Methods and Algorithms for Constructing Credit Scoring Systems

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One of the most important tools for ensuring the sustainable operation of banks is creditscoring modeling. The need for credit scoring models arose as a result of the competition of a rapidly growing number of banks that competed for each client and therefore the speed of decision-making was an important factor. The ancestor of modern credit scoring systems was the Durant model in 1937, who first conducted research to find factors that could separate bad and good borrowers. As a result of the analysis of credit histories, he identified factors that make it possible to assess the degree of credit risk, and also proposed a method for assessing a potential borrower. Subsequently, the rapid development of computer technology made it possible to completely abandon the loan officer, thereby providing an objective solution.

Thus, the main advantages of credit scoring models are the speed and impartiality of making a decision on issuing or refusing a loan. At first glance, everything seems perfect. However, back in 1937, Durant established that there is no single credit scoring model that includes specific variables and an optimal decision-making threshold. The choice of model variables depends on the nature of the data and what cultural or economic variables may affect the quality of the model. In addition, to work effectively, the scoring model must be regularly revised as new statistical data becomes available. That is, for each bank in a specific region or country, its own model must be built. And this is the first pitfall of scoring. The second is the impossibility of recording a certain state of the client, when dry numbers of personal data indicate trustworthiness, but some factors, for example, the behavior of the borrower may indicate an unstable psycho-emotional state, which in the future may affect professional activity. It seemed that in order to make an objective decision, we needed to get rid of the human factor in the form of credit inspectors. At the same time, a loan officer is needed to assess the human factor of the borrower. And when making a credit decision, the bank still has to rely on the assessment of credit analysts, which is especially important when the economic situation changes.

All of the above serves as a prerequisite for the constant search for new ideas and methods for building and improving creditscoring systems.

To classify borrowers, statistical methods [1] (regression analysis, probit analysis, logistic regression and others), data mining methods (decision trees, artificial neural networks, genetic algorithms and others), and expert methods are used. For example, article [2] focuses on the use of fuzzy logic methods and neural networks to develop a methodology for assessing the creditworthiness of an entrepreneur. The authors claim that the neuro-fuzzy logic approach takes into account the minute details of the credit rating expert's thought process to arrive at the final decision.

Credit scoring systems are also used to assess the solvency of small and medium-sized enterprises (SMEs), which, as is known, have a decisive influence on the country's economy, but have either very little or no government funding. From the bank's point of view, as borrowers compared to large firms, enterprises, SMEs are less organized in maintaining financial records, which complicates the assessment of credit risk. In article [3], to solve this problem, a system for predicting the credit risk of SMEs' was developed by introducing a multi-criteria credit scoring model. The model was built using a hybrid best-worst method (BWM) and the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). Initially, BWM defines the weighting criteria and TOPSIS is applied to evaluate SMEs. A multi-criteria credit decision support tool was demonstrated in [4]. The authors present the application of the SMAA-Fuzzy-FlowSort (Stochastic Multicriteria Acceptability Analysis) approach to the case of modeling bank credit ratings. Its stochastic nature allows the imprecision and uncertainty that naturally accompany decision-making to be incorporated into the proposed framework, while its output complements the ordinal nature of a clear classification with cardinal information that indicates the degree of membership in each rating category. Combined with the SMAA variant of GAIA (Geometrical Analysis for Interactive Aid), which offers a visual representation of the bank's judgment analysis, both of the latter approaches provide a holistic multi-criteria decision support tool in the hands of the credit analyst and enable rich inference.

According to the Basel II Agreement, in order to reduce credit risk, it is necessary to make credit decisions not only on the basis of creditscoring systems, but also taking into account the opinions of credit analysts. The work [5] presents an approach based on neural networks and multi-criteria methods, which allows the opinion of experts to be included in the credit decision-making model. Note that in a number of studies, in particular, during the development of the CreditExpert expert system [6], it was revealed that an effective credit system cannot exclude experts from the process of assessing loan applications.

In a number of works, the algorithm for integrating statistical and expert approaches is presented in the form of a decision tree. The input data to the algorithm is statistical data and expert knowledge, formalized in the form of rules. It should be noted that the inclusion of expert assessments in the credit decision-making model presupposes the use of collective decision-making methods, which have recently been rapidly developing.

In [7], Bayesian strategies were used to make a consensus decision by a team of credit analysts and a credit scoring system. The proposed approach to forming a collective decision on issuing a loan to a borrower is based on the integration of private decisions of a group of independent experts and decisions of a credit scoring system, each of which classifies the client into one of three classes: favorable, conditionally favorable and unfavorable.

Thus, modern science offers various approaches to building creditscoring systems. As research shows, each of the approaches has its own advantages and disadvantages, which should be taken into account when applying them in practice.

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