

TDDD92

Artificial intelligence -- project

Kursinformation – en översikt

Outline

About us

About the course in general

About the individual task

About the joint project

Discussion and questions

**"Moderately"
detailed: more
information
online / later
meetings**

2010-2022: AIICS – adv. AI and Integrated Computer Sys.



Avdelningens fokus: Autonomi, intelligenta artefakter

My own focus: distributed knowledge

*Acquiring **knowledge** about the world,
including building maps, locating salient points
and other forms of semantic knowledge,
by a team of **autonomous** agents,
sharing the information among themselves
and to humans*

More on this in TDDE05, TDDE19

Assistant(s): David Bergström

And hopefully more soon...

Special advisors: Jonas Kvärnstrom

...

Course goals

0: Course goals



- **Learning outcomes**: After the course, each student should be able to:

- **Choose** relevant **AI-technic** and related literature
- **Evaluate** AI-related technologies for **integration** into a system

- **Implement** an AI-technic and **integrate** it in the **system**
- **Evaluate** AI-related technologies and how they **affect** a system (how did it work?)

- **Describe and evaluate** technical solutions in writing

- **Not a goal:**

- Invent your own techniques - instead: use existing ones, adapt them, create a whole based largely on the techniques

0b: Course goals – why?



■ Why those goals?

- **Choosing** relevant AI techniques and literature describing them
- **Evaluate** AI-related technics (be)for(e) **integration** in a system
- **Implementat** an AI-technic and **integret** it in a **system**

- **Evaluation** of AI-related technics and how they **affects** a system
- **Describes in writing and evaluate** technical solutions

In large parts:
Preparation for degree project

Immersion in AI:
Using any technology *for real*

Making use of existing materials, not reinventing the wheel, assessing which *existing* wheel fits

Describe and explain the motivation:
Why do we do what we do?

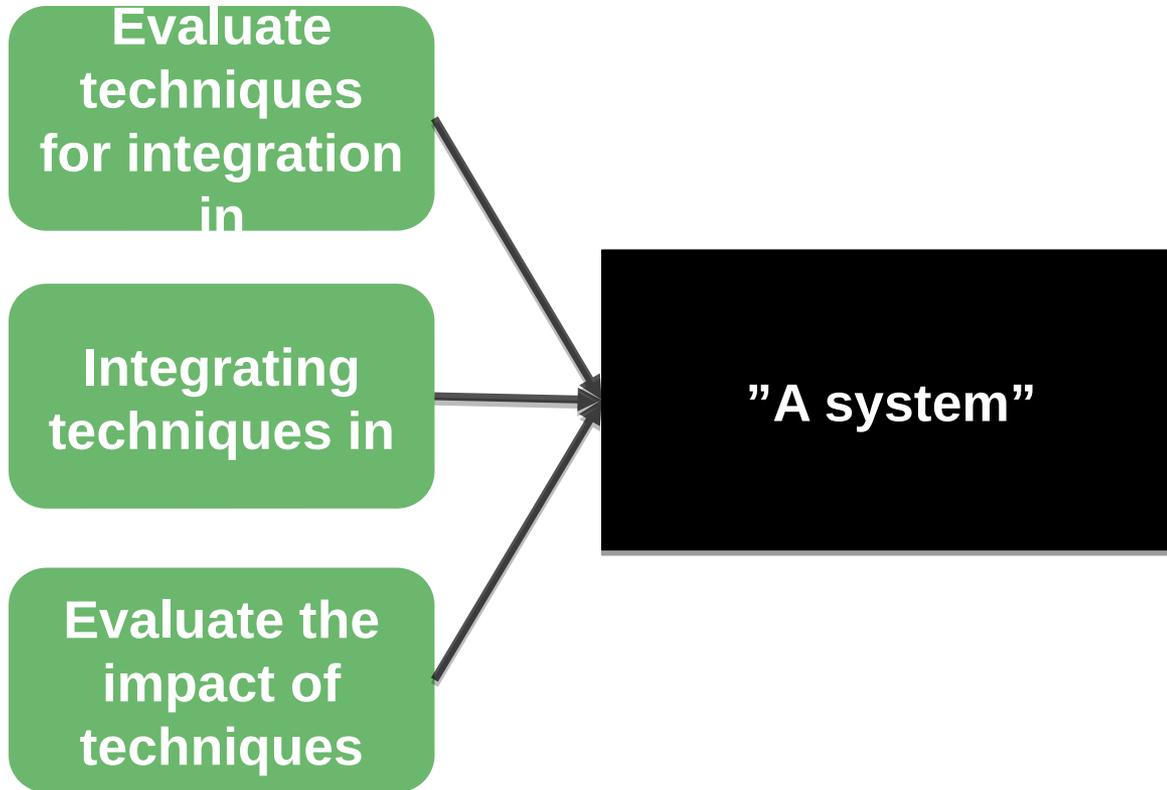
Understanding specifications well enough to choose + implement them correctly

Work with existing systems, find out how they work, adapt to frameworks

Collaborate on a project with both own responsibilities and common part (integration)

How do we achieve the goals?

1: System?



Can't do it all yourself - we'll help

1b: Previous system

- Original system: RoboCup, humanoid robots / football



Hardware often causes problems...

1c: New system

- Since 2018: Starcraft II Learning Environment



1d: Who should play?

- Should we leave playing to humans?



Sasha "Scarlett" Hostyn,
winner of Intel Extreme
Masters tournament (feb
2018)

- No, we will hire an agent to play for us...

1e: New material

- First version of the course in 2018
 - Have had a few years to detect any problems
 - Have been further *developed, bugfixed, extended*
- But:
 - **lab** **students**
 - ~~No plan survives first contact with the enemy~~
 - -- *paraphrased from* Helmuth von Moltke the elder



Impossible to foresee all ways of using the system
Difficult to adapt *exactly* to your prior knowledge

Give us feedback
if there are any ambiguities / problems!

1f: Introduction to the system

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■ Initial lab serie to familiarise with the system

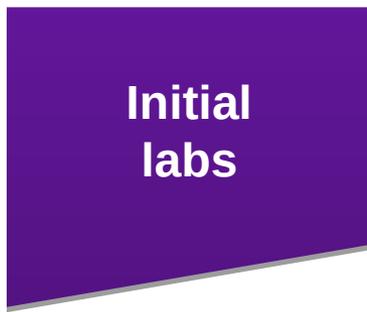
- In tutorial-form – *introduction*, not a result in itself
 - Installation
 - Lab 0 – perform some tasks (“play the game”)
 - Lab 1 – intro to automation/AI
 - Lab 2 – defense, base expansion
 - Lab 3 – more advanced tasks

Can be done directly

Without AI, but important preparation for the final project!



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- v37
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- v41 self study
- v42 exams
- v43 exam
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- v52 självstudier
- v1 exams
- v2 exams



Initial
labs

1g: Lab sessions and tutorials



- **Lab sessions, tutorials**
 - Lab sessions every weeks
 - Work even own your own

- Start with **self study** week 1
 - Read, play a bit StarCraft, ...
 - Instructions / links on the website



Mer om StarCraft senare!

1h: Computer requirements



- **StarCraft II Learning Environment (SC2LE) under Windows**
 - Software available on USB stick and downloadable
 - Can be used on **PC-rooms** in E-building
 - Can be used on your **own computer**
 - Requires Windows, on the computer or perhaps in a virtual machine (free via minit.liu.se)
 - Instructions use PyCharm; downloadable for free

2: Theme



- What are we going to achieve? We need a theme to guide us!

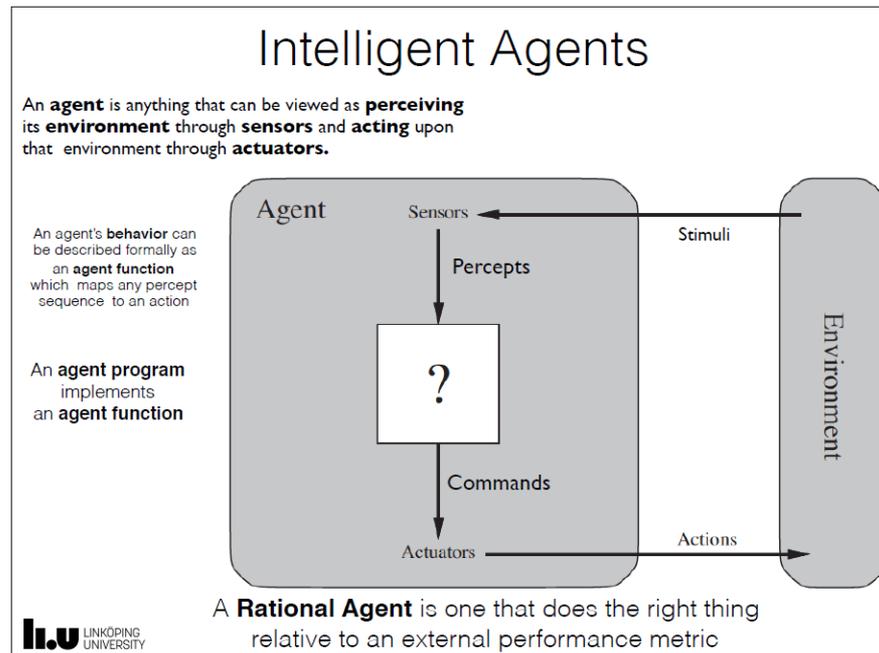
Sequential

Decision Making under Uncertainty

Create an agent that play StarCraft II, who decides what to do

3: Agent

- But what is an **agent**? How do you create an agent?
 - Informally: write a program that play StarCraft, som:
 - **Senses** its surrounding through (virtuel) sensors
 - **Decides** what to do (relative to a goal)
 - **Acts** in the StarCraft-world
 - **More formally, more details:** in TDDC17

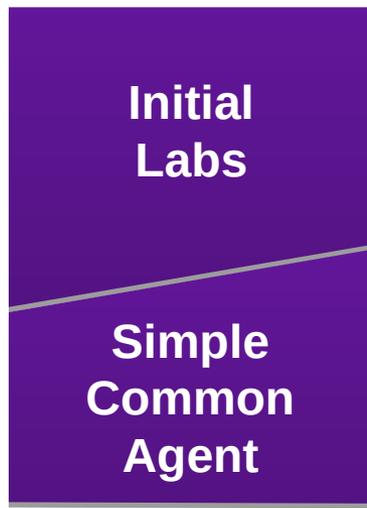


3b: Agent



- After the lab serie, in HT1:
 - Each team create a **minimal agent** without an AI-technic
 - Group size: 5-7 persons depending on number of student in the course
 - A **baseline** for testing and comparison
- Project groups are decided **later/soon**:
 - You should form your own groups – but wait until we know **how many you are!**
 - This decides the group size

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2 (back to): Theme

- What are we going to achieve? We need a theme to guide us!

Sequential

The agent can think about the future, choose actions that seem to lead to long-term progress...

But it cannot determine a complete plan in advance!

Decide, act, see what happened, *decide again*

Decision Making

Create an agent that play StarCraft II

Agents needs to decide on what do by itself...

under Uncertainty

One reason for sequential: we don't know everything, don't see everything

Other players also act in the world, and we don't know either what they intend to do

Realistic assumption:
Uncertainty about the world

Central to artificial intelligence!

4: AI-technic

Choose
technic
to study

Evaluate
*according to
literature*

Describe
*selected
technic*

Individuel report:
Period 1,
parallel with
AI-course

**"AI-technic" – but
we have just started
with the AI-course**

Implement,
integrate

Evaluate
*impact on the
system*

Describes
final results

Project:
AI-part in
period 2, *after*
AI-course

4b: Individual investigation



■ Thursday 220901: FÖ2, problem and technics

What general problems are interesting to solve in StarCraft? Why?

- Before: Read *An Introduction to Game-Playing Systems and StarCraft II* (web)

When the day comes to choose the problem to solve:
Coordination is key: Members of a group should solve different
problems!

■ Tuesday 220906: FÖ3, individual task + discussion

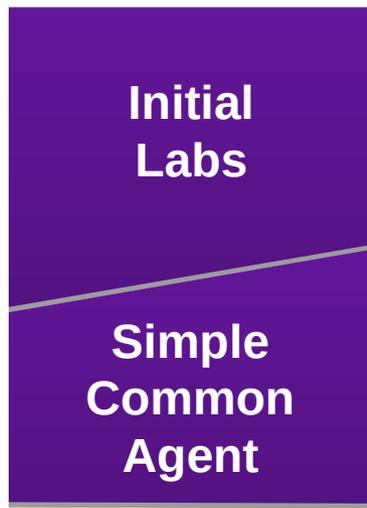
- Preparing to plan your own evaluation, more about what is expected in the report
- Followed by student-driven discussion, questions/thoughts about problems/techniques

4c: Individual investigation



- **By Friday 220909: Submit an investigation plan**
 - About 1 A4
 - Problem(klass) you want to solve
 - Specific technic/algorithms to evaluate
 - Scientific references to these techniques/methods
 - ...
 - **Instructions:**
 - <https://www.ida.liu.se/~TDDD92/2021/utredning.shtml>
 - Template with more information:
<https://www.ida.liu.se/~TDDD92/2021/mallar/>
- **Feedback** if we find *obvious problems*

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Planning report

Feedback

■ Thursday 210909: Lecture on repport writting

- By a person fram the Department of Culture and Society (*IKOS*)
- How to write a scientific report, t.ex. A bachelor/master thesis report? What do you need to think about and write?

**The individual report will later be reviewed by IKOS,
must be written correctly
(guidance for the degree project!)
And in Swedish.**

4e: Individual investigation



- **Main help option: questions via issue tracker**
 - AI is a broad field, and you have a lot of freedom
 - Answering all the questions requires many experts
 - Same as TDDC17 – many teachers
 - We have several helpers - but not everyone can be available all the time
 - Issues in the issue tracker can be distributed and handled by a group:
<https://gitlab.liu.se/tddd92/student-issues>
 - Do not use email!

4f: Individual investigation



■ Extra help seminar

- Address issues "face to face" (or Zoom), in whole class
- But many *technic specific* questions **cannot be answered spontaneously**:
 - Not all teachers will attend every workshop to answer individual questions
 - Use issues – prepare the question **in advance before the seminar** or take it entirely via issues

■ Often on Tuesday

4g: Individual investigation



■ Sunday 211009 (last week of HT1):

- Exchange your report with an other student in your group
- Give feedback on what is *difficult to understand*
 - Difficult to do yourself - by now you already know everything!

■ Tuesday 211011: Review completed

- Use the feedback to iterate and polish your report

**The review is part of the grading process:
*Describes and evaluate in writing***

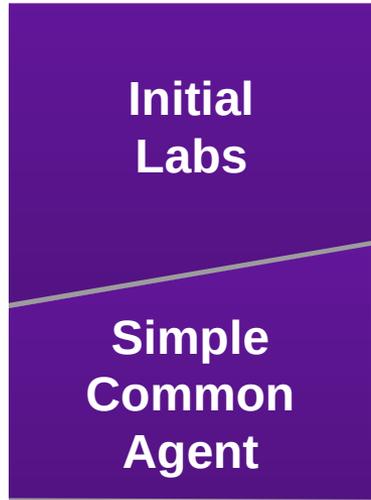
■ Sunday 211016: First submission to us

- **Learning opportunity, not grading**
- We spend a *fixed, limited amount of time commenting on the most obvious*
- No guarantee that we will discover everything - limited resources in the course!
- The better the first version, the more relevant comments

■ Januari 2022: submission

- Grading!

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Feedback

Feedback

Polishing

Inlämning, betygsbedömning

5a: Project

■ About project (HT2):

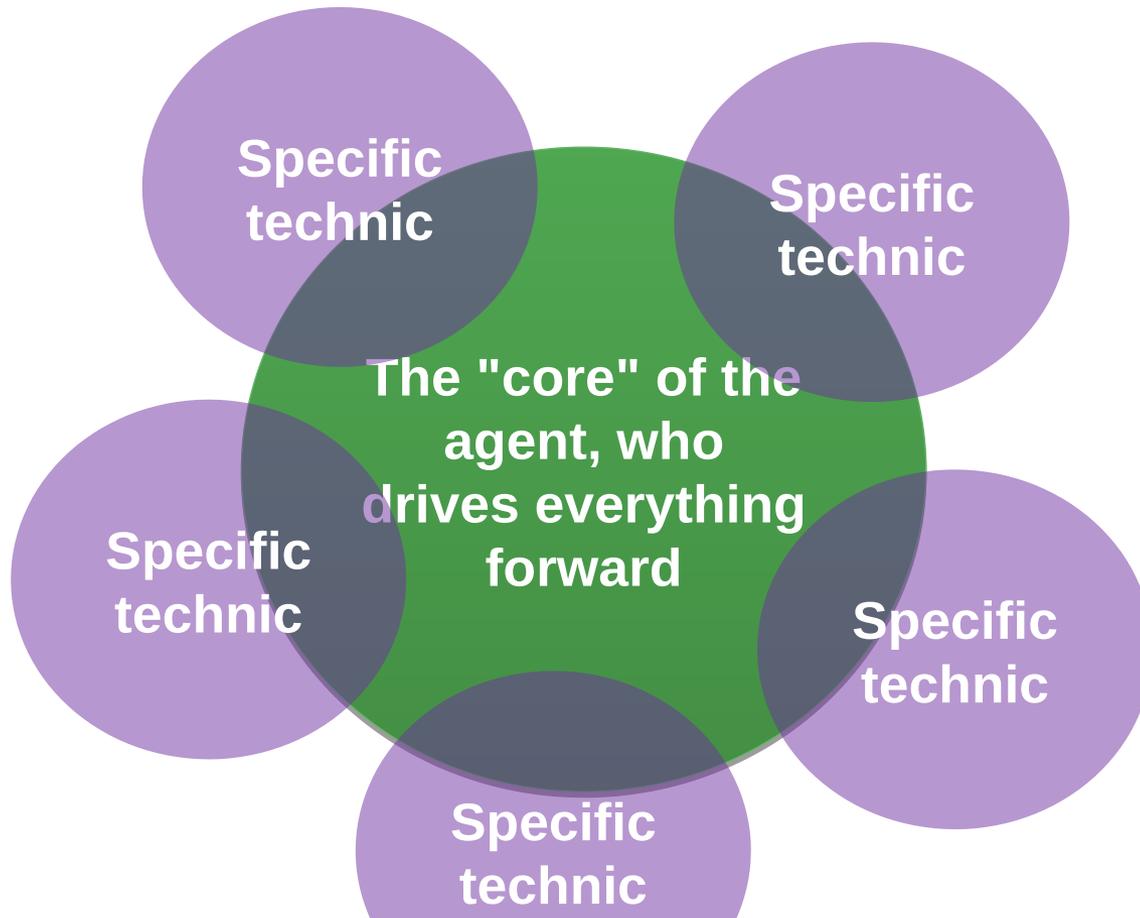
- Implement an AI technology and compare with behaviour without this technology
- It should be mostly implemented during self-study, but:
 - Supervisor available one lab session per week
 - Supervisors available at weekly *reporting* time
 - Extra "question time" (seminar) each week, plus *issues*

- Competitions with other team – continuously and at the end
 - Show off and *test* what you have done - does not affect the grade

- Extend the report with information about the project results
 - How was it implemented?
 - How did you adapt the technique to the specific situation in StarCraft?
 - How did this affect the agent's behavior and "performance"? Why?
 - ...

5b: Project

■ Implementation and integration?



Everyone needs their own responsibility

Everyone needs to take joint responsibility for the core, the "glue", the integration into a whole

More project info to come - this is enough for today

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**Initial
Labs**

**Simple
Common
Agent**

Planning report

**Investigation,
evaluation**

Review, polish, submit

Feedback

Feedback

Project

**Implementati
on of
AI-technic**

**Integration,
testing**

Polishing

**Evaluate results
Write project report**

Inlämning, betygsättning

6: Take responsibility



■ ”After the course students should be able to”:

■ This is a **project course**

- You are **proactive**, you drive both the investigation and the project forward
- We provide **support**, but we don't spoon-feed you
- We can answer many questions, but not all of them

■ **You will practice:**

- **Selecting** information of high quality (scientific articles)
- **Plan** your work
- Work in **group**
- **Implement** something advanced
- **Present** and **reflect**

7: Changes in the course



- My first year, so not many