# Chapter 53
# Customer Profiling in Complex Analytical Environments Using Swarm Intelligence Algorithms

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## ABSTRACT

*Customer profiling is always an interesting task from perspective of business. It became even bigger challenge in situation of complex analytical environment. Complex analytical environment can be caused by multiple modality of output variable as well as from big data environment, which cause data complexity in way of data quantity. As an illustration of presented concept particle swarm optimization algorithm will be used as a tool, which will find profiles from developed predictive model of neural network. Presented methodology has practical value for decision support in business, where information about customer profiles which prefers to buy some product or group products are valuable information for campaign planning and customer portfolio management.*

## INTRODUCTION

Data mining as a discipline brings a completely new direction on business planning from the last decades. Developing churn models, fraud detection models and customer segmentation have become an important element for successful business in conditions where market competition exists. Data mining has become a tool for reducing uncertainty and tool for business planning. It also has a role as a decision support instrument. Even mentioned techniques rely on huge amounts of data, in the very beginning, sources for analysis were mostly local transactional databases and local data warehouses. When a company needs to develop strategy against running churn rate, it mostly relies upon existing local transactional data or data warehouse for the modeling purposes. Similar situations for other types of problems like fraud detection or segmentation are also common. Mentioned strategies have leaned on huge amounts of data usage for finding useful patterns, mostly on local data sources.

The big data era not only brings new challenges relative to bigger quantities of data from external and internal data sources, but also brings with it a whole new way of strategic, analytical thinking which connects the traditional approach by using data mining techniques within internal databases, along with data sources as forums, blogs and social networks in finding the right answers for solving business problems. All of which demands a different approach in designing analytical solutions and demands new ways for analytical models to be integrated.

Big data environment brings greater complexity into data mining projects (Klepac, 2015a; Klepac, 2015b; Malhotra, 2014). In this conditions biological concepts became important factor for finding solutions (Acharjya, 2015; Alam, 2014).

This text will present novel methodology of particle swarm optimization algorithm usage as a tool for finding customer profiles based on previously developed predictive models which predicts events like selection of some products or services with some probabilities.

It means that particle swarm optimization algorithm will be used as a tool which should find optimal values of input variables within developed predictive models as referent values for maximization value of probability that customer will select/ buy some product or service.

Basic idea is a holistic process which includes development of multinomial predictive models (predictive models with more than two states which represents probability for selecting/buying product / services), and usage of this model developed on historical data sample for finding typical customer/buyer based on evaluated values of input variables by using particle swarm optimization algorithm.

This problem is not so expressed in case of predictive models with binomial outputs, which represents probability of buying some product or service.

Even in situation when those predictive models are not solved with linear models (like neural networks, SVM, Bayesian networks), and linear dependencies are not so obvious, regarding binominal output, profiles could easily been recognized, thanks to attribute relevance analysis which is relatively simple and unambiguous.

Task about profiling customers based on selecting/buying product /services in situation when predictive model are used for probability of N possible states calculation, became hard task which demands lot of manual work with doubtful results.

Contrary to situation with binomial states of output variable in predictive model, attribute relevance analysis for multinomial output, regarding overlapping in impact zones, and combinatory expansion could not provide clear information for setting input variable values for determination buying preferences represented as values for buying or not, one of the many product/services.

For retailers, web shops, and other industries it is a challenging task, which can be solved by using particle swarm optimization algorithm in combination with existing predictive model.

In that case, for each observed product/service, aim variable within predictive model should reach criteria of maximum probability of selecting/buying product /services by using particle swarm optimization algorithm. Final result will give optimal values of input variables for each product /services which could be behavior characteristics, or socio demographic characteristics and from which model are developed based on attribute relevance analysis.

Result of those analytical approaches are characteristic points in multidimensional spaces which can be used for case base reasoning, or clustering by distance measure usage as well as for profiling.

Other benefits, which proposed method provides is the answers on questions like:

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