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