Bioinspired hybrid robot control architecture with continual learning

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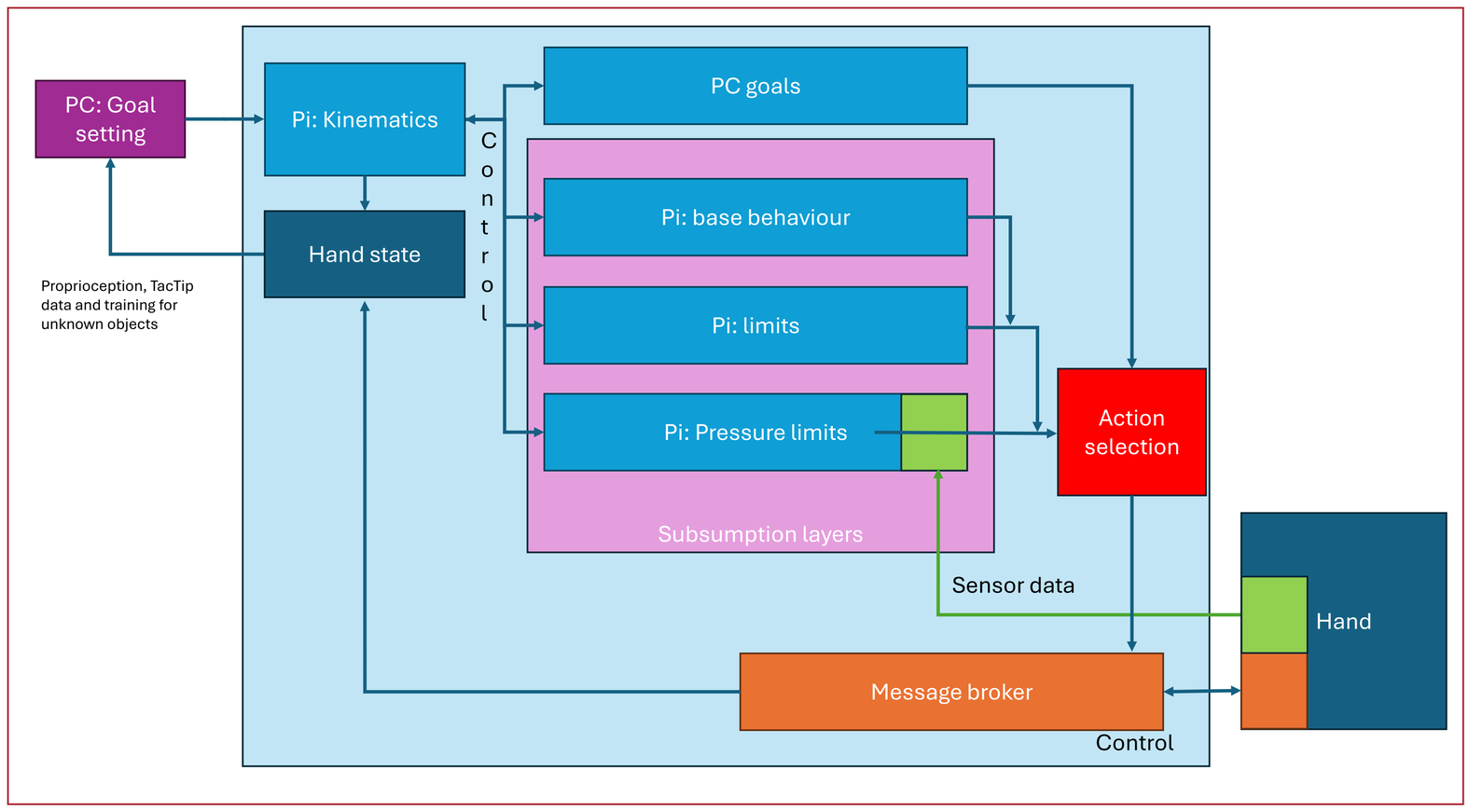
Current status

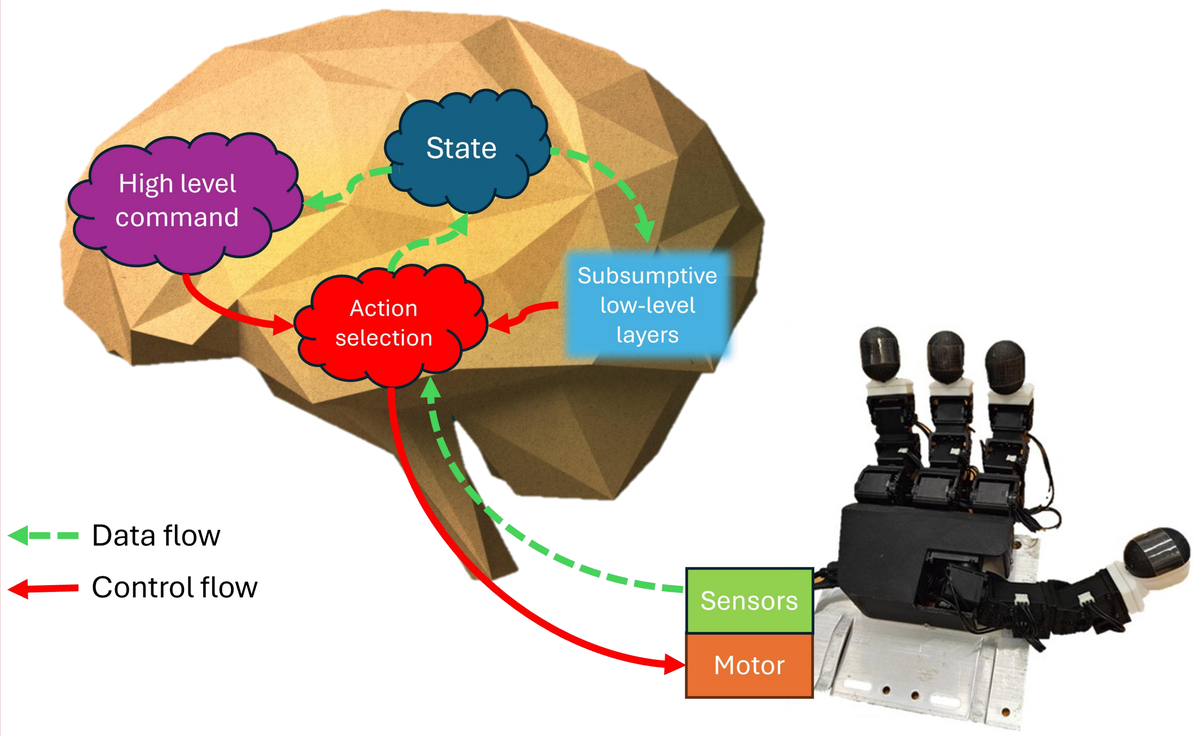
Current robot control falls into two major categories:

- Traditional
- Neural Network

Traditional control is robust and caters for novel situation but doesn't learn

Neural networks can be trained to work optimally for known situations to give a better response and can learn from experience but struggle with generalisation





Proposed solution

Our proposed solution combines both techniques.

1. A traditional control system using a subsumptive architecture provides low level behaviour control in novel situations locally near the hand.

2. A remote neural network will use the state data provided by the traditional system to learn and refine behaviour such that it can override local control for optimum performance in known situations.

Advantages: This system will provide a robust control architecture that is resilient to the loss of remote control. It will have low compute power needs near the hand. The architecture provides basic and protective control whilst still allowing the system to learn, refine and innovate

Progress: Local Control

We have built an open source fully actuated LEAPhand. This is tethered to a Raspberry Pi which provides the subsumptive control. The Raspberry Pi receives control commands from the remote system and passes them through a multithreaded controller before the appropriate command is directed to the hand. The hand is continuously polled for its current state which is then stored in a shared object

An API is presented over websockets to the remote control input. This accepts motion commands and provides state data for remote training.

Progress: Remote control

To provide initial control we have used a LeapMotion capture device to build a teleoperation system that allows control of the hand over websockets. The system currently has two operation modes:

1. The angles for each finger joint are sent
2. The end point coordinates for each finger are sent

The remote controller then interprets these API calls in order to control the hand.