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Centre for Applied Intelligent Systems Research

# Master Thesis Project

## DT7001 & DT7002

Slawomir Nowaczyk



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# Course Basics

30 credits course

- 20 weeks of full-time work
- 800 (!) hours of work (per person)

Web pages:

**https://tinyurl.com/HH-ITE-MSc**

https://hh.se/student-web/content-a-z/thesis-information-for-students-at-school-of-information-technology.html

**http://caisr.hh.se/Student_projects**



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# Goal

…provide training in independent technological/scientific research and development work within the field of Embedded and Intelligent Systems in Computer Science and Engineering



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# Examiners

- Embedded Systems
  - Alexey Vinel
  - Mohamed Eldefrawy
- Intelligent Systems
  - Slawomir Nowaczyk
  - Fernando Alonso-Fernandez



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# Learning Outcomes

- Independently search for solutions
- Use advanced methods of analysis and construction
- Discuss the international research and development
- Assess scientific papers
- Relate own work to international research
- Present and defend own work



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# Grading Criteria

- Overview & understanding of needs and related work
  - Highlight weak & strong parts in referenced works and how it differs from the own work
- Understanding and refinement of problem/research questions
  - Identify methods needed to investigate the problem and answer the questions
- Method & setup of study/experiments to get & evaluate results
  - Define enough tests/measurements to get sufficient results & evidence for conclusions
- Solution of problem or answer of question and other results
  - Solve problems, create & evaluate feasible solutions, analyse the quality of results
- Initiative, creativity, ambition, planning and organization
  - Use feedback from supervisor for reflection, rather than asking for solutions
- Final oral presentation and final report
  - Results and the conclusions are clearly stated, discusses different aspects of the problem



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# Core Requirements

- Understand the problem
  - in context!
- Formulate research question(s)
  - novelty!
- Develop a solution
  - in context!
- Evaluate the results
  - rigorously!
- Summarise the findings
  - conclusions!



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# Process

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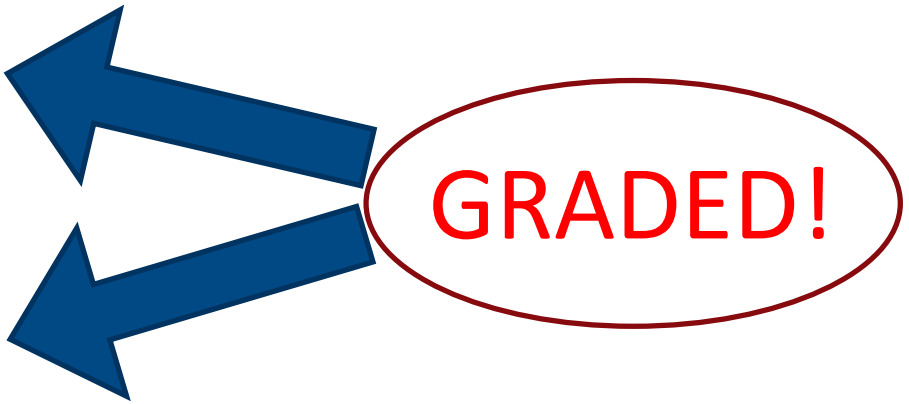
# Process Overview

- Topic selection
  - until Wednesday, 28th of October, 18:00
- Start report
  - report December 10th, presentations 14th/16th/17th
- Half-time seminar
  - middle of March
- Final seminar
  - end of May



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# Topic Selection
## (check prerequisites!)

- Look at list of proposed topics
  - talk to supervisors to learn more
- Topics are mainly updated in October
  - so there might still be new topics still popping up
  - it's also possible to propose your own topic, e.g. with a company, but you need a supervisor at ITE
- Provide ranking of three preferred topics
  - Wednesday, 28th of October, 18:00 (GoogleForm)
  - you can also indicate preferred partner (but no guarantees)


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# Course Registration

Once you have fulfilled these requirements

- and I get a confirmation from your supervisor:

1. Approved topic & possibly a teammate
2. Sufficient credits & course prerequisites
   - 60 credits on advanced level (or close to it...)
   - show your LADOK transcript to the supervisor
   - if credits are missing, they'll need to vouch for you
3. Plagiarism course certificate
   - https://academy.sitehost.iu.edu/index.html



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# How to Recognize Plagiarism: Tutorials and Tests

- A quite comprehensive resource by Indiana University
  "expect to spend about 2 hours learning from this instruction and taking Certification Tests"
- Designed for social sciences context, not engineering
  - but the core concepts are very similar
- The test is very structured and "mechanical"
  - learn their strict rules (e.g. seven-words-in-a-row, page nr) but also understand that many of these things are a little bit more nuanced

Crucially: in engineering, the "Parroted Paraphrase" **is** plagiarism



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# A Bad Example…

### 2.1.2 Clustering

Similar to Region growing, clustering relies on similarity criteria for subdivisions to be grouped. The simpler clustering techniques use a spatial similarity criterion such as the Manhattan distance or the Euclidean distance [9]. In [10] Euclidean clustering is used to find objects placed on a table in a robotic context. The segmentation was done after ground removal (removal of the table). Focusing the segmentation to certain regions of the point cloud the performance varied significantly depending on whether several objects of interest were included in that region or not, with better accuracy when only a sin

This has led to a suspension…

### 1.3.2 *Clustering*

In Region growing [4], clustering depends on resemblance standards for subsections to be grouped. The more natural clustering techniques utilize a spatial standard suchlike the Euclidean distance [35] or the Manhattan distance[32]. In this paper [7], Euclidean clustering is utilized to discover objects set on a table in the robotic context. The segmentation was performed after the ground removal. Centring the segmentation to specific regions of point cloud the execution differed fundamentally relying upon whether numerous objects of interest was incorporated into the region or not, with superior accuracy when just a sole object of interest was incorporated.

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# Start Report

- Deadline is 10th of December
  - for sending to the examiner! (another GoogleForm)
- Must be approved by the supervisor first
  - and you need time to incorporate their feedback
- So a reasonable schedule is:
  - on 25th of November send report to supervisor
  - around 2nd of December you get feedback
  - you have a week to address the comments



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# Start Report

- Approximately five pages of text
  - please use the provided LaTeX template
- Report should cover three main aspects
  - problem formulation
  - literature review
  - project plan & management methodology
- A short presentation in week 51
  - 10 minutes + 5 minutes for questions

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# Problem Formulation

- What you are going to do and why
- How will the result be evaluated
- Presented in a way that makes it clear what you your intended contribution is
- Put the emphasis on the novelty of your work, not only on the task itself
- Do not focus too much on implementation



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# Literature Review

- You should discuss 5+ research papers
- Well-chosen, i.e., ones that really provide sufficient coverage of your main topic
- Provide reasons for including particular papers, clearly relate them to your project
- Discuss how your work will extend the solutions presented in the literature



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# Project Plan

- Present the main tasks to achieve the results
  - this should be more detailed than 5-6 broad phases
  - split your problem into meaningful sub-problems
  - including some form of success criterion for each!
- Provide order and the expected timeline
  - including dependencies across tasks, and conditions
- Try to keep it realistic
  - e.g., do not forget “report writing”
- Follow a “real” project methodology
  - preferably something agile



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# Supervision

- It is not instruction!
- Support, guide and tutor
- Keep regular meetings
- Ask questions!
- But be independent!
- Track the contributions in a group

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# Fallback

- The plan is to be done by end of May
  - but of course things don't always go as intended…
- Will get a second chance after summer
  - and third one sometime next December/January
- But regular supervision is only until May
  - expect to meet your supervisor every 1-2 weeks
  - during and after summer, maybe once a month
  - you have the right to work on your own for one more year but if you don't finish, you fail the course

And new thesis topic only in exceptional circumstances



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# Master of Science



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# Science

- Be clear about the science part of it, do not only focus on the engineering aspect
- What have you learned during the project?
- How can your findings benefit the next person trying to solve a similar problem?
- What are the limits of applicability for the solutions you have proposed?

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# Reasoning & Comprehension

- You need to demonstrate the ability to reason about both problems and solutions
- The learning outcomes and grading criteria focus a lot on comprehension skills
- Not enough to solve the stated problem, you need to describe and evaluate both your solution, as well as your methods



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# Conclusions

- When stating your conclusions, it is not enough to just describe work done
- You need to put your work in context
- Demonstrate the novelty in the project
  - where did you go beyond the state of the art
- Be clear about evaluation of your results
  - how good they are, why those methods were chosen, how to proceed next, lessons learned, …

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# Report



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# Report Writing

- Refer in text to all figures and tables
  - explain their purpose, not only what they show
- Provide full bibliography references
  - pick whichever style you prefer, but don't mix them
- Use clear and consistent notation in text
  - font for scalar and matrix, explain abbreviations, …
- Use sections & subsections for readability
  - choose their titles and their contents carefully



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# Materials



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# Useful Material

- Course syllabus
- Course description
- Grading criteria



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# Questions?