



AI Development / Decision making - Practical Works

The 5 practical sessions, each lasting 4 hours, will take place:

- Friday, January 26th 2024 from 14:00 to 18:15
- Friday, February 16th 2024 from 14:00 to 18:15
- Friday, March 1st 2024 from 14:00 to 18:15
- Friday, March 6th 2024 from 14:00 to 18:15
- Friday, March 13th 2024 from 14:00 to 18:15

Instructor: David Bilemdjian

Objectives

To develop in a **team of maximum 4 to 5 individuals** a collaborative AI for the Real Time Strategy game "Starcraft: Brood War". This AI will have to implement the following techniques:

- Behaviour Trees
- a Blackboard-like cooperation structure

BWAPI, the API for interacting with Starcraft, will be used.



<https://bwapi.github.io/index.html>

Hardware: Windows PC configured for computer development

Language & IDE: Development in C++ using Visual Studio 2022 IDE is preferred. If other languages and IDEs can be used, they are not recommended as the documentation available in connection with development in BWAPI may be etic.



Terran



Protoss



Zerg

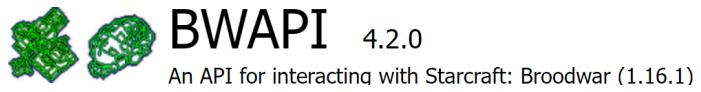
1st Practical Session

- Presentation of development objectives.
- Deliverables, delivery date and evaluation criteria:
 - Deliverable: Visual Studio project in C++ (or other language but I doubt it), compressed into a .zip archive delivered through Drive or Git repository,,
 - **Delivery Date: 17/03/2023 23:59:59 at the latest**
 - Evaluation methods: a grade taking into account
 - **40%** : quality of the AI structures (BT, Blackboard, ArmyManager, Squads,...) developed and the general software architecture. Key criteria are flexibility and modularity: use of a tree of classes, use of generics and abstract classes. Development of debug tools (visual or textual) will be considered.
 - **20%** : readability and cleanliness of the code, comments
 - **40%** : depth of the various AI capacities
 - diversity of buildings construction and units training
 - resources harvesting
 - scouting and exploration strategies
 - combat management: complexity of attacks & defenses, annexation of opponent bases
 - **BONUS** (2 points max): AI performances during contest

- Introducing "StarCraft: Brood War", a Real-Time Strategy game from Blizzard
 - Gameplay
 - Races: Terran, Protoss and Zerg
 - The StarCraft maps:
 - start locations, choke points, expansions,
 - fog of war
 - Grid System: pixel level, walk tile, build tile
 - Strategic considerations: develop, defend, attack
 - Resources on the Internet:
 - Liquipedia:
 - <https://liquipedia.net/starcraft/StarCraft>
 - Youtube videos from Dave Churchill:
 - <https://www.youtube.com/c/DaveChurchill/videos>
 - <https://www.youtube.com/watch?v=czhNqUxmLks>
 - StarCraft Tech Tree: technology tree (units upgrade)
 - https://liquipedia.net/starcraft/Technology_tree
- Setting up the development project in Visual Studio 2022 & first compilation: using StartCraft

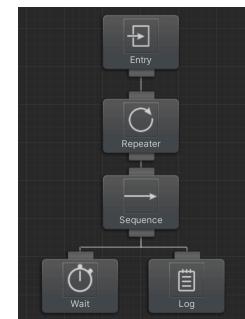
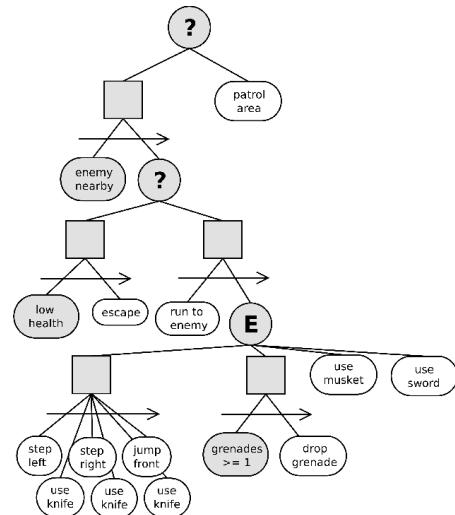


- Detailed presentation of BWAPI, the API for interfacing the AI module with StarCraft:
 - General architecture
 - Data structures
 - Classes and methods
 - What information is input to the AI module?
 - Orders given to units
 - Analysis of the map
 - Speed of execution
 - Visual debugging
 - In-game control of the AI module by command line



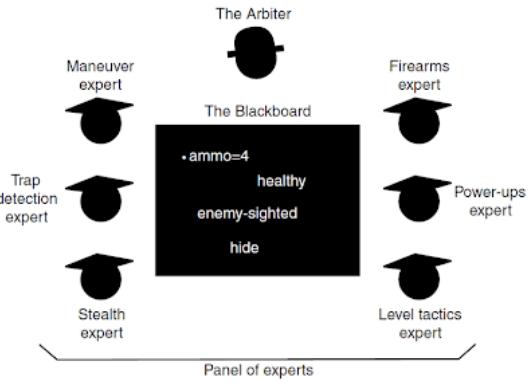
2nd Practical Session

- Behaviour Tree implementation, technical considerations in C++:
 - Software Architecture:
 - Task base class
 - Various Nodes:
 - Conditions, actions, composite nodes
 - Selector: OR operator
 - Sequence: AND operator
 - Non deterministic
 - Selectors and Sequences: shuffling
 - Parallel Tasks
 - Decorators:
 - conditional evaluator, cooldown, interrupt, inverter, repeater, task guard, until failure, until success
 - First objectives for StarCraft AI :
 - Minerals gathering
 - Scouting
 - Unit Building & Upgrading
 - Attacking
 - Combat Management



3rd Practical Session

- Implementation of a Blackboard-type cooperation structure, technical considerations in C++:
 - Set of expert decision making tools: think, erase, write onto the Blackboard
 - The blackboard: data structures (hash tables), actions
 - The arbiter: expert selection based on insistence value
 - Software architecture
- Implementation for StarCraft AI
 - Units coordination



4th Practical Session

- Continued development of an AI for StarCraft.

5th Practical Session

- Depending on the progress of the development:
 - Tournament
 - Further development



Basic Buildings: Protoss Nexus, Terran Command Center & Zerg Hatchery