

Behavior Selection Algorithm for the Emotional Expression Humanoid Robot WE-4RII based on Decision Theory with Emotion

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Intelligent robot is the robot that is able to do suitable behaviors for itself in relation to the external stimulations. The intelligence can be seen as composed of ‘Sense’, ‘Plan’ and ‘Act’ parts roughly speaking. The ‘Plan’ component includes complex cognitive processes, such as generating robot’s behavioral plan, deducing necessary information, and modifying current plan based on previous experiences, etc. Among them, decision making process is necessary for the robot to select behaviors. And, it has been found that the decision making process is related with emotion by researches in neurophysiology and psychology.

Emotional Expression Humanoid Robot WE-4RII(Waseda Eye #4 Refined II) is the humanoid robot capable of interacting with human and environment in various ways. It has fundamental intelligent and emotional capability to make this interaction possible. The robot is confronted with situations where it should decide its behavior. However, current behavior selection based on simple operant conditioning is very simple and mainly concentrates on learning suitable behaviors. Therefore, implementing decision making mechanism by integration of decision theory and emotion will make the robot’s decision making more sensible and adaptable.

ACT-R is the cognitive model for simulating human’s cognitive process as precisely as possible. So it also can be used as a model for robot’s decision making process, in order to make more plausible decision making robot. The proposed decision making algorithm is designed based on ACT-R’s decision algorithm and integrated with current emotion system of WE-4RII robot. It evaluates each behavior’s preference with expected emotional experience and current emotional status, valence and arousal, thus affecting the selection of the behavior.

The new robot’s behavior selection showed different characteristics compared to the previous one. The robot can select different behaviors according to the robot’s current emotion, which makes robot’s reaction more variable. The robot, moreover, can change its behavioral strategy more easily according to its success and failure, because results of robot’s behavior affect emotional changes of the robot recursively. Therefore, it is certain that decision making process of the robot should be integrated with emotion system like human to be more intelligent.