Motivation-based Action Selection Mechanism using Quadruped Robot

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Abstract − An intelligent robot must be able to select sequential and goal-oriented behaviors to achieve given goals. For this, we had proposed motivation-based action selection architecture using behavioral motivations. A behavioral motivation is first generated with association between sensors and behaviors. The architecture constructs a network of behavioral motivations to achieve given goals using the shortest reinforcement learning method. The constructed network can be operated as fully connected finite state machine. To show the validity of our proposed method, experimental results of a quadruped robot that is called by AIBO will be illustrated.

Keywords − Behavioral motivation, Action selection mechanism, behavior-based control, Quadruped robot.

1. Introduction

A robot must be equipped with action selection mechanism (ASM) to select behaviors to achieve given goals. An ASM must be able to decide "what to do next" that is one of the most fundamental problems in the action selection problem. For this, the following have to be taken into consideration; (1) how does it describe sensors for perceiving environments? (2) how does it select goal-oriented and sequential behaviors? (3) how does it make a plan in real-time? (4) how does it obtain locally or globally optimal solution? (5) how does it achieve multiple goals? We had proposed motivation-based action selection architecture in consideration of these factors [1]. To show the validity of the architecture, some experiments are carried out using a quadruped robot that is called by AIBO. This paper is organized as follows. Section II describes details of the motivation-based action selection mechanism. Section III presents experimental results to verify the validity of the method using three scenarios. Finally section VI presents our conclusion remarks.

2. The Motivation-based Action Selection Architecture

A behavioral motivation has to be defined for deriving the motivation-based action selection architecture. The behavioral motivation is described by person. To select goal-oriented and sequential behaviors, it defines static and dynamic behavioral motivations [1]. And, a network of behavioral motivations is constructed for achieving given goal by the shortest path- based reinforcement learning method. All behavioral motivation modules are processed in parallel. So, it can be operated as fully connected finite state machine (FSM). This property makes dynamic planning and multi-goal processing possible. Because it is operated as fully connected FSM, on the other hand, it can obtain not globally but locally optimal solutions.

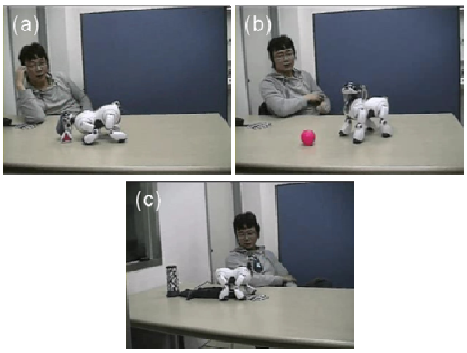

Fig. 1. Three Scenarios; (a) "BITE" (b) "DANCE", and (c) "CHARGE".

3. Experimental results

To show the validity of our proposed architecture, some experiments are carried out using a quadruped robot that is called by AIBO. "BITE", "DANCE", "CHARGE" scenarios were used. Here, a "BITE" scenario is that the AIBO bites the bone and then brings it to a person. A "DANCE" scenario is that the AIBO approaches a ball and in consequence it dances in front of the ball. At last, a "CHARG E" scenario is that after the AIBO approaches a charging station and starts charging the battery. The three scenarios were accomplished with a success rate of greater than 95% by the proposed architecture as shown in Figure 1.

4. Conclusions

We proposed an action selection mechanism like a fully connected FSM using static and dynamic behavioral motivation.

References

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