Social Hierarchical Learning

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SHL accomplishes **hierarchical learning** for **socially cooperative tasks** between robots and humans operating in the same physical space on the same tasks. **Reinforcement learning** and **learning by demonstration** are leveraged for primitive skills acquisition. An SHL system learns a task decomposition encoding the structure of a plan derived from user interaction. Finally, the system learns how to assign roles in real-time, adapting SHL agents to collaborate with human co-workers to **improve team efficiency and performance** through cooperative task execution.

Primitive Skills Acquisition

Keyframe Based Skill Training
- ✧ Training designed for non-experts

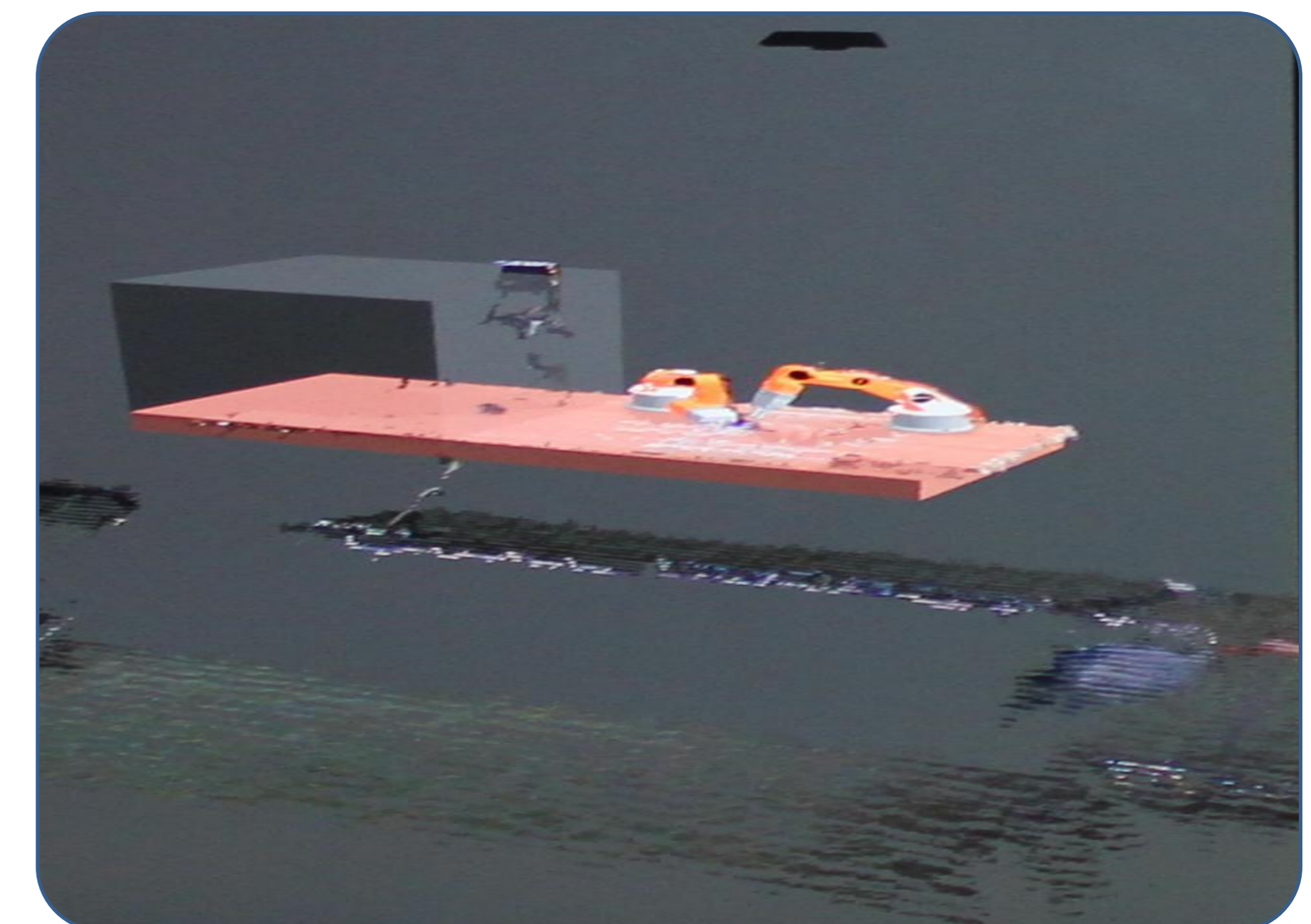**Multi-scale Adaptive search Based Execution**
- ✧ Dynamic environment, high dimensionality path planning

Feature Extraction for Intention Recognition
- ✧ Determining means-oriented and object-oriented intent

Social Modeling of Action Consequences
- ✧ Learn social effects of path choices

Task Decomposition

Learn Hierarchical Task Structure By Demonstration
- ✧ Receive sequence of skills as input

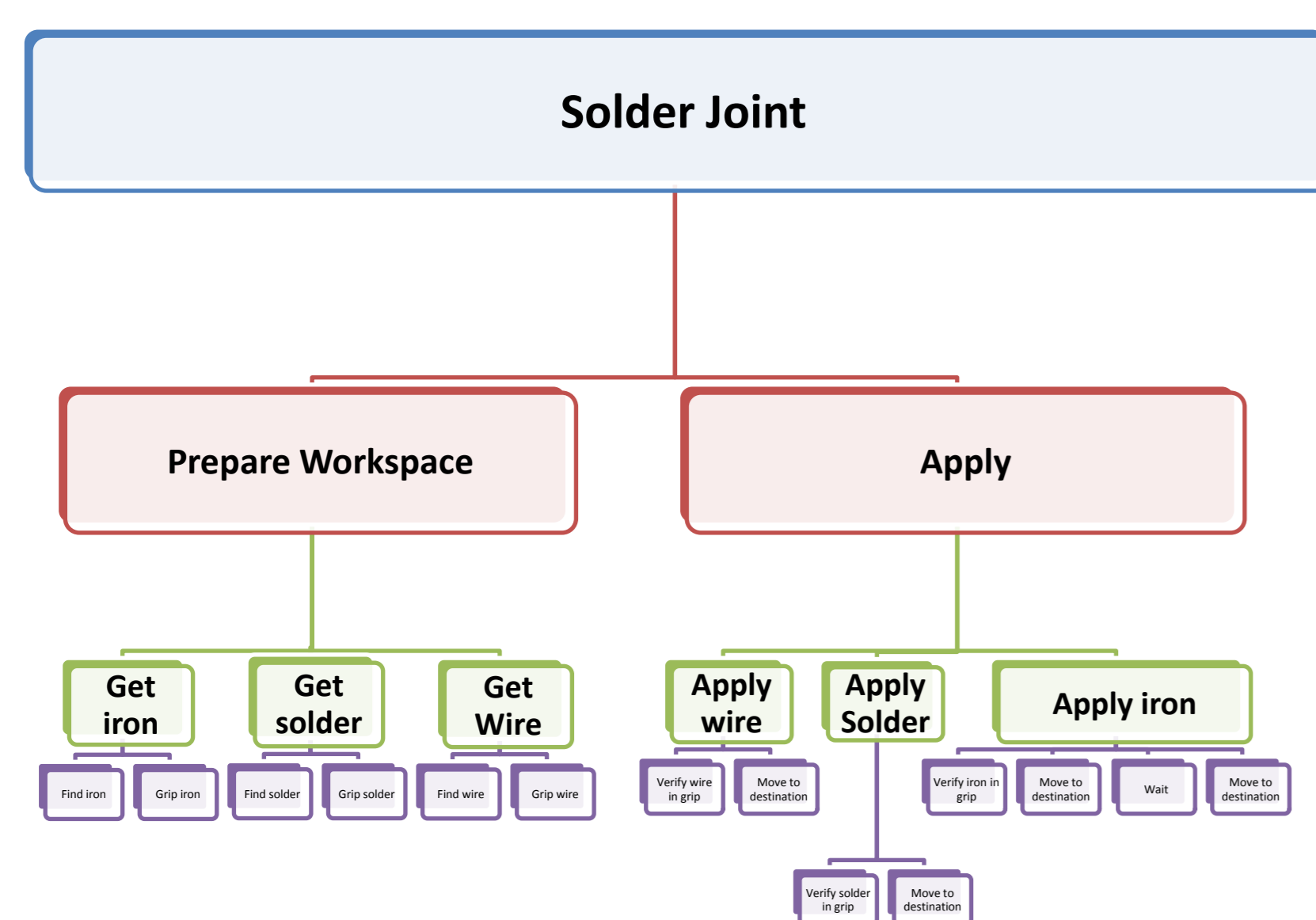**Determine Parallel Task Components**
- ✧ Output tree with parallel tasks and role divisions identified

Visualize Representation Of Task To User
- ✧ Shared task representation between humans and robot

Determine Valid Subtask Assignments For Multiple Agents
- ✧ Account for agent proficiencies and preferences

Cooperative Task Execution

Dynamic Multi-agent Role Assignment
- ✧ Assign branches of subtasks to available agents

Real-time Performance Assessment
- ✧ Perform individual-agent assessment during operation

Live Agent-level Role Adaptation
- ✧ Re-assign roles based on agent preferences and abilities

Teammate Social Modeling
- ✧ Adapt skill executions to minimize team disruption