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

We set our agents in a 2D-grid world with predators that try to kill agents, plants that can be harvested. Agents have to avoid being killed and eat to survive.

Combining Affect and Reasoning

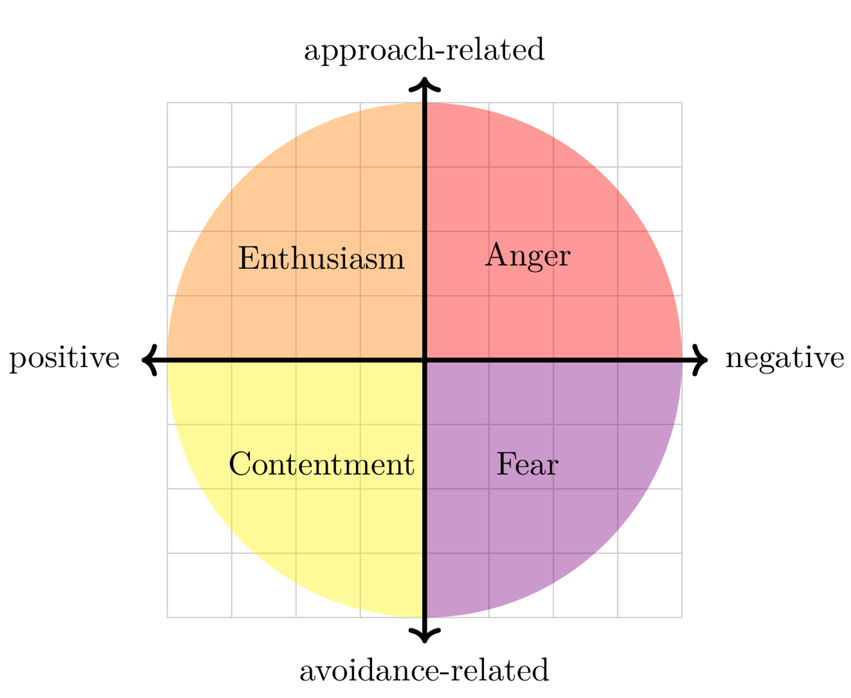
We have created an AI consisting of loosely coupled components that communicate via a central message space.

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 implemented four emotions: anger, fear, enthusiasm, contentment.
- Anger: **negative** and **approach-related**,
- Fear: **negative** and **avoidance-related**.
- Enthusiasm: **positive** and **approach-related**,
- Contentment: **positive** and **avoidance-related**,
  (the organism avoids action because its needs are met).



Proof of Concept

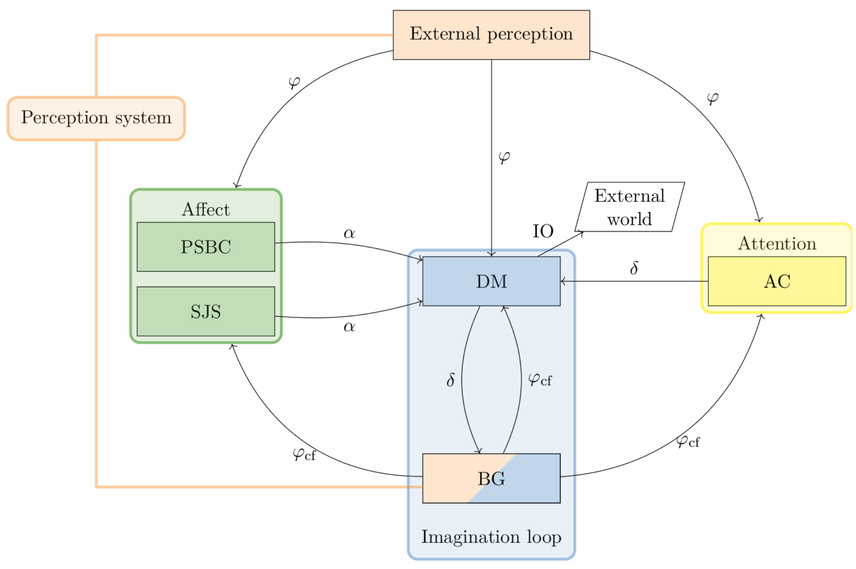
We wrote a proof of the concept Haskell. The two major components are the world simulation and the AI.

World simulation

- Implements the semantics of the Wumpus world.
- Possible actions: rotate, move, pick up item, give item, attack, etc.
- Agents get perceptions: visual data, breeze from pits, stench from predators, location, direction.
- AIs are interfaces that 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 maker (DM) takes actions.
- The belief generator (BG) simulates the consequences of actions.
- The attention control (AC) selects important targets.



Evaluation

- The AIs had to perform tasks in simple test worlds (harvesting plants, fleeing, attacking weak enemies).
- Different populations with different personalities were compared.

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 simple tasks and in complex environments. Different personalities have different success rates.

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