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Enhanced Gene Expression Programming for signal-background discrimination in particle physics

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In order to address the data analysis challenges imposed by the complexity of the data generated by the current and future particle physics experiments, new techniques for performing various analysis tasks need to be investigated. In 2006 we introduced to the particle physics field one such new technique, based on Gene Expression Programming (GEP), and successfully applied it to an event selection problem. While GEP, as initially proposed, was proven to be more flexible and more efficient than other evolutionary algorithms, it does not incorporate many of the advanced developments in the field of evolutionary computation. This paper will present our developments of the algorithm and will discuss results obtained with alternative mapping mechanisms between the solution space and the representation space, the effect of a more controlled selection process of the candidate solutions, and of adaptable discrimination thresholds for supervised classification problems. The enhanced version of the algorithm was applied to a signal-background discrimination problem in a particle physics data analysis. Comparative studies of the initial and the enhanced version of GEP were performed and the results will be presented and discussed.

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