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Vidya: A God Game Based on Intelligent Agents Whose Actions are Devised Through Evolutionary Computation

Background: Vidya is a strategy computer game, god-style, which can be seen as a rich environment where virtual beings compete among themselves for natural resources and strive within the artificial ecosystem. Some of these beings, the *Jivas*, are intelligent agents designed to be autonomous and survive against all odds. In the Vidya game, *Jivas* form clans; one of them is selected to receive non-detailed guidance from the game player - the clan's *Deva* (i.e., the god). *Jivas* perceive the guidance from the player as an "intuition" or *vidya*, to which they have autonomy to accept or not. The player's task is to help his clan to increase its survivability in a non-monotonic world (see Fig. 1). Genetic Algorithms were used to model the *Jivas*' intelligence for selecting actions to be performed.

Model: The task of the Jiva's decision module is to select the best action to be performed by them in all perceptive states; Jivas perceive a small portion of the world through a variable perception square (see Figs.2-3). The action selection is then realized using GA, where each action is mapped to one chromosome of the GA's population. So, a fitness function that relates actions to losses or gains of the Jiva, helps on the tuning of actions according to Jiva's perceptions. The algorithm also considers future gains and losses to select better actions that are due to start at the Jivas' present.

Results: The experiments carried out evaluated the proposed evolutionary algorithm that implements the Jiva's intelligent behavior. We measured the algorithm performance (processing time) and the Jiva's intelligence (through analysis of Jiva's adaptability, i.e. its total gain in a given time interval). We varied the GA's population size (*PS*) and the number of future steps that the algorithm infer to select good actions (*F*). Results show that the configuration $PS = 192$ and $F = 2$ was the best compromise between algorithm performance and intelligence (see two graphics below).



Fig. 1. Jiva, other beings and objects of Vidya

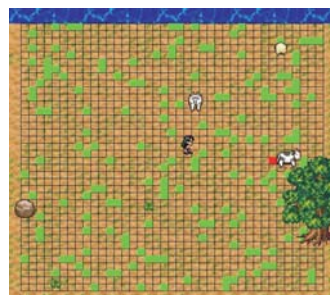
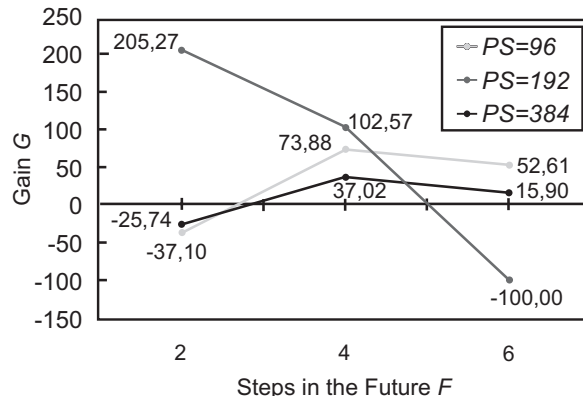
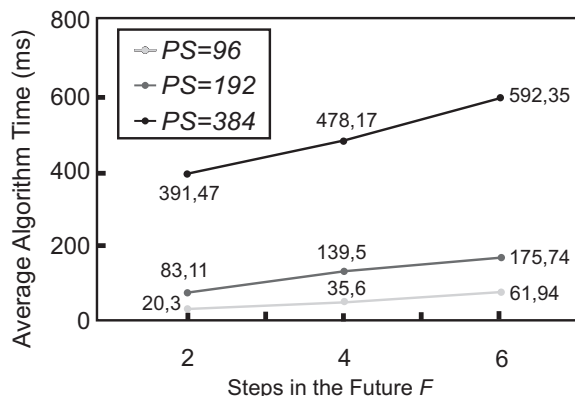


Fig. 2. Jiva perceptible square Fig. 3. Detail of a selected action: eat-fruit

Conclusion: This work introduced the Vidya game and put forward a particular autonomous intelligent agent, the Jiva. The use of Genetic Algorithms proved to be a good choice, because not only it produces good results in improving Jiva's intelligence, but also the computational performance obtained was acceptable in supporting the agents' decision process. We left as future works three tasks: (i) the analysis of emergent behaviors of Jivas' societies; (ii) the reuse of Jiva's intelligence in other game scenarios and (iii) further investigate small ecosystems and societies using Vidya.



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