# Chapter 3
# Finding Optimal Input Values for Desired Target Output by Using Particle Swarm Optimization Algorithm Within Probabilistic Models

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## ABSTRACT

*Developed predictive models, especially models based on probabilistic concept, regarding numerous potential combinatory states can be very complex. That complexity can cause uncertainty about which factors should have which values to achieve optimal value of output. An example of that problem is developed with a Bayesian network with numerous potential states and their interaction when we would like to find optimal value of nodes for achieving maximum probability on specific output node. This chapter shows a novel concept based on usage of the particle swarm optimization algorithm for finding optimal values within developed probabilistic models.*

## INTRODUCTION

Predictive model development is demanding process. It demands precise and objective determination of sample construction, target variable construction, attribute relevance analysis, model testing and many other activities which will guarantee that developed model is robust, stable, reliable and predictive.

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If we are talking about predictive models with binominal output and predictive models based on logistic regression, neural networks or similar techniques, than determination of initial states of variable values for achieving specific output are relatively simple. It can be manual process, but achievable from perspective of human effort.

Reason why someone would like to find out which values of input variables will cause best fit for specific output is that we would like to find out typical case, or profile. That means if we would like to find out typical profile of churner based on developed binominal predictive model we should find combination of input values which will result with maximum output value in zone of wanted output.

Things became more complicated when we have multinomial output from predictive models.

Main advantage of binominal output usage is ability to understand relations between target variable and potential predictors and business logic check.

From technical point of view, data mining techniques like neural networks, and logistic regression by the nature of their algorithms, prefers to operate with values between 0 and 1. Dummy variables could be interpreted as membership declaration with 0 and 1values. If some value belongs into specific class represented as dummy variable, it is true and dummy variable has value "1" otherwise "0".

Robust and stable predictive models have few attributes incorporated into model. It could be 6-10 of most predictive attributes. As it is evident initial data sample could contain more than hundreds of potential predictors. Some of them are original variables from databases as socio demographic values assigned to each customer, and other has behavioural characteristics defined by experts and extracted from existing transactional data.

Attribute relevance analyse has two important functions:

- Recognition of most important variables which has greatest impact on target variable
- Understanding relations and logic between most important predictor and target variable, and understanding relations and logic between most important predictors from target variable perspective

Contrary to assurance that powerful hardware and sophisticated software can substitute need for attribute relevance analyse, attribute relevance analyse is important part of each kind of analysis which operates with target variable. Recognition of most important variables, which has greatest impact on target variable, reduces redundancy and uncertainty at model development process stage. It provides robustness of the model and model reliability. Attribute relevance analyze besides importance measuring, evaluates attribute characteristics. Attribute characteristics