview: https:*tinymlbook.com/*

Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, Online book: https: www.deeplearningbook.org/

TensorFlowLite website for documentation and examples: https:*www.tensorflow.org/lite*

Playlist of the Spring 2020 semester lectures: https: www.youtube.com/playlist?list=PLyuI16070OtycIT15i_I2_mhuLxnNvPvX