FAKULTÄT FÜR !NFORMATIK
Faculty of Informatics

Diplomarbeitspräsentation

kbs Knowledge-Based Systems Group

Design and Implementation of an Agent Architecture combining Emotions and Reasoning

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Introduction & Problem Statement

- Reasoning and search can explore solution spaces, but they can't tell an agent which goals it should value.
- Often, outcomes are valued via goal functions and are categorized into "good" and "bad" ones, depending on the value of the function.
- Can one combine simple emotional reactions to situations with reasoning techniques to obtain intelligent behaviour?

Wumpus World

As our setting, we chose and elaborate version of the well-known Wumpus world: a 2D-grid world with Wumpuses that try to kill agents, plants that can be harvested, and items that can be picked up. Agents have to avoid being killed and have to periodically eat either the fruit from plants or the meat from Wumpuses whom they can fight.

Combining Affect and Reasoning

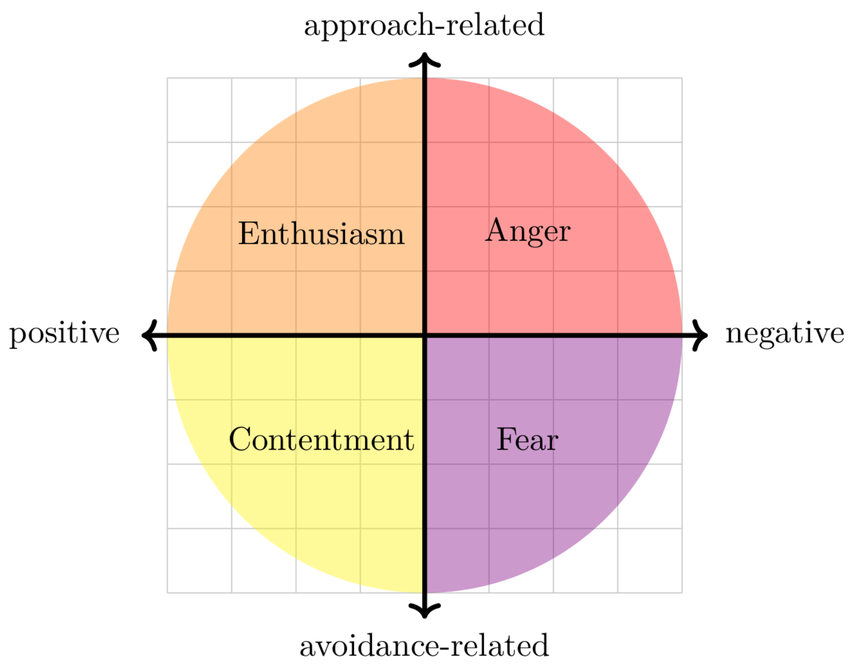
We have created an AI consisting of loosely coupled components that communicate via a central message space.

Structure

- Agents emotionally evaluate their current situation and take a hypothetical action based on the strongest emotion.
- The world is simulated one step ahead.
- If the outcome satisfies the strongest emotion, the action is actually taken.
- If not, the planning continues or a different action is tried.

Emotions

- Evolutionarily speaking, organisms felt fear and anger long before they felt social emotions.
- We thus divided the emotions into pre-social and social ones.
- The pre-social emotions are put into four categories based on neurological research: anger, fear, enthusiasm, contentment.
- Anger is negative and approach-related,
- Fear is negative and avoidance-related.
- Enthusiasm is positive and approach-related,
- Contentment is negative and avoidance-related, inasmuch as it leads the organism to avoid action because its needs are met.



Proof of Concept

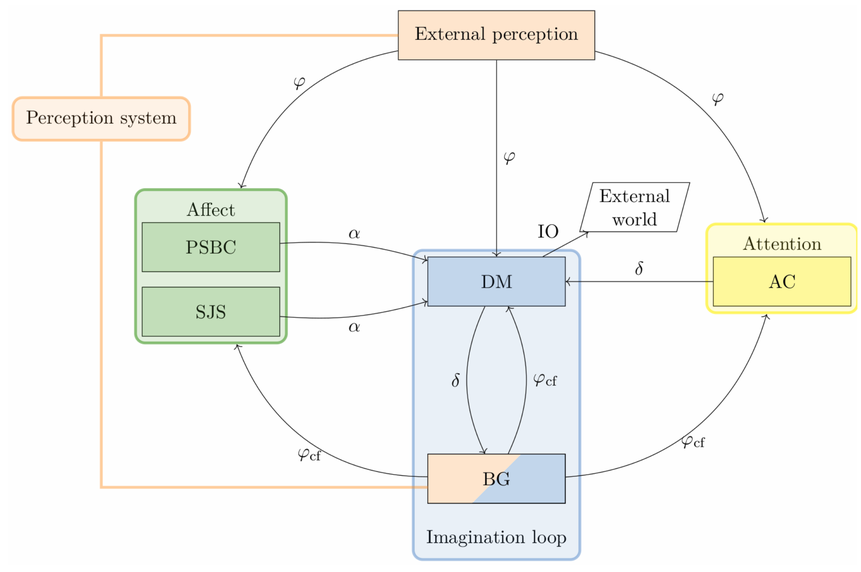
We wrote a proof of the concept Haskell. The two major components are the world simulation and the AI.

World simulation

- Implements the semantics of the Wumpus world.
- Offers a number of actions: rotate, move, pick up item, give item, attack etc.
- Provides agents with perceptions: visual data, breeze from pits, stench from Wumpuses, location, direction.
- Treats AIs as black boxes that need only implement a `getAction`-function.

AI

- Consists of loosely coupled components that communicate via a shared message space.
- Components are called sequentially in each round.
- Each component can read the previous messages and insert its own.
- The pre-social behaviour control (PSBC) and social judgment system (SJS) provide emotional reactions.
- The decision makes takes hypothetical or real actions.
- The belief generator simulates the consequences of actions.
- The attention module selects important targets like fruit or nearby hostile agents.



Evaluation

We put the AIs in a number of test worlds to see whether they would perform reasonable actions:

- Harvesting a plant and eating its fruit when hungry,
- Fleeing from a Wumpus when low on health.
- Attacking a Wumpus when in good health.

Conclusion

- We created a hybrid AI that combines emotions and reasoning.
- There are no explicit goal functions, only conflicting emotions.
- The AI performs well on rudimentary tasks.

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