GAMUT: A system for customer modeling based on evolutionary algorithms

Luca Sammartino[1], Mikhail Simonov[1], Massimo Soroldoni[1], Andrea G. B. Tettamanzi[2]
[1]) Nomos Sistema S.p.A., Viale Monza 265, 20124 Milano, Italy. Phone +39 02 25290 1
[2]) Genetica—Advanced Software Architectures S.r.l., Via S. Dionigi 15, 20139 Milano, Italy
E-mail: `sammartino@nomos.it`, `simonov@nomos.it`, `soroldoni@nomos.it`, `tettaman@genetica-soft.com`

Abstract

GAMUT is an integrated system for customer modeling in business applications. GAMUT's core is the Genetic Engine, an evolutionary algorithm which learns models of customers, represented as sets of fuzzy rules, from a data set containing their personal and historical information.

A critical success factor for any business is its ability to use information effectively. A key technology aimed at achieving this strategic advantage is known as *data mining* [1]. One interesting application of data mining for banking institutions is credit risk modeling. For this purpose, the GAMUT (Genetic Algorithm Modeling UTility) system was developed by Nomos Sistema S.p.A. in the framework of the EUREKA HPPC-SEA Project.

Credit risk modeling can be formulated as an optimization problem. Given a data set with N records with predictive values $c_i \in \{0, 1\}$ (0 = bad customer, 1 = good customer), a possible formulation of the objective function is

$$z = \frac{1}{N} \sum_{i=1}^{N} \left[c_i + k(1 - c_i)\right] (c^* - c_i)^2, \qquad (1)$$

where c^* is the model estimate and k is the average number of good customers a bank needs to compensate for one bad customer.

GAMUT uses existing information to obtain predictive models of behavior for a prospective customer; it consists of 5 modules: *Data Set Designer*, a tool for data extraction from existing databases, *Data Set Generator*, included mainly for testing purposes, *Data Analyzer*, designed to help analysts to filter and analyze the available data, *Genetic Engine*, the core of the system, presented below, and *Model Manager*, providing the visualization and execution capability of predictive models.

A model in the GAMUT system is represented as a fuzzy rule base; the approach followed for the synthesis and optimization of fuzzy models stems from a previous work on the evolution of fuzzy controllers [2].

The Genetic Engine employs island-based distributed evolutionary algorithms to evolve fuzzy models of a data set, and has been implemented as a platform-independent server application for use in a heterogeneous multi-tier architecture. All process settings (including evolutionary algorithm parameters) are user-configurable depending on specific needs.

GAMUT has been successfully validated on a real-world customer scoring application for credit card approval. Experimental results demonstrate that the evolutionary approach is able to find models with a good generalization capability in a reasonable time. As a matter of fact, models obtained in the above mentioned application allow considerable improvements in terms of profitability.

A tool like GAMUT can be viably used as a decision support system in the back-office activity of a large financial institution and might prove useful also in other branches of business.

References

[1] A. Berson and S. J. Smith. *Data Warehousing, Data Mining & OLAP.* McGraw Hill, New York, 1997.

[2] A. Tettamanzi. An evolutionary algorithm for fuzzy controller synthesis and optimization. In *IEEE International Conference on Systems, Man and Cybernetics*, volume 5/5, pages 4021–4026. IEEE Systems, Man and Cybernetics Society, 1995.