

Homework 3

ID2209

Distributed Artificial Intelligence and Intelligent Agents

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Problem Statement

Implement the following using the JAVA Agent Development Framework (JADE) [1]

Task #1 M.A.S for solving the N-Queens problem where agents coordinate with each other to choose the right positions.

Task #2 M.A.S with mobile agents that can perform dutch auction in different places. Mobility means in this context that agents have the possibility to move between containers.

N-Queens

Agent Design

The M.A.S for task #1 consists of only one agent-type, the **QueenAgent**. The **QueenAgent** is designed to be reactive and receiving messages from other agents, upon receipt of a message from another queen, the agent will compute a “safe” position on the board according to the following algorithm (randomness is used to be able to find different solutions to the same puzzle):

Algorithm 1 QueenAgent algorithm for selecting a slot on the board

Require:

B ▷ Board
 id ▷ Id of the agent
 T ▷ Safe positions on the current board that have already been tried

Ensure:

p is the selected safe position which have not previously been tried. If no safe position is found, $p = -1$.

procedure SELECT_SAFES_SLOT(B, id, T)

$R \leftarrow \text{Shuffle}(B[id])$ ▷ random shuffle the row of possible positions
 $p \leftarrow -1$
for $r \in R$ **do**
 $i \leftarrow \text{indexOf}(r)$
 if $\text{safeDiagonally}(i) \wedge \text{safeVertically}(i) \wedge \neg i \in T$ **then**
 $p \leftarrow i$
 break
 end if
end for
end procedure

Society Design

The **QueenAgent**'s will take turn selecting slot on the board, the first queen will initialize the puzzle by selecting a slot on the board and then notifying the *next* queen to indicate that it is its turn to select a slot. If a queen finds a safe slot and there is no queen left that have'nt selected a slot, the puzzle is solved. Further more if a **QueenAgent** fails to find a safe slot on the board it will notify the *preceeding* agent about this and ask it to change its slot on the board. If an agent fails to find a safe slot on the board that have'nt already been tried and there is no preceeding queen to notify, the puzzle is considered unsolvable. In order for the queens to find each other they register at the **DirectoryFacilitator** (DF).

Mobile Agents

Agent Design

The **CuratorAgent** and **ArtistManagerAgent** in this scenario uses the same behaviours as for Homework2 with a few modifications:

- Both agents runs in parallel to their other behaviours, a cyclic behaviour **ReceiveCommands** that receives commands from a controller agent to do one of the following: (i) move to a container (ii) clone itself (iii) kill itself
- Both agents use GUI's for interacting with the user and start/stopping auctions rather than the command-line as used in Homework2.
- The **ArtistManagerAgent** will run a cyclic behaviour **ClonesServer** for receiving auction-results from clones. Consequently, after finishing an auction, if the **ArtistManagerAgent** is a clone and has a "parent"-agent, it will send the result to that agent.
- Auctions are ran locally on containers, not globally on the platform.

The **ControllerAgent** and **ControllerGUI** is derived from the example code at the tutorial [2] that the homework is based upon. The **ControllerAgent** creates containers and agents and issues commands to agents to move, clone or die. The **ControllerAgent** communicates with the user through the **ControllerGUI**.

Society Design

The dutch auction interactions from Homework2 have been extended for intra-platform mobility where auctions are performed locally on containers instead of globally on platforms. Further more the results of auctions are forwarded by clones to parent-agents which will synthesize the results and present the best price from its point of view. The interactions between bidders and auctioneers in the actual auction is identical to the interactions presented in Homework2.

Conclusions

Extending simple agents to be intra-platform mobile allows for designing agents with further capabilities for acting autonomously. The agents for this homework were limited to mobility

within a single platform but the same design principles could be applied for inter-platform mobility if the underlying agent-architecture allows for it.

Attachments

Documented source code can be found in the attached zipfile. See README.MD in the root directory for instruction on how to execute and build the program.

References

- [1] Telecom Italia. Java agent development framework. <http://jade.tilab.com/>, 2016. [Online; accessed 11-Nov-2016].
- [2] Jean Vaucher and Ambroise Ncho. Jade tutorial and primer. <http://www.iro.umontreal.ca/~vaucher/Agents/Jade/JadePrimer.html>, 2003. [Online; accessed 26-Nov-2016].