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RESEARCH OF IMAGE CLASSIFICATION METHODS USING NEURAL NETWORKS ON GPUS

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Annotations: The paper examines the classification of images on GPUs by means of neural networks, namely, using the example of the categorization of household goods. This topic is relevant, since in everyday life we are surrounded by images and it is easy for a person to interpret them, and it is much more difficult for a computer, all the more to classify or segment images.

As a result, a system was created that automatically classifies goods, modifying existing approaches, and obtained a custom one that works better for this task. Having improved the product, it can be used for any organization where it would be convenient to automatically classify products. ТЕКСТ, ТЕКСТ, ТЕКСТ, ТЕКСТ, ТЕКСТ.

Key words: machine science, neural measures, image classification.

The development of knowledge-intensive branches of human activity in modern society is accompanied by the growing role of computer technology. Nowadays, the flow of information is significantly increasing; there is a need to find new ways of storing, presenting, formalizing and systematizing it, as well as automatically processing it.

The task of image classification is taking an initial image and inferring its class (cat, dog, etc.) or group of plausible classes that best characterizes the image. For humans, this is one of the first skills they begin to learn at birth.

The work will solve the problem of categorizing household items. Since categorizing goods for large shipments can be time-consuming for workers, automating this process will greatly simplify their work.

This can also be useful if the categorization on the site is not very obvious (with categories and subcategories), then it will be easier for a user who wants to sell/buy a product to place an ad/buy a product based on the photo.

The goal requires solving the following scientific problems:

- research, cleaning and processing of the data set;
- selection and design of neural network architecture;
- selection of a method evaluation metric, selection of a validation method;
- study of the influence of neural network components on classification accuracy;
- study of the influence of hyperparameters on classification accuracy.

The goal of the work is to develop a model that would make it possible to determine the category of goods for household items, and there will be 69 such categories. It is important to analyze approaches to solving such problems in order to choose the most suitable one for a specific task of categorization into 69 classes. No less important in this context is a deep analysis of the structure and approaches to obtaining, analyzing and processing data.

The object of the study is the analysis of methods and means of using neural networks in applied systems and the process of such a network that would meet the stated goals of the work. The subject of the study is the architecture of the neuron network.

Achieving the goals was achieved using the Python programming language, the Keras framework for working directly with neural network architectures and the implementation of various methods and libraries numPy, scikit-learn, HTML5, CSS3, framework and JavaScript language for creating a website to display the results.

The scientific novelty of the work lies in the fact that a system was created that classifies goods with an accuracy of 92.5% and is quite small and fast in size, so the model can be used on a smartphone, the result of predictions for a new infection can

be obtained in 10 ms. At the moment there are no analogues of such an open source system.

The work reviewed and investigated methods and approaches in problems of image classification using neural networks. Model selection, quality metrics, model evaluation methods, and hyperparameter selection were described, and comparisons were made between different models and suitable approaches.

The input data for this task was open data - images of everyday objects, of which there were 69 classes. The data set is not balanced. The problem of class imbalance was solved using the augmentation method. In total, there were 104461 images in the data set, 3450 images were used for the test, 101011 were used for training. Accordingly, each class had an average of 1400 copies, the smallest class contained 719 images for training and the largest - 2389. The class was used for the test. A comparison was made of such architectures as: DenseNet; InceptionV3; SqueezeNet; MobileNet. As a result, the DenseNet model showed the best accuracy, which in the process improved the accuracy of the initial model by more than 20%. If a ready-made solution needs to be used in a system with limited resources, then you can use the SqueezeNet model, which gives slightly worse accuracy, but the volume of the model is 8.5 times smaller, and the accuracy is only 8.9% worse. Methods for improving models have been proposed. The modified models were tested, resulting in an accuracy of 88.7%.

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