

Cognitive Technology

Triet Pham

Optum

Eden Prairie, USA

triet.pham@optum.com

ABSTRACT

The assessment of our progress on A.I. has often been gauged by how well our machine can perform intellectual tasks compared to its human counterparts. That is not to say building A.I. is about building human intelligence, but the way humans solve problems and the way our physiological brain works has been the source and inspiration behind many advancements in the field. Cognitive technology stems from the cognitive science space – it frames the way we design machine solution to behave as a general computational system that closely mimic the cognitive abilities of humans as a whole. This may involve knowledge-intensive reasoning, reactive execution, self-planning, attention and perception, working memory, and learning from experience. Other A.I. systems today are designed around solving specific tasks, not general ones. Cognitive technology ushers in a new wave of A.I. solutions that can solve intractable problems we have not been able to address before – such as reasoning over large action space, handling imperfect information, and computing long-term planning in complex environments. This paper highlights the practical research and development that has been accomplished here at Optum using cognitive technology.

Author Keywords

cognitive technology; cognitive architecture; intelligent agents; soar cognitive architecture

INTRODUCTION

The cognitive technology work being done by our team can be broken up into two sub-categories. The first is cognitive architecture, and the second is intelligent agent.

Cognitive architecture can be seen as the blueprint for building intelligent agents. The key difference is that a cognitive architecture has to function as a general computational system, such that it has all the cognitive abilities ready-to-go for undertaking any tasks. Our team introduced cognitive architecture to Optum during the annual Dev Days 2019 conference. We are also training competencies around this area.

Intelligent Agents are high level software abstraction for building autonomous entity with varying cognitive abilities. In 2018, our team built and deployed an intelligent agent for monitoring virtual machines and automatically reconnecting disconnected hosts in the VMWare space. This piece of work won the Make It Happen 2018 award. We also used it to detect and remediate blocking sessions within databases. In

a 2019 Optum hackathon, we created a POC of the Intelligent Agent being used for ambient computing. We called this agent R.A.I., Rational Ambient Intelligence, and it was designed to interface with IoT devices to act as a central supportive system.

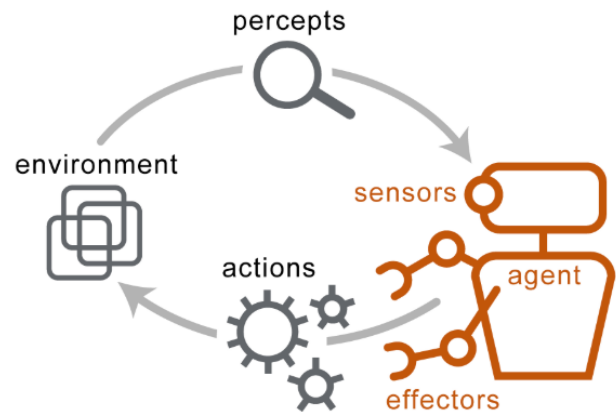


Figure 1. Intelligent Agent

COGNITIVE ARCHITECTURE DESCRIPTION


Cognitive architectures are designed to be general systems that exhibit intelligent behaviors close to that of a human brain. There are actually many cognitive architectures out there. Both the theories and implementations are evolving. One of the more established cognitive architecture is the SOAR cognitive architecture currently being maintained and developed by John Laird and his peers at MIT.

Our team have been researching with the SOAR cognitive architecture, as it has been proven in the military space and holds a lot of fleshed out capabilities. We're currently working on building a support system for population health with this tool.

We're also creating educational materials and fast-tracking folks at Optum to learn this type of technology.

INTELLIGENT AGENTS DESCRIPTION

Intelligent agents are designed to perceive information from large environments, contextualizes that information, and has the ability to use a combinatorial of modern ML techniques and an inference engine that allows it to become powerful at reasoning and making decisions in real time.















VCenter apsw8218.ms.ds.uhc.com:

monitoring

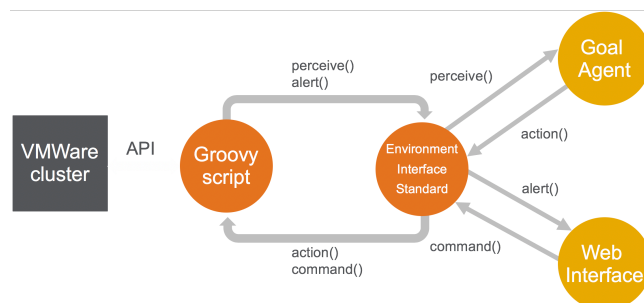
Last checked: a few seconds ago

Pause

Resume

Host	 Connected <div>3 / 5</div>	 Maintenance Mode <div>1 / 5</div>	 Ticket Status	Host Status
vsme8115.uhc.com			no	Retired
vsme8114.uhc.com			no	Retired
vsme8203.uhc.com				Decom Shutdown
vsme8204.uhc.com				Decom Shutdown
vsme8205.uhc.com				Decom Shutdown

The VMWare Intelligent Agent is built using GOAL programming language, which offers declarative beliefs and goals. We tie the GOAL agent to an interface layer that can pass and receive information to scripts. The scripting language of choice was groovy, and we used it to manage interactions with external environments.



We also designed persistent beliefs into the agent. When one agent dies, its beliefs gets persisted so that another agent can resume its knowledge and generated rules. This is done through an agent coordinator that handles the handover process.

```

graph TD
    GOAL[GOAL Intelligent Service]
    Existing[Existing SN Tickets]
    Managed[Managed Hosts]
    New[New SN Failure Ticket]
    CMDB[Server Configuration Item CMDB]

    Existing -- Host Status --> GOAL
    GOAL -- Attempt Action --> Managed
    GOAL -. Failure Ticket .-> New
    CMDB --> Existing
    CMDB --> Managed
    CMDB --> New
  
```

Figure 4. Multi-systems interactions

The research on cognitive technology is ongoing, and we want to show that Optum can be the one to push A.I. tech on our mission to make the healthcare system work better for everyone. We built intelligent agents to handle automation tasks in large and complex environment, such as the VMWare space. We find new ways to solve problems using cognitive architecture so that we can discover innovations and grow our A.I. talent. As our world become more information driven, so too will our solutions have to be more capable of digesting this information, reactive, robust, and generalized to handle tasks of many kind. Cognitive technology offers a next step to A.I. assistants, support systems, or the way our A.I. is able to make sense of our physical world or even virtual worlds beyond that.

1. <https://github.optum.com/sdsml/AmbientIA>
2. <https://github.optum.com/sdsml-agents>
3. <https://github.optum.com/sdsml/CSPIntelligentAgent>
4. http://www.mind.ilstu.edu/curriculum/ants_nasa/intelligent_agents.php
5. Is it an Agent, or just a Program?: A Taxonomy for Autonomous Agents by Stan Franklin and Art Graesser
6. Software Agents: An Overview by Hyacinth S. Nwana
7. Intelligent agents: theory and practice by Michael Woolridge and Nicholas R. Jennings
8. The Soar Cognitive Architecture by John E. Laird
9. <https://goalapl.atlassian.net/wiki/spaces/GOAL/overview>