

ABSTRACT

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This work presents an evolutionary model to enable the evolution of intelligent systems, based on a genetic algorithm and using the fuzzy logic in the evaluation process of multiple objectives. The traditional evaluation method of genetic algorithms is modified, thus a fuzzy system is executed during the evaluation process, aggregating the many objectives of the problem and generating a fitness for each individual. The proposed model presents a simplest and more interpretable way to insert preferences and/or specifications because it uses the fuzzy logic. These preferences are introduced before the evolution process ensuring that the evolution is guided in the desired direction, avoiding the necessity of a designer intervention at the final of the process to choose the most appropriate solution. Further the implementation in the purely simulated environment, the model also has a platform with an interface to real applications using a microcontrolled hardware, making possible a real environment for acquisition of input and output data for future applications. Case studies in different application areas are analyzed through computational simulations and compared to results found by other techniques. The case studies include benchmark problems for multiobjective evaluation, fuzzy system design, PID control design and fuzzy control design. Another case study was developed to test the functionality of a simple microcontrolled hardware prototype. The tools developed for evolution, evaluation and implementation presented good performance in the case studies analyzed and can be used as a basis for new applications and implementation of real systems.

Keywords: Fuzzy systems; Genetic algorithms; Multiobjective optimization; Hybrid systems.