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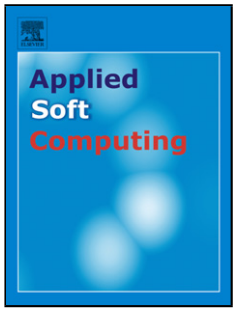

Title: Surrogate modeling based on granular models and fuzzy aptitude functions

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PII: S1568-4946(17)30740-8
DOI: https://doi.org/doi:10.1016/j.asoc.2017.12.016
Reference: ASOC 4613

To appear in: *Applied Soft Computing*

Received date: 11-5-2017
Revised date: 4-11-2017
Accepted date: 12-12-2017

Please cite this article as: Israel Cruz-Vega, Carlos Reyes Garcia, Hugo Jair Escalante, Jose de Jesus Rangel-Magdaleno, Juan Manuel Ramirez Cortes, Surrogate modeling based on granular models and fuzzy aptitude functions, *<![CDATA[Applied Soft Computing Journal]]>* (2017), https://doi.org/10.1016/j.asoc.2017.12.016

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Highlights for review:

- Evolutionary Algorithms. In particular, we are basing this work in Genetic Algorithms and the reduction of fitness function evaluations by using surrogates; the reduction is of at least 70% compared to Matlab's algorithm without reducing the quality of solutions.
- Granular Computing. Granular computing emerged from the need to represent the vast quantity of numerical information with intuitive and practical forms of knowledge, several theories back up this concept of abstraction of the information like Fuzzy Logic. In this work, the granules of information are obtained with a Gaussian' similarity function in the numeric aspect, the knowledge extraction is formulated with fuzzy rules from some behaviors of the granules along the GA' searching process.
- Fuzzy Systems. The extracted knowledge of life index and distance respecting the most fitted individual is expressed by using fuzzy rules and used as a mean to infer in the surveillance of granules along the searching process.
- Learning Vector Quantization. The parameters of granules need updating; the main parameters are granules' position (coordinates) and the respective width. In this work, we are using a neural structure similar to "learning vector quantization" to update these parameters and to manage the formation of global surrogates (with widespread width and away from the optimum zone of the GA) and local surrogates (with a narrow granules' width and near the optimum region). The action of the LVQ helps in the convergence of the algorithm to the global optimum value and to reducing the fitness function evaluations.

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