

REVIEW

of the author's summary of the dissertation of Sergey Mikhailovich Golovanov
"Algorithms for automatic grouping of electronic components taking into account the
specified efficiency of division into groups", submitted for the degree of Candidate of
Technical Sciences in the specialty 2.3.1 –
Systems analysis, control and information processing, statistics

Problems of optimal facility location and grouping of objects arise in many fields of science and technology, many methods and algorithms have been developed to solve them. However, there are areas of application where classical clustering methods cannot solve the problem. The fact is that most of these methods allocate clusters in any data set, even if the differences between the objects are insignificant. Obviously, such a result does not always bring a practical effect. There are problems that require searching for a clustering option that provides a given efficiency of division into groups. At the same time, the outcome of solving the problem, in which such an option cannot be found, is no less significant than when such an option is determined. In fact, with such a formulation of the problem, we are talking about determining the property of homogeneity (heterogeneity), set by the requirements of the efficiency of division into groups.

The dissertation of S.M. Golovanov is devoted to solving this problem, for which the author suggests a method based on the sequential execution of the following actions:

- introduction of characteristics that determine the given efficiency of division into groups;
- introduction of the vector of indicators of the effectiveness of division into groups, combining separate numerical indicators of the quality of division that complement each other;
- introduction of the region of effective division in the space of the efficiency characteristics.

In order for the variant of dividing the set into groups to satisfy the specified requirements for the efficiency of division, it is necessary to fulfill the condition: the vector of the efficiency indicators of the division into groups corresponding to such a division belonged to the region of effective division. At the same time, to determine the boundaries of the effective division area, a semi-supervised learning method is proposed with the use of marked training samples consisting of objects of a given type that meet certain additional requirements.

The author proposes the search for an automatic grouping option that provides a given efficiency is carried out using any classical algorithm that has proven its effectiveness in clustering objects of a given type, which is supplemented with procedures that perform grouping for each option involved in finding the optimal solution to the problem:

- a) calculation of the value of the vector of indicators of the effectiveness of division into groups;
- b) determination of the belonging of the vector of indicators of the effectiveness of division into groups to a given region of effective division;
- c) if condition b) is met, then the grouping option participates in the search for a solution to the problem, if not, then it does not participate.

The second part of the dissertation is devoted to the development of algorithms that increase the efficiency of detecting potentially unreliable objects during non-destructive testing. The author suggests that such objects are objects with hidden defects that can lead to failure during long-term operation. To solve this problem, the author has developed algorithms for determining the outliers based on the analysis of total (cumulative) deviations of the characteristics of the objects. The use of these algorithms in addition to the existing algorithms for determining outliers makes it possible to increase the overall efficiency of identifying potentially unreliable objects. To determine the most effective algorithm (as well as its parameters) for determining the outliers, the author has developed a semi-supervised learning approach based on the use of marked training samples.

To illustrate the practical application of the developed algorithms, as well as confirming their effectiveness, the dissertation contains a large number of examples confirming the efficiency of the methods proposed by the author.

The undoubted advantage of this work is its focus on solving an important practical problem of improving the efficiency of rejection tests when forming batches of electronic components. The practical orientation of the work is confirmed by two certificates of state registration of computer programs developed with the participation of the author of the dissertation.

As a comment of this work:

1. Excessive focus on solving a particular problem (clustering of a specific type of objects, batches of electronic components). The work would have benefited if more attention had been paid to general theoretical aspects, since algorithms for automatic grouping, taking into account the given efficiency of division into groups, will obviously find their application in solving other practical problems.

In general, the work was carried out at a high scientific and technical level. The author has done a lot of research work. Despite the above comment, the work submitted

for defense meets the requirements for candidate dissertations, is a completed scientific qualification work, and its author, Sergey Mikhailovich Golovanov, deserves to be awarded the required degree of Candidate of Technical Sciences in the specialty 2.3.1 - System analysis, control and information processing, statistics.

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