BOTTOM-UP APPROACH FOR BEHAVIOR ACQUISITION OF AGENTS EQUIPPED WITH MULTI-SENSORS

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Abstract – While the top-down approach of artificial intelligence encounters the frame problem, the bottom-up approach based on a creature's evolution and behavior is effective for robotic design of intellectual behavior in a specific field. We propose the Evolutionary Behavior Table System (EBTS) using a simple genetic algorithm (SGA) to acquire the autonomous cooperative behavior of multi-agents as the bottom-up approach. In EBTS, a set of rules is expressed as a table composed of sensor input columns and actuator output columns; a row of the table corresponds to a rule. Since each rule is transformed to a string of Boolean values, we treat a long string composed of actuator output strings in the rules as a gene to obtain an optimum gene that adapts to the environment using SGA. In computational experiments, the collective robots could convey an object to a goal through cooperative work; the multi-fingered hands grasped the object and transferred it to the goal. Final truth tables obtained by the gene data do not always assure an optimum solution, but the calculation cost is reduced from astronomical figures to around one ten to twenty thousandth. If we use the top-down methodology, astronomical trials are needed to specify the optimum pattern. Therefore, EBTS is an attractive method because it is very useful for obtaining general robotic behaviors in both collective and multi-fingered hand tasks.

Index terms*:* Multi-agent, Bottom-up approach, Collective task, Multi-fingered hand, Evolution, Behavior table, Genetic algorithm.