Contribution ID: **120**   Type: **Talk (15min + 5min)**

Exploring Autonomous Agent Architectures in the context of Data Analysis Workflows

Wednesday 26 February 2025 15:00 (20 minutes)

In artificial intelligence (AI), the Autonomous Agent Architecture (AAA) is a fundamental framework through which agents interact with their environment. The AAA leverages the Observe-Think-Act loop that allows either software or physical agents to reason within dynamic domains. This loop consists of three stages: observing data, reasoning about it, and finally acting based on the decisions made.

This talk will introduce the concepts of the AAA and explore the possibilities and benifits that combining the AAA with Data Analysis Workflows might offer. Using the ability to observe and adjust workflows, robustness and reliability of workflows could be improved by adhering to domain constraint and semanticaly verify intermediate steps. These intermediate results of workflows could be validated, comparing outputs against predefined rules or expected patterns. When inconsistencies arise, the system could flag them for human review, suggest alternative hypotheses, or adjust subsequent steps dynamically. Furthermore, if implemented using symbolic reasoning, users will be able to trace decisions back to encoded knowledge, thereby enhancing transparency and trust on the results correctness.

By observing and applying symbolic reasoning techniques, it is possible to ensure that workflows comply with domain constraints and remain effective even with an incomplete knowledge base. The AAA can work in uncertain conditions, but to function, it has to operate using knowledge assumed to be true or false. As soon as conflicting observations occur its knowledge base gets updated. This mechanism could allow workflows to function despite having noisy or partial datasets. Research has shown how symbolic AI approaches can solve configuration and scheduling tasks efficiently, while insights from solving Multi-Agent Pathfinding (MAPF) problems demonstrate how symbolic reasoning can coordinate multiple agents to minimize conflicts and optimize shared objectives. These techniques could allow workflows to be both reliable, efficient and adaptable to changing conditions.

I want to participate in the youngRSE prize

yes

Primary author: BERTRAND, Nikolas

Presenter: BERTRAND, Nikolas

Session Classification: ML-assisted and more general data workflows

Track Classification: Research Software: AI and ML in a research context