

MACHINE LEARNING METHODS FOR EVALUATING INNOVATIVE PROJECTS

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I. INTRODUCTION

Modern trends in digitalization and the introduction of decision support information systems in various areas determine the need for the development of mathematical modeling methods applicable to data analysis. Machine learning methods are of particular relevance for solving applied problems, which allow, using the available data, to establish the mutual influence of the characteristics of the objects under study. Mathematical methods and their implementation in the form of machine learning algorithms allow the decision maker to rely on the results of solving problems using various algorithms to determine the optimal control strategy, comparing them by assessing the accuracy.

Strategic development and competitiveness in the market of a company, corporation - any organization of small, medium and large business requires the availability of market analysis tools, the creation and assessment of unique, innovative solutions (technologies) and their further implementation, which guarantees companies of any level of prosperity in the digital economy. Mathematical modeling and machine learning algorithms are gaining popularity in the field of analysis of heterogeneous data for decision-making due to the possibility of exploring alternatives using simulation of situations, varying parameters and evaluating them. The article presents an example of the applicability of the scoring model to the assessment of innovative projects.

II. MATERIALS AND METHODS

The company's competitiveness in the market is ensured by the availability of innovative projects, start-ups, the selection and assessment of the characteristics of which is often a difficult task to formalize. Generators of startups and innovation projects are not always employees of the companies themselves. Often, campaigns looking through scientific project competitions, hackathons, and large companies organize their own competitions for the selection of promising projects. Any invention, innovative project, startup needs financial investment for development, and the creators of ideas are interested in finding companies that can evaluate the project and provide financial support. For example, various business angels and funds can act as an investor. A business angel is usually a private investor who is able to support a project, but finding an investor is a difficult task for a startup. In Russia, there are Funds aimed at financing innovative projects, Science Cities are being created, for example, Skolkovo, Innopolis, which are focused on finding and helping in the implementation of startups. Many young enterprises resort to the help of the Foundations, which organizes a competitive environment and allows the foundations to choose the most attractive projects in their opinion. For investors, the issue of evaluating innovative projects is relevant - this issue has acquired particular importance in connection with the current situation of necessary self-isolation in the context of a global pandemic and the need to support the transition to the digital economy to ensure competitiveness in the market. The paper presents the results of simulation modeling for evaluating innovative projects, we developed a mathematical model for evaluating innovative projects based on scoring modeling for evaluating the characteristics of projects. Scoring is well established in the banking industry and is widely used to assess customer creditworthiness.

Assessment of the borrower is carried out everywhere by banks and credit institutions when issuing funds for various needs. Banks have an information system based on a scoring model that takes into account various assessed characteristics of a person, which allows them to evaluate a client to form a final score in order to make a decision on the allocation of funds. In many banks forms of online interaction with a client for obtaining a loan have been developed, through a questionnaire presented on the bank's website. In Russia, there is a United Credit Bureau, which, based on a scoring model, provides clients with highly effective services for risk assessment, loan portfolio management and anti-fraud [1]. For innovative projects assessed by Foundations and companies, it is possible to use scoring to assess the prospects and competitiveness of the project in the first approximation. The digitalization of the economy and the transition to an online format for analyzing applications for financing innovative projects and use of mathematical methods have a number

of significant advantages in contrast to manual processing of applications, which contains the subjectivity of the decision maker and takes a lot of time to make decisions. Machine learning methods make it possible to automate these processes to a large extent. The training takes place on statistically collected data and solutions. The sample must be divided into training and test components to check the parameters of the trained algorithm in order to eliminate the problem of overfitting. The authors have developed a scoring model for evaluating innovative projects. To solve this problem, the following artificial intelligence methods can be applied: logistic regression, support vector machine, random forest and decision trees.

To assess innovative projects, a scoring model was developed to support decision-making to determine whether the characteristics of the project meet the interests of the investor. For this model, machine learning algorithms are implemented and a comparison is made. The best answer was shown by the decision tree algorithm, the results of the constructed decision tree are presented in Figure 1. For model training we used such signs as the age of a person looking for an investment, whether he has a good presentation of a product and a prototype, an indicator of his environment, expressed in his professional maturity in its areas, the investments required for the project, the investor's interest in the subject of the project, the number of projects successfully implemented by the entrepreneur, the estimated payback period, as well as the completeness and breadth of the business plan.

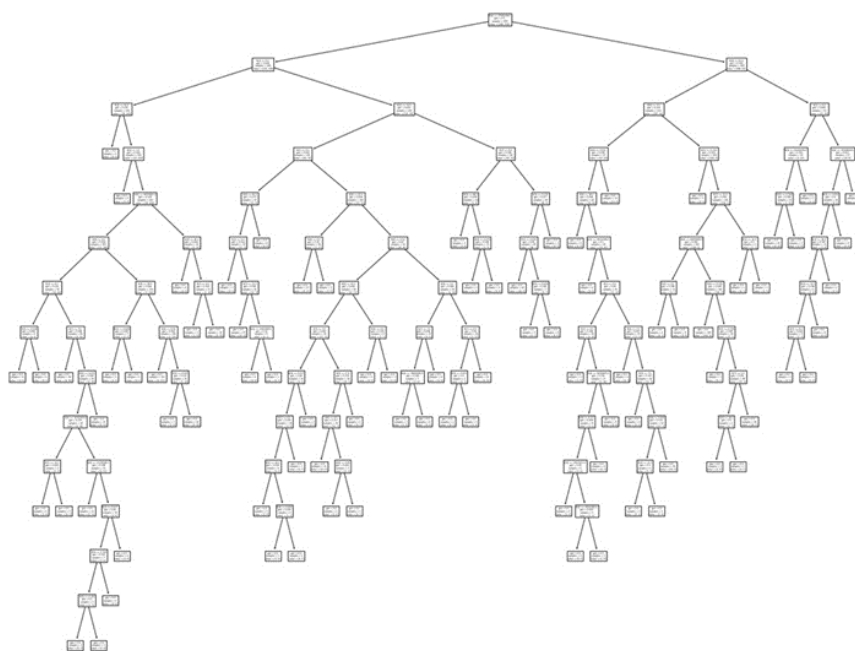


Figure 1. Visual representation of the decision making model

When constructing the model, a decision tree classifier was used, with the help of which the most important parameters in the data were identified, and a decision-making model was built and trained. To assess the quality of the decision tree model, cross-validation methods were used to evaluate the analytical model on independent data, however, the AUC-ROC metric is considered a better indicator for this task. The trained model has performance of 0.85 according to the AUC-ROC metric, which is considered an excellent result and indicates the possibility of using the constructed model in the consideration of existing investment funds for evaluating innovative projects.

III. CONCLUSIONS

The use of mathematical methods and machine learning algorithms based on them for solving applied decision-making problems is an urgent development of information technologies. Note that the proposed methods will automate and optimize the processing of projects submitted for consideration. In essence, the developed mathematical model and its implementation are a prototype of an expert decision-making system. The results obtained when solving the problem of evaluating innovative projects show the applicability of machine learning and artificial intelligence methods, which allow evaluating the characteristics of a project and selecting the most promising ones in order to minimize the risks of investors.

REFERENCES

[1] United credit bureau [Electronic resource]: https://bki-okb.ru/sites/default/files/service_documents/scoring_2019.pdf (date of access 05.10.2021).