# THE PROBLEM OF USING ARTIFICIAL INTELLIGENCE TECHNOLOGIES WHEN MAKING RESERVES IN A BANK

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## Annotation

**Reservation issues in a commercial bank** contain a subjective component related to the decision on the reservation rate by a competent employee. To increase the level of objectivity, it is proposed to use the **clustering method** based on **data mining**, which will allow identifying **new patterns in the grouping of loans by risk level**.

## Introduction

The *current stage of banking development* can be characterized as **information** and **innovation**, since most of the innovations introduced are somehow connected with the *digitalization of individual products or services of credit institutions*. The introduction of new information technologies makes it possible to *speed up the processing of large amounts of data*, *simplify the interaction between the bank and the client*, and *increase the objectivity of decisions* made through the mathematical justification of decisions made.

The greatest potential for use in banking is such a technology as **artificial intelligence (AI)**. The algorithms embedded in the programs allow you to *give answers to regulated requests* and *identify previously unknown patterns*. In addition, AI technologies can *reduce labor intensity in the banking sector* by automating some of the routine processes, thereby reducing the cost of banking operations. Further implementation of AI will be associated with *automation and simplification of the bank's internal processes*, including the field of risk management. What used to be based primarily on the subjective judgments of bank employees can and will need to be *translated into machine algorithms*.
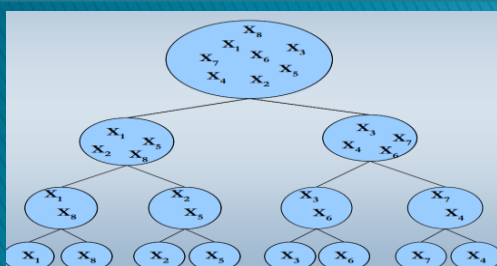
**Figure 1. Top-down clustering (dendrogram)**

## Methods and Materials

The main method used in this work is the **clustering method** or **cluster analysis**, which is a method of grouping multidimensional objects based on the presentation of the results of individual observations by points of a suitable geometric space, followed by the allocation of groups as clusters of these points. The mathematical definition can be adapted for making reserves in a bank. In banking, clustering can be used to distinguish groups of loans based on similar **criteria:** the quality of debt service, the degree of security, the size of the loan, and the level of profitability for the bank. Accordingly, clustering will be the basis for formation of groups of homogeneous loans and further setting reserve rates.

The paper also uses **methods of analysis and synthesis**, **deductive method**, **grouping method** and **graphical representation of data**.

## Results and Discussions

**New steps** are proposed **for making reserves in a bank**: 1) *cluster analysis*; 2) *formation of groups of homogeneous loans*; 3) *calculation of the probability of non-repayment of loans*; 4) *formation of reserves*.

The *first* and *third stages* in the presented scheme require the use of a mathematical apparatus for justification. In contrast to the modern scheme of forming reserves, the new approach has added a *clustering stage*, which allows you to *determine new types of groupings of loans issued*. Whereas in the current conditions, instead of clustering, classification is used based on known, *analyst-defined features*.

**Clustering** refers to descriptive tasks that can be solved using *data mining*, while calculating the probability of non-repayment of loans will refer to predictive tasks. In essence, clustering will be a grouping of loans according to several criteria in such a way that within one cluster the loans are similar to each other and at the same time differ from the elements of other clusters. At the same time, during the clustering process, the user does not know in advance by what criteria the loans will be grouped. This determines the intelligence of this process, when the similarities and differences of loans will be analyzed objectively on the basis of *retrospective data*.

The most appropriate method for evaluating a bank loan portfolio is **top-down clustering**, which implies that all objects (loans) belong to a single cluster (portfolio of loans issued). During the iterative process, the clusters will be divided into **subclusters**, thus forming a **dendrogram** (*Figure 1*). The values of the similarity measure between different objects will be calculated using the **k-means method** (*Figure 2*).
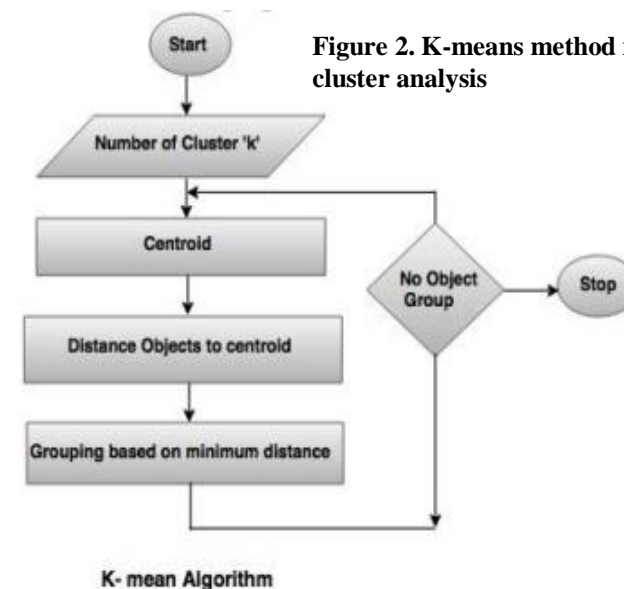
**Figure 2. K-means method in cluster analysis**

## Conclusion

The current *system of forming loan reserves in the bank* involves the allocation of five groups of loans according to the level of risk. Assigning a particular loan to a separate group is largely a *subjective process*, which results in banks receiving instructions about the inadequacy of the created reserves. The introduction of a *mathematical apparatus in the form of cluster analysis* into the reserve calculation scheme will help to *increase the level of objectivity* of this process, which will reduce regulatory risks for the bank.

Cluster analysis as a stage in the *formation of reserve groups* will be carried out on the basis of retrospective data for each bank separately, which will allow taking into account the *specifics of the banking operations* carried out by a particular bank.