Ensemble of deep networks in recognition of selected classes of medical images.

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Abstract

The subject of work focuses on the development of automatic methods of analysis of medical images of melanoma and breast cancer. The solutions proposed in this work are based on the use of different deep neural CNN structures and classic type classifiers (SVM, random forest of decision trees).

The main task is to develop effective methods of creating the classification ensembles and the methods of fusion of individual results of its members in the final verdict. The results of numerical experiments confirm the hypothesis that the use of a properly defined and integrated set of deep CNN classifiers allows for improvement in the generalization ability of the proposed classification system concerning the results achieved by the individual classifiers.

The experimental study was conducted for two types of images. In the case of melanoma, it is a dermatoscopic image of the skin and in the case of breast cancer, it is a mammographic image. Several solutions for building a team of classifiers are proposed and tested in the paper. One of them is the cooperation of the deep CNN network with classical classifiers. The results of the experiments showed a relatively slight improvement in the results of such a solution compared to the best individual CNN solutions.

The second proposed solution is a team consisting of many cooperating deep networks of different structures, the results of which are fused through a majority voting, based on the probability of class membership. Regardless of the type of imaging, the developed classification system turned out to be very efficient, generating results at the level of the best-world solutions.

Conclusions from the conducted research confirm that team machine learning, based on combinations of various classifiers, can bring significant benefits in the process of analyzing medical images. At the same time, these results emphasize the importance of proper selection of team members and their optimal configuration to achieve the best results.