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IMPLEMENTING CST IN LEARNING LAYER OF CSIA FOR HIGHER LEVEL OF INTELLIGENCE

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----------**ABSTRACT**----------

Development of cognitive architecture where the agents at different levels exhibit different levels of thinking. The paper primarily focus on building the skill tree at the learning layer of the architecture. These include the discovery of one's own body, including its structure and dynamics. Also the acquisition of associated cognitive skills such as self and non-self-distinction. This can be achieved by implementing CST(Constructing Skill Trees). CST is a hierarchical reinforcement learning algorithm which can build skill trees from a set of sample solution trajectories obtained from demonstration. CST is much faster learning algorithm than skill chaining. CST can be applied to learning higher dimensional policies. Even unsuccessful episode can improve skills. Skills acquired using agent-centric features can be used for other problems.

Keywords: Cognition, CST[Constructing Skill Trees],Reinforcement Learning, Sensorimotor Skills.

I.INTRODUCTION

The idea of applying robotics technology in agriculture is very new. In agriculture, the opportunities for robot-enhanced productivity are immense and the robots are appearing on farms in various forms and in increasing numbers. We can expect the robots performing agricultural operations autonomously such as spraying and mechanical weed control, fruit picking, watching the farms day and night for an effective report, allowing

farmers to reduce the environmental impact, increase precision and efficiency, and manage individual plants in novel ways.

The present project is one among those, which involves improvement in the fruit picking robot. The fruit picking robots need to pick ripe fruit without damaging the branches or leaves of the tree. Mobility is a priority, and the robots must be able to access all areas of the tree being harvested. It goes then without saying that the robots must be intelligent, and have a human-like interaction with their surroundings through senses of touch, sight, and image processing. One of the disadvantage of fruit picking robots is that they are not able to distinguish between the riped fruit and unriped fruit while picking. This motivated us to add human intelligence to the robots so that it can distinguish between the riped and unriped fruits.

II.PROBLEM DEFINITION

Development of cognitive architecture where the agents at different levels exhibit different levels of thinking. The project primarily focus on the acquisition of sensorimotor skills. These include the discovery of one's own body, including its structure and dynamics. Also the acquisition of associated cognitive skills such as self and non-self distinction. To investigate the level of thinking which includes identifying the behaviour of agents, reasoning about other agents and about their own mental states agents, reasoning about other agents and about their own mental states.

III.EXISTING SYSTEM

EM ONE BY PUSH SINGH [1]

CRIBB ARCHITECTURE

The CRIBB architecture consists mainly of two representations. They are primary representation and secondary representation.[2]
Primary representations describe the agent's simulated environment.They are the system own beliefs about situation and behaviour of person and other facts about physical world.
Secondary representations describes about the agent's state.They include mental states like perception, belief and intentions.

BDI ARCHITECTURE

1. **Beliefs** -- information the agent has about world. Using the term *belief* rather than *knowledge*, we can recognize that what an agent believes may not necessarily be true.
   Beliefset[3]

2. **Desires** -- states of affairs that the agent, in an ideal world, would wish to be brought about. This is a motivation stage of agent.
   Goals

3. **Intentions** -- desires that the agent has committed to achieve.
   Plans
   Events

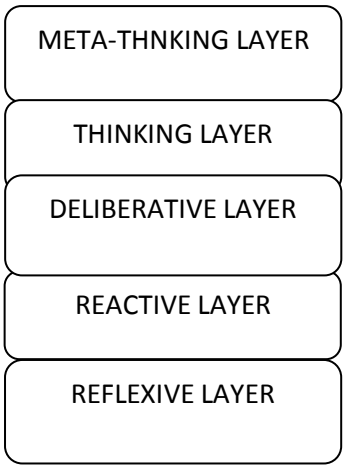
Learning algorithms

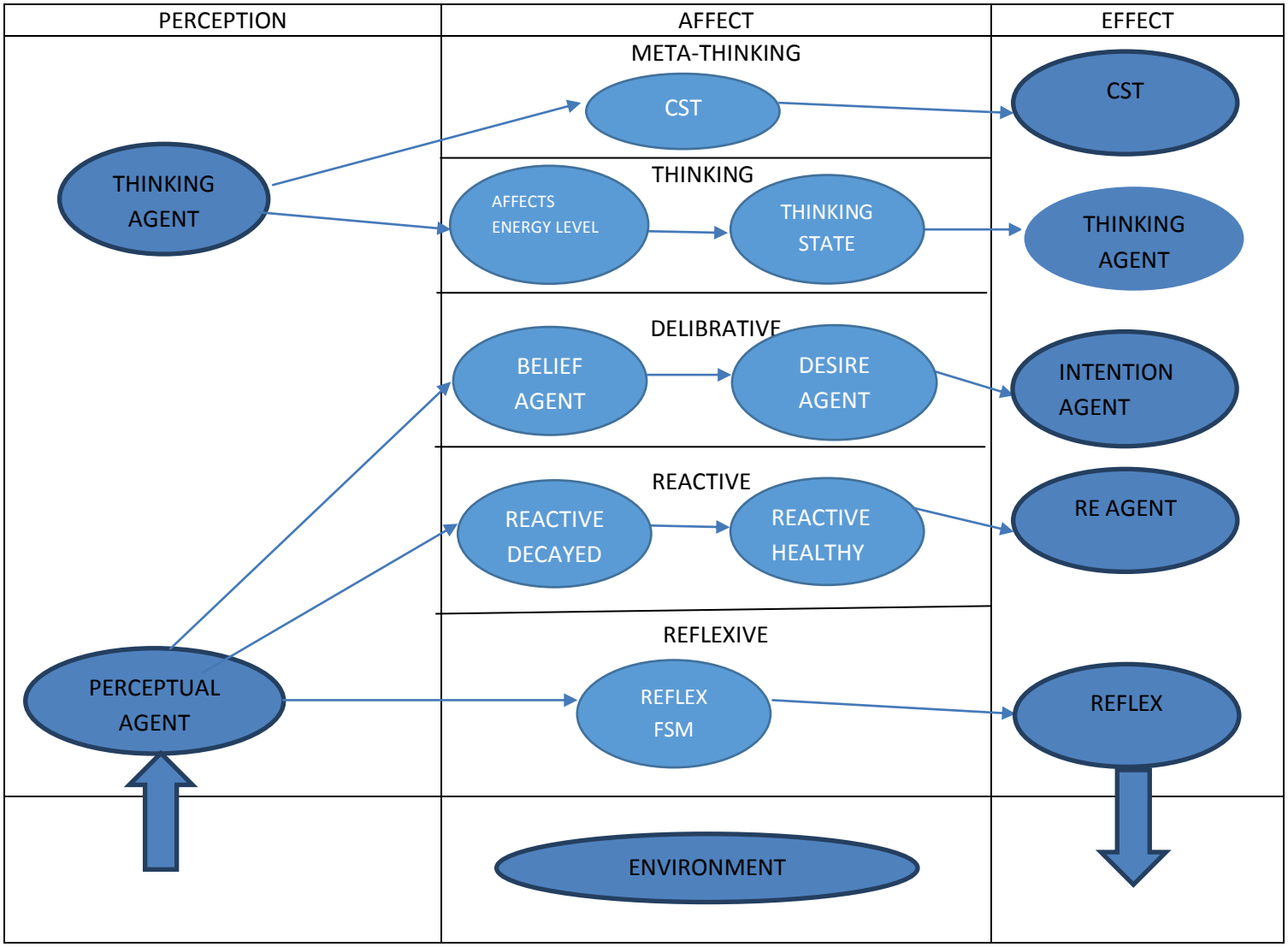
1. Q-learning[4]

- In learning layer already existing algorithm is q-learning algorithm.
- This algorithm calculates based on what and how to map situations to action for maximizing a reward.
- Q-learning algorithm tries to find a maximum reward for action.

2. Reinforcement learning
   The robot is already capable of sequencing its existing controllers to achieve the skill's goal. Second, the robot may choose the range of the learned skill. It may even choose to learn multiple skills to achieve a given subgoal rather than a single monolithic skill, learning each component skill in an appropriate space.

IV.NEWLY PROPOSED ARCHITECTURE





Development of learning methods that allow robots to acquire models of the dynamics of their own bodies and interactions with new objects.

Challenges:

1.Learning is incremental process through physical interaction as it is impossible to anticipate all situations.

2. Data has to be acquired autonomously through sensorimotor requirements that are costly in time and energy.

3. How an agent discovers skills?[6]

Human intelligence and interactions consists of an important feature i.e., acquisition of new skills, ability to create new skills, refine them through practice and then apply in new task contexts.

To achieve this feature, Autonomous skill acquisition is incorporated in artificial intelligence.Achieving autonomous skill acquisition ,we should design a robot system such that while solving a problem, we can identify a sub-problem that may be important in the future, capture them as skills and frame each skills as learning problem, use certain form of learning to improve each skill policy over time and finally when faced

with new problem, use existing skills as necessary to find a solution to that problem. And hence it would be faster.

CST Implemented architecture is implemented as 5-layered architecture.[7]The layers of this architecture define incremental control systems for robots that show different levels of thinking. The five layers are reflexive,reactive,deliberative(including all BDI MODELS),thinking and meta-thinking. The three columns are perception, intention, and reasoning.

EXPLANATION

Reflexive Layer
It is the first level where the agents exhibit the simplest behaviours. For a given input the agents will produce the output. The agents will act on the input (i.e.,perception).Behavioural response such as an action will be the output. The reflexive agents form the first layer of CST Implemented architecture. Reflexive agents are designed so that they follow the environment rules.The agents will sense the surroundings around them such as the presence of edges, center points, obstacles, etc.For each move, they will see their adjacent positions then make their next move. The reflexive level exhibits simple reflexes such as avoid hitting the wall, avoid obstacles. The main task of such agents is to move in the environment and avoid collisions with other agents and objects in the environment.

Reactive Layer
In the reflexive level the output will always be the same for the same input. In reactive level the output is determined not only by its input , but also by its internal state. Reactive agents comprise the second layer of CST Implemented architecture. Reactive agents exhibit goal-oriented behaviour. They add on to the behaviour of the reflexive agents.

Deliberative Layer
The goals that reactive agents attempt to satisfy are specified by the deliberative agents. Deliberative refers to any system whose output is not only determined by its input and current state, but also by it previous states and/or the current/previous states of other systems. Deliberate agents occupy the third layer of CST Implemented architecture. The BDI agents determine which of the reactive or reflexive control mechanisms are active according to the goals the entire architecture attempts to satisfy. The deliberative agents effectively follow different goals based on cost and utility functions.

Thinking Layer
The agents will make decisions at one level, based on the actions that occurred at another level. Thinking makes use of reinforcement learning. This learning improves the effectiveness and efficiency of the architecture. The actions for agents are to be experimented by trial and error method.

Meta-thinking Layer
Meta-thinking refers to thinking on thinking. The learning ability of the agents in the thinking layer is improved over time. Actions that are learnt in thinking layer will be captured as sub-skills so that, they are used for future conditions. The agents in meta-thinking layer communicate with the other agents.

V.CONCLUSION

By using CST in the learning layer, the agricultural robots will be able to use the skills acquired in some problem to more quickly solve a new problem. This helps in faster skill acquisitions which helps us to distinguish between riped and unriped fruits. By CST we can overcome the disadvantage of existing fruit picking robots.

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