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Using federated learning to solve the problem of determining coastlines on satellite images

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Distributed deep learning methods can be used to solve various image analysis and processing tasks. It is quite difficult to assemble a large dataset for a certain set of tasks due to restrictions on data distribution. For such tasks, federated learning is used. The main feature of this method is the presence of local data on the nodes of the distributed computing system, which cannot be transferred to other nodes due to various restrictions. The task of determining the coastline from satellite images is reduced to the task of segmentation. DeepResUnet and TransUnet deep neural network models were selected. Landsat8 with images of rivers and bays in Russia was chosen as the dataset. Computational experiments were conducted to train two models on one node (deep learning), on multiple nodes (distributed deep learning and federated learning). The results of solving the problem of determining the coastline both on a single node and on a distributed system are presented. For experiments on federated learning, various methods of data separation between nodes of a distributed system have been identified. Data separation between nodes is proposed, both according to the geographical location of the satellite image and randomly. A comparative analysis of the results of federated learning with various methods of data distribution is discussed.

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