

Case-Based Reasoning in Generative Agents: Review and Prospect

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Introduction

Survey	Focus	Proposed Components
[19]	Multiagent	Decision-Making thought, Tool use, and Memory
[54]	Agent and multiagent	Brain, Perception, and Action
[48]	Agent	Profiling, Memory, Planning, and Action
[17]	Domain-Specific Agents	Perception, Reasoning & Decision Making, Adaptive Learning, and Personalizing
[11]	Agent	Configurator, Perception, Short-term memory, Actor, World model, and Cost

Existing frameworks and roadmaps for future generative agents.

**Background:**

- LLM-based agents have attracted significant research interest since the release of ChatGPT.
- Various frameworks and roadmaps have been proposed.
- Most existing frameworks focus on LLMs, lacking integration with other AI paradigms.

**Contribution:** Drawing on perspectives from psychology, cognitive science, psychiatry, and AI, we propose a Case-Based framework for agents.

Separation of Language and Reasoning

**SHP Hypothesis:**  
A unified cortical area exists to process hierarchical structures.

Disapproved by facts from

- Clinical neurology cases.
- fMRI brain imaging studies.
- Analysis of algebraic structures.

**Dual-Process Models (Example)**

- Automatic processing: carried-out automatically.
- Controlled processing: limited capacity and intentionally controlled.

Similar theories: Freud, Jung, Stanovich-West, Evans etc.

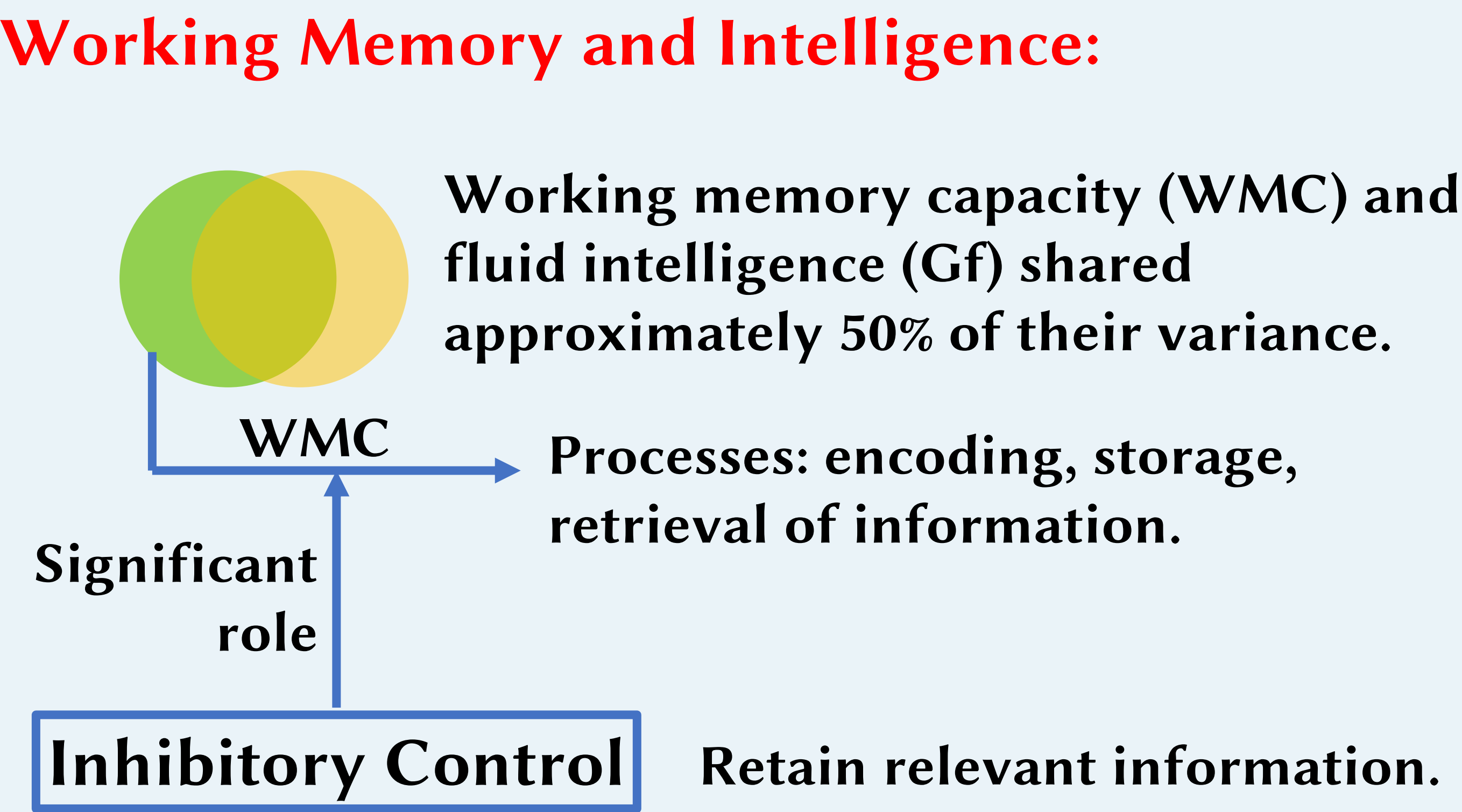
**Can we automate all reasoning processes via training?**

Negative Results from:

- Cognitive neuroscience.
- Experimental psychology.
- Developmental psychology.

Implications: the need of various AI paradigms in agents.

Unique Role of CBR

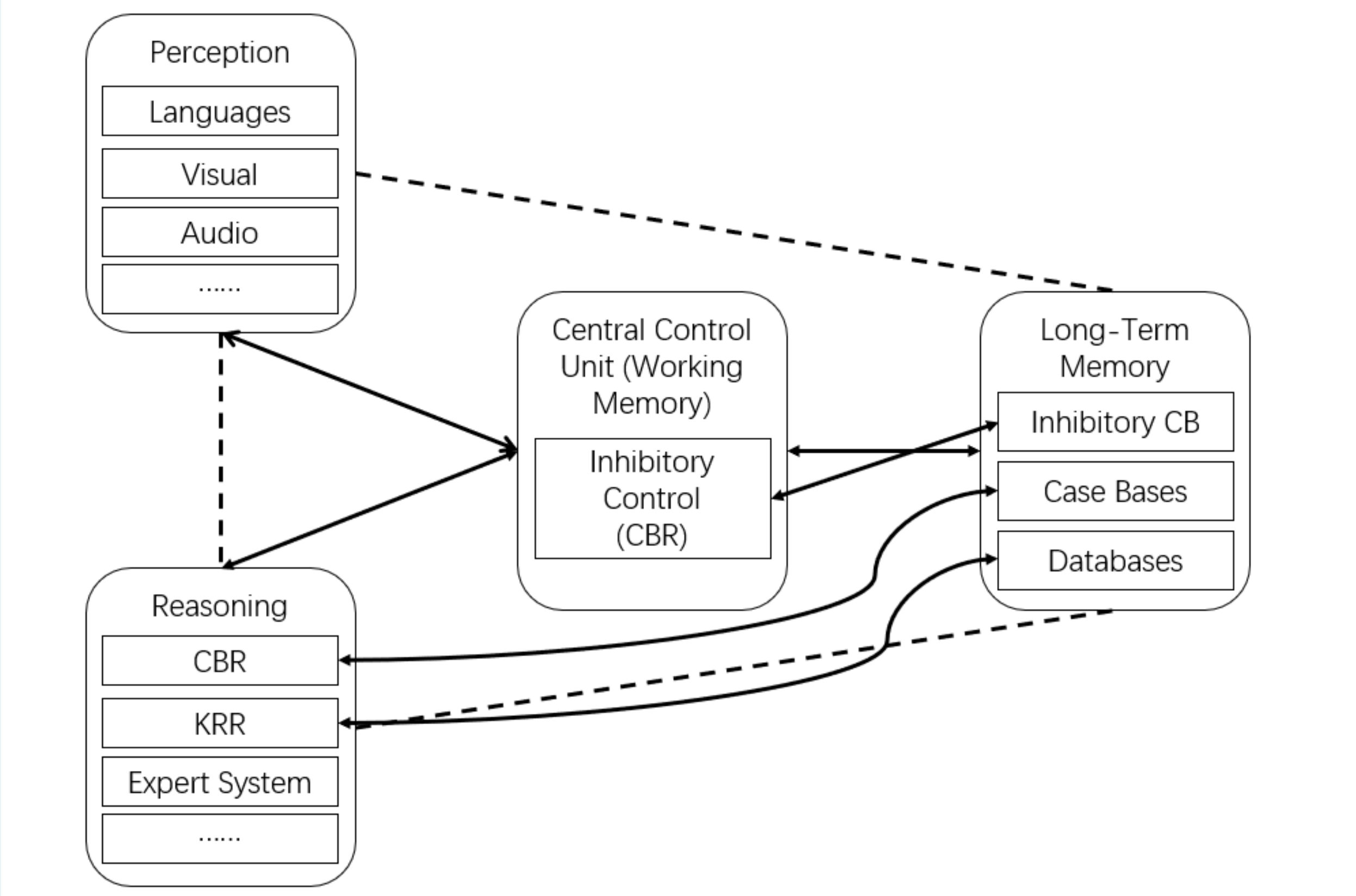


**CBR:**  
The AI paradigm that mostly resembles working memory.

**Advantages of using CBR as the central control unit of agents:**

- Inhibitory control.
- Balance among multiple AI paradigms.
- Agent maintenance cost.

Framework & Roadmap



**Inspiration:**

- Defining the modules according to the cognitive processes instead of the actions they involved.
- The “high cohesion, low coupling” design principles found in software engineering practice.

**Modules:**

- Central Control Unit: Case-based inhibitory control that chooses relevant cognitive pathways and information.
- Perception Modules: Languages, visual, audio etc.
- Reasoning Modules: Reasoning AI paradigms such as CBR, KR&R, and expert systems.
- Long-Term Memory: case bases, knowledge bases, etc.