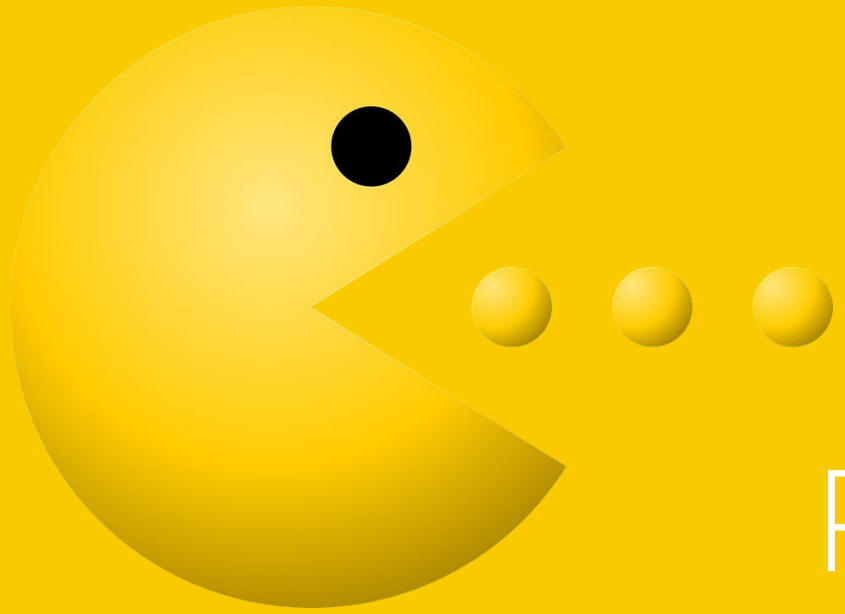

PAC-MAN

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Fonte: https://cdn.pixabay.com/photo/2013/07/12/16/57/pacman-151558_960_720.png

Our Goals

Develop an Agent for Pac-Man that would:

- Achieve a good score in the ranking
- Be a real competitor in a more realist situation
  - Consider level completion speed
  - Consider survivability and strategy skills to outwit ghosts attempts of entrapment
- Play with equal success any new level presented to it

How we achieved our Goal
Our Strategy Planners

The programming approach was to create a decision-making process in *layers*:

Topographer

- Makes a topography analysis of the game map.
- Computes the information once for each game:
  - Pathways
    - Corridors
    - Crossroads
    - Corridor Adjacencies
  - Ghosts Den

Strategy Advisor

- Before each Pac-Man's move, creates a picture of the game situation.
- Provides valuable information to future strategy plan:
  - Pac-Man Info
    - Crossroads
    - Accessible Crossroads
    - Crossroad Semaphores
    - Ghosts in pursuit at each corridor end
    - ...
  - Ghosts Info
    - Distance to Pac-Man
    - Path to Pac-Man
    - ...

Strategy Analyst

- According to Advisor information.
- Chooses the best game plan and which Execution Agents to call and validates their advised move.

Topographer & Strategy Advisor
What is analyzed

Ghosts Den
- Dynamically calculated.

Pathways
- All non-wall coordinates.

Corridors
- A list of adjacent pathways coordinates and two crossroads as ends.
- Can be:
  - SAFE – Has no ghosts;
  - UNSAFE – Has 1 or more ghosts.

Corridor Adjacencies
- Pairs of adjacent corridors.

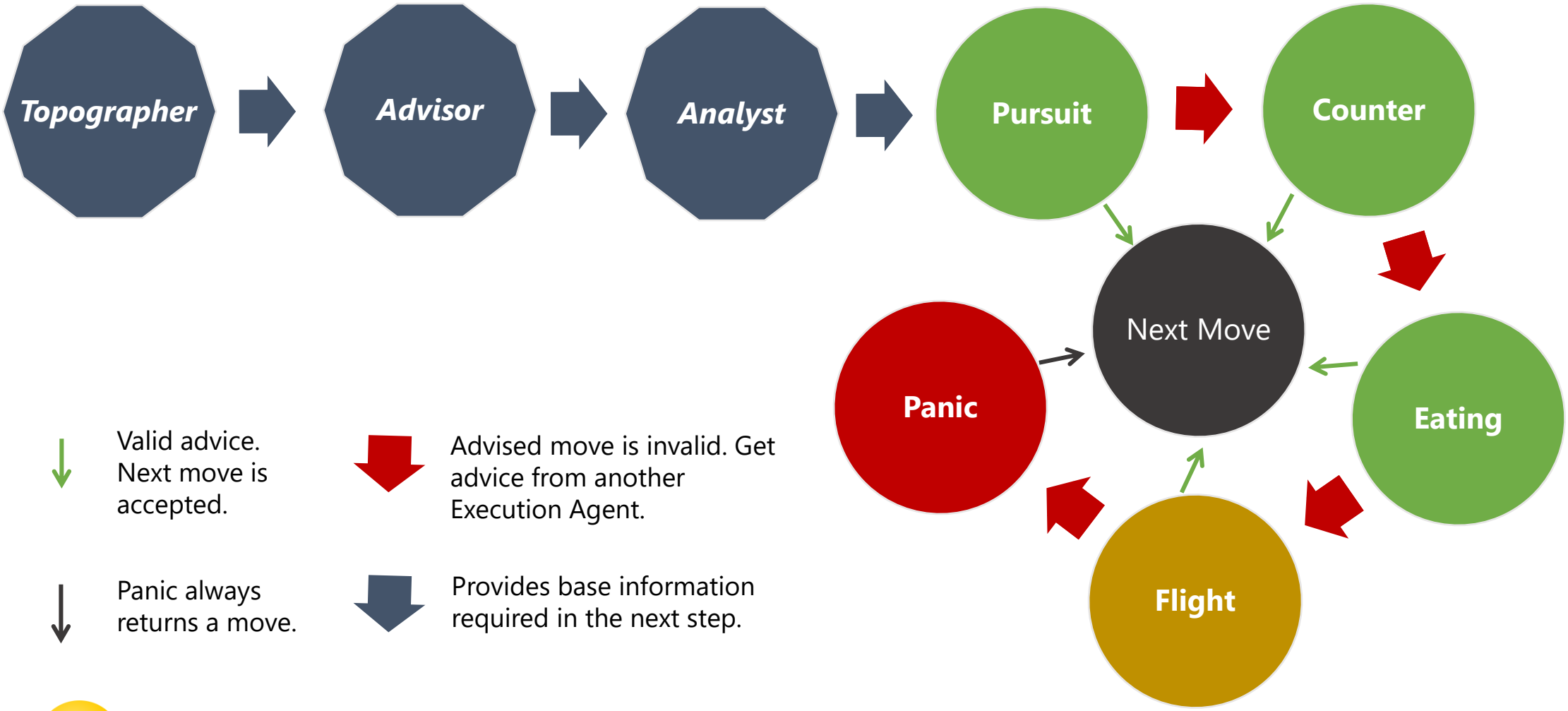
Crossroads
- A coordinate that joins corridors.
- Belongs to all corridors it joins.
- A crossroad directly accessible to Pac-Man (the ends of its corridor) is classified with a semaphore like system:
  - GREEN – No ghosts in proximity;
  - YELLOW – There are ghosts at a dangerous distance of the crossroad. Pac-Man can escape if he goes directly through that crossroad;
  - RED – Considering that the ghosts are in pursuit of Pac-Man, it is impossible for Pac-Man to escape from that crossroad before a ghost gets to it (or a ghost is already inside Pac-Man's Corridor).

Strategy Analyst | Execution Agents

How they change Pac-Man behavior

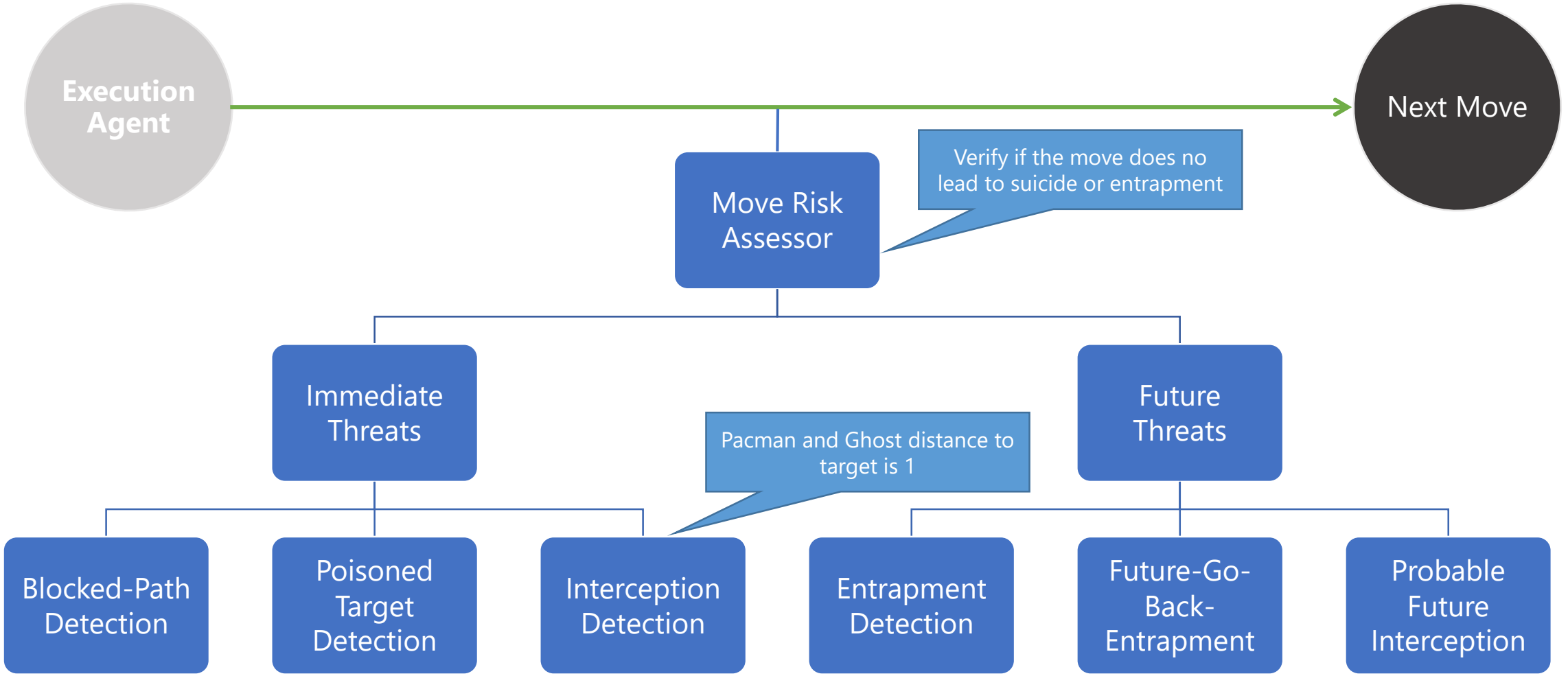
Strategy Analyst | Execution Agents

How the next move is computed



Strategy Analyst | Execution Agents

How the next move is validated



Strategy Analyst | Execution Agents
How Search Tree is used

Type 1 Search

- Used by Strategy Advisor and some execution agents (Eating, Counter, Pursuit);
- Uses A* algorithm with Manhattan Distance as heuristic;
- Search based on corridors (ie. Search Nodes are corridors);
- Returns the shortest path to the target.

Type 2 Search

- Used by Flight execution agent;
- Uses A* algorithm with Manhattan Distance as heuristic;
- Search based on corridors (ie. Search Nodes are corridors);
- Allows avoiding given coordinates;
- Returns *n* possible paths to the target.

Type 3 Search

- Used by Panic execution agent;
- Uses a custom algorithm;
- Search based only on safety criteria of the immediately adjacent corridors;
- Returns next coordinate

Game Constants

Game Constants are changeable and were tested

- 4 game constants can be changed
- Default values were decided by choosing the best average of a list of averages of 10 simulations each for the situations of Evaluation 2 -> combination of the 3 game constants (results in *results* folder in the repository).

Safe Distance to Crossroad	Minimum escape margin if Pac-Man is racing towards a crossroad against a ghost
Safe Distance to a Ghost	Distance (number of steps) at which a ghost probably isn't in pursuit of Pac-man
Pacman -> Ghost Pursuit Multiplier	Value from 0 to 1. • 0 -> Pac-Man does not pursue the ghost • 1 -> Pac-Man pursues any ghost in maximum range until the timeout of the ghost
Number of offensive ghosts	Number of ghosts at unsafe distance to prefer offensive strategy (counter first)

Results
Our Goals vs what was achieved

Achieve a good score in the ranking

With 4 ghosts averaged (with various configurations and maps) about

- 1200 points in level 2 (high score was 1482)
- 1100 points in level 3

Be a real competitor in a more realist situation

Survivability rate of 94% with 4 ghosts at level 2 and 90% with 4 ghosts at level 3

Play with equal success any new level presented to it

Averaged similar scores in both maps with the same conditions

Work Percentages

Based on the amount of work and the contribution to the creation of the architecture of the solution, we agreed the following percentages of work per member:

- Luis Moura 40%
- Maria Lavoura 30%
- Pedro Teixeira 30%