HOW TO BUILD A SOFTWARE AGENT?

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CONTENT

Questions and answers → Learning environment → Engineering sw. agents

Knowledge graph creation → Tools → Working in groups

Presentation of tasks → More resources
QUESTIONS?
BEFORE START...

• Any question about the lecture?
• Any suggestion or petition?

Go to www.menti.com and use the code 6346257
ABOUT OUR LEARNING ENVIRONMENT
Current position: Researcher

Topic: Formal and applied methods of Artificial Intelligence for autonomous multi-agents systems

Education:
- Ph.D. in Computing Science, Umeå University. Sweden.
- Ph. Lic. in Computing Science, Umeå University.
- M.Sc. Master’s degree in Computer Science, Malmö University. Sweden.

Industrial experience:
- 4 years R&D engineer in a telecommunications company.
OUR COMMUNICATIONS

• Top 5:
  1. Email esteban@cs.umu.se
  2. Canvas tools, chat, discussions, etc.
  3. UmU Play video comments (https://play.umu.se)
  4. YouTube video comments
  5. Scheduled office visits
What about you?

What experience in software tools do you have?

Open https://www.menti.com/
Code 3093764
OUR AGREEMENTS

Social
• Respect
• Dialogue
• Inclusiveness

COVID related
• In physical laboratories sessions (if any) take measures https://support.cs.umu.se/covid-information/info
• If person is infected, contact ISE2020 course teachers
OUR AGREEMENTS

Technical

• Design/development attribution
• Design/development agreement
• Design/development acknowledgement
• No Wizard-of-Oz in final projects (Adobe XD, Figma, Sketch, Balsamiq, etc.), only in the presentation of the initial design
CONTENT

Learning environment → Engineering sw. agents → Knowledge graph creation

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More resources
ENGINEERING AGENTS
Recap:

• The Belief-Desire-Intention (original) is a theory to explain and predict the behavior and mental state of people.

• BDI model in (computer science) is used to design software to explain predict behaviour of agents with mental states.
ENGINEERING AGENTS

[Diagram showing an agent interacting with an environment through sensors, actuators, percepts, and actions]
TOOLS FOR BUILDING AGENT’S MODULES

This lecture focus

Agent

Sensors

Percepts

Environment

Actuators

Actions

HOW TO IMPLEMENT THIS ARCHITECTURE?

To implement this architecture we need to meet a number of difficult challenges.

For example,

1. **How can we create a knowledge base for our agent?**
2. **How can we make it function in a changing environment and maintain focus on its current goal** without losing the ability to change goals in response to important events in its environment?
3. **How can we make it capable of explaining some of these events** and use the explanations to fill gaps in its knowledge base?
4. **How can we get it to use its knowledge to do intelligent planning?**
Learning environment → Engineering sw. agents → Knowledge graph creation

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More resources
KNOWLEDGE GRAPH CREATION
THE AGENT’S KNOWLEDGE

What an agent should have in its mind?

It depends on the environment!
THE AGENT’S KNOWLEDGE

Information about the environment is updated
TOOLS FOR KNOWLEDGE BUILDING
Tools for ontology engineering and management

Altova SchemaAgent (pro: connected with UML and other tools; con: non free). URL: https://www.altova.com/


Sigma (pro: open source; con: installation bugs mostly Linux support). URL: https://github.com/ontologypoportal/sigmakee

TopQuadrant (pro: Eclipse-like; cons: bugs, non free)

Every year changing!

PROGRAMMING LANGUAGES USED IN ARTIFICIAL INTELLIGENCE TOOLS

- Python
- C++
- Java
- Swift
- Go
- Julia
- C#
- JavaScript
Question: What programming language(s) do you use/prefer?

Answer keywords in https://www.menti.com/
code: 3093764
PROTÉGÉ
PROTÉGÉ
PROTÉGÉ
Try some DL (Description Logics) queries with the people ontology and check the explanations:

- adult and has_pet some cat or has_pet some dog
- adult and has_pet value Rex
- woman and has_pet min 1 cat
- animal and is_pet_of some adult

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>∃</td>
<td>Existential, someValuesFrom</td>
<td>“some”, “at least one”</td>
</tr>
<tr>
<td>∀</td>
<td>Universal, allValuesFrom</td>
<td>“only”</td>
</tr>
<tr>
<td>∃</td>
<td>hasValue</td>
<td>“equals x”</td>
</tr>
<tr>
<td>=</td>
<td>Cardinality</td>
<td>“exactly n”</td>
</tr>
<tr>
<td>≤</td>
<td>Max Cardinality</td>
<td>“at most n”</td>
</tr>
<tr>
<td>≥</td>
<td>Min Cardinality</td>
<td>“at least n”</td>
</tr>
</tbody>
</table>
Try some queries with people ontology and check the explanations:

**Check the explanation!**
Try Protégé with the core ontology!
TASK
BUILDING A KNOWLEDGE BASE COLLABORATIVELY
COLLABORATIVE TASK

Procedure:

• Split the group in Zoom rooms to form teams —randomly—

• Select a specific running example of a smart environment

  1. Examples: an older adult living at home with some specific needs (smart home environment), a tourist looking for specific city places with particular needs (smart city), a mixed reality pet that work as a companion of a person with specific needs (smart virtual environment), etc. —please imagine other scenarios

   1. Re-use the previous example - maybe

• Knowledge graph collaboratively building based on the example

  2. In the Zoom room one person opens the Zoom Whiteboard (Share Screen->Whiteboard-> Share)

  3. Create the taxonomy of entities (nodes) with relationships (is-a) using a color

  4. Create semantic relationships (e.g. has_pet, is_pet_of) with other color

  5. Add some individuals in other words, examples or instances of those entities with other color

  6. Add names of the group member in the top-left of the drawing

  7. Add a title to the graph, example: older adult smart environment graph, tourist smart city graph, etc.

• Save the drawing graph locally

  8. In Zoom click in Save on top of the Whiteboard

• Answer questions (next slide), take notes about those answers. Then present those answers.

• Time 10 minutes
COLLABORATIVE TASK

Alternatively, for sharing if Annotations and Whiteboard in Zoom is limited:

1. All the team members go to o365.umu.se/
2. Login with UmU credentials
3. One person creates and opens a new Whiteboard
4. Share the link of the new whiteboard with the other members via Zoom
5. Make the knowledge graph collaboratively
6. Save the graph
COLLABORATIVE TASK

Procedure:
• Open Web protégé: https://webprotege.stanford.edu/
• Create an account
• Create the taxonomy (the families of knowledge entities)

• Time 10 minutes
COLLABORATIVE TASK

Questions

• What information of the graph is necessary?

• What parts of the graph change on time (dynamic smart environment variables)?

• What information may be uncertain or incomplete?
PRESENTATION OF THE RUNNING EXAMPLE AND KNOWLEDGE GRAPH
PRESENTATION OF EXAMPLE AND KNOWLEDGE GRAPH

Procedure:

• Join the main Zoom session
• Different members of the group present the running example.
• Others present the graph.
• Other the reflections

Time for every presentation 5-10 minutes
Learning environment -> Engineering sw. agents -> Knowledge graph creation

Tools -> Working in groups -> Presentation of tasks

More resources
MORE EXAMPLES AND RESOURCES
RESOURCES

Videos
1. Knowledge graph introduction using Protégé and Web Protégé
   - https://play.umu.se/media/t/o_3x6wbk3a
2. Knowledge graph inference using Web Protégé
   - https://play.umu.se/media/t/o_w26f2068
3. Knowledge graphs relationships
   - https://play.umu.se/media/t/o_kvb62yvt
EXAMPLES

https://amslaurea.unibo.it/15657/1/poli_nicola_tesi.pdf
https://github.com/conner985/UnityLogic
Game of Life

- At each step in time, the following transitions occur:
- Any live cell with fewer than two live neighbours dies, as if by underpopulation.
- Any live cell with two or three live neighbours lives on to the next generation.
- Any live cell with more than three live neighbours dies, as if by overpopulation.
- Any dead cell with exactly three live neighbours becomes a live cell, as if by reproduction.

https://people.cs.umu.se/~tkampik/demos/js-son/
THANK YOU