Situated language understanding in a cognitive robotics platform

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SUBTLE MURI Year 5 Review

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Cognitive Robotics (Troy Kelley, ARL)

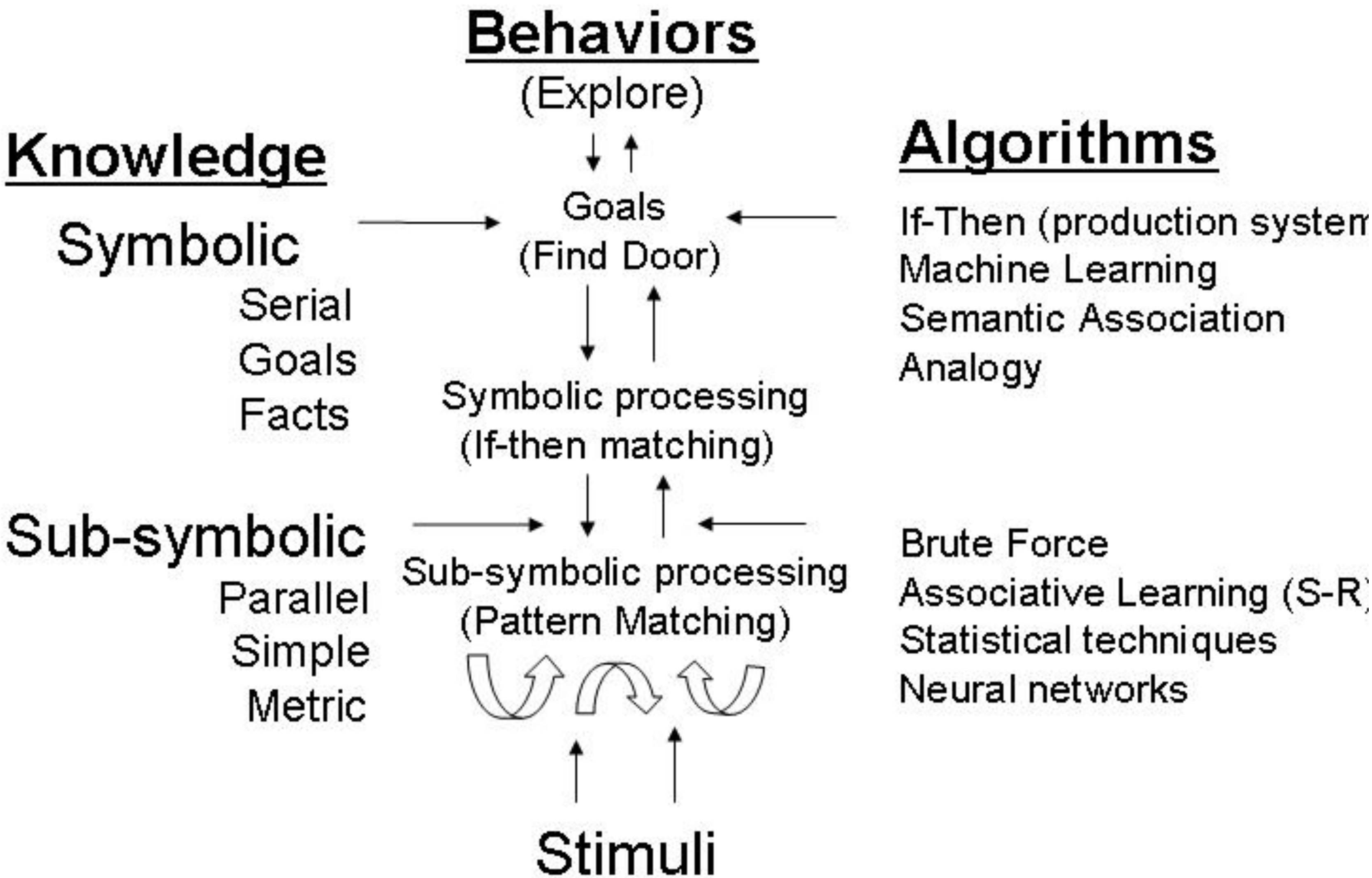
- Goal: Have robots learn, think, react the way a human would
  - Motivation:
    - Apply cognitive psychological principles
    - Allow for naturalistic learning by the robot
    - Make human-robot interaction robust & natural

- Apply lessons learned from cognitive psychology to solve robotics problems
- Use existing cognitive architectures
  - (ACT-R and Soar)
  - Used to simulate human operators for weapons systems

Goal: Natural language to production system

- Commander's instructions
- Parsed sentences
- Semantic representation
- Goal vocabulary
- Goal execution

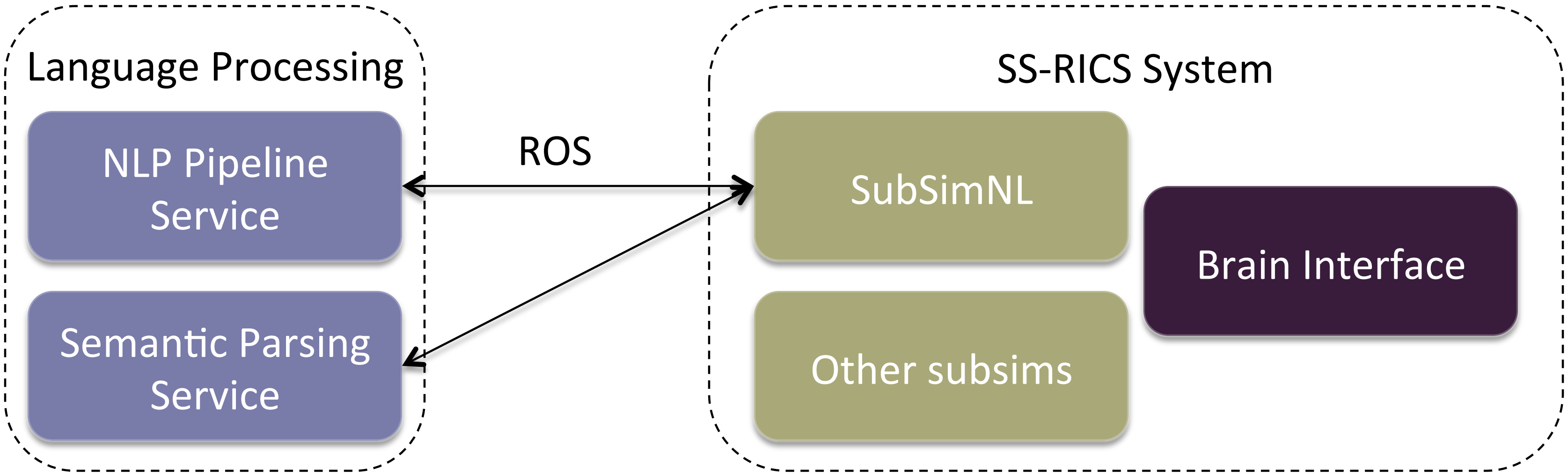
Symbolic and Subsymbolic Robotic Intelligence Control System



Integration

- Integration between MURI work and SS-RICS over three visits to ARL
- Step 1: natural language proof of concept
  - Used existing NL assets to create simple “keyword spotting” system to trigger goals
- Step 2: integration of Penn NLP pipeline and semantics
  - Ported assets to be callable from SS-RICS platform, enabling more sophisticated semantics
- Step 3: robust, easily maintained interface to SLURP
  - Access over standard channels (ROS) allows continuous integration with minimal effort

Architecture



- NLP Pipeline and Semantics run as independent services
- ROS interface between NL services and SS-RICS process
  - Can be used by any ROS system!

Converting commands to productions

- Goal: Go to X:
  - Antecedent: destination is set ("CurrentDestination Arg *=*;1”)
  - Consequents:
    - Execute: Say “Going to the $CurrentDestination”
    - Execute: Move to $CurrentDestination
    - Execute: Say “Commander, I am finished moving to the $CurrentDestination”
    - Unset $CurrentDestination
    - Quit

Converting commands to productions

- Upon getting a go command:
  - Action: go, Location: hallway
  - Set a fact in the mind: $CurrentDestination = hallway
  - Trigger the GotoX production
- Goal is to create a set of standard productions that can enable a core set of scenarios
  - Tell me if you see a…
  - Find a…
  - If you observe X, do Y…
- By building up more complex production chains, we can enable more sophisticated behavior

Demo

Summary

- No fancy behaviors yet, but the fundamental connection between MURI work and ARL is there
- Integration effort has pushed us to focus on clean, modular interfaces
- SS-RICS integration provides example of our ability to support multiple architectures with core SLURP components