«Сейфуллин оқулары – 18: « Жастар және ғылым – болашаққа көзқарас» халықаралық ғылыми -практикалық конференция материалдары = Материалы международной научно-практической конференции «Сейфуллинские чтения – 18: « Молодежь и наука – взгляд в будущее» - 2022.- Т.I, Ч.V. - P. 210-211

DEVELOPMENT OF A PROGRAM FOR IDENTIFICATION OF THE BODY OF CATTLE

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ANN (artificial neural networks) is a mathematical model of the functioning of neural networks traditional for living organisms, which are networks of nerve cells. As in the biological analogue, in artificial networks, the main element is neurons interconnected and forming layers, the number of which may vary depending on the complexity of the neural network and its purpose (tasks to be solved).

Perhaps the most popular task of neural networks is visual pattern recognition. Today, networks are being created in which machines are able to successfully recognize symbols on paper and bank cards, signatures on official documents, detect objects, etc. These functions make it possible to significantly facilitate the work of a person, as well as increase the reliability and accuracy of various work processes due to the absence of the possibility of making an error due to the human factor.

A neural network is a mathematical model in the form of software and hardware implementation, built on the principles of functioning of biological neural networks. Today, such networks are actively used for practical purposes due to the possibility of not only development, but also training. They are used for prediction, image recognition, machine translation, audio recognition, etc. [1].

The convolutional neural network has a special architecture that allows it to recognize patterns as efficiently as possible. The very idea of the CNN is based on the alternation of convolutional and subsampling layers (pooling), and the structure is unidirectional. CNN got its name from the convolution operation, which assumes that each image fragment will be multiplied by the convolution kernel element by element, while the result should be summed up and written to a similar position in the output image. This architecture provides recognition invariance with respect to object shift, gradually enlarging the “window” on which the convolution “looks”, revealing more and more large structures and patterns in the image.

Working with images is an important area of application for Deep Learning technologies. Globally, all images from all cameras in the world constitute a library of unstructured data. Using neural networks, machine learning and artificial intelligence, this data is structured and used to perform various tasks: domestic, social, professional and government, in particular, security.

The basis of all architectures for video surveillance is analysis, the first phase of which will be image (object) recognition. Then artificial intelligence using machine learning recognizes the actions and classifies them. In order to recognize an image, the neural network must first be trained on the data. This is very similar to neural connections in the human brain - we have certain knowledge, we see an object, analyze it and identify it.

Neural networks are demanding on the size and quality of the dataset on which it will be trained. You can download the dataset from open sources or build it yourself.

In practice, it means that up to a certain limit, the more hidden layers in the neural network, the more accurately the image will be recognized. How is it implemented?

The picture is divided into small sections, up to several pixels, each of which will be an input neuron. Synapses transmit signals from one layer to another. During this process, hundreds of thousands of neurons with millions of parameters compare the received signals with the already processed data [2].

Simply put, if we ask the machine to recognize a photo of a cow, we will break the photo into small pieces and compare these layers with millions of existing images of cows, whose feature values the network has learned. At some point, an increase in the number of layers leads to simply memorizing the sample, and not learning. A neural network for image recognition is perhaps the most popular way to use neural networks. At the same time, regardless of the features of the tasks being solved, it works in stages, the most important of which we will consider below.

A variety of objects can act as recognizable images, including images, handwritten or printed text, sounds, and much more. When training the network, it is offered various samples with a label of which type they can be attributed to. A vector of feature values is used as a sample, and the set of features under these conditions should make it possible to unambiguously determine which class of images the NN is dealing with.

When training, it is important to teach the network to determine not only a sufficient number and values of features to give good accuracy on new images, but also not to retrain, that is, not to unnecessarily “adjust” to the training sample from images. After completing the correct training, the NN should be able to identify images (of the same classes) that it did not deal with during the training process.

It is important to take into account that the initial data for the neural network must be unambiguous and consistent so that situations do not arise when the neural network will give high probabilities that one object belongs to several classes.

In general, the creation of a neural network for image recognition includes:

1. Collection and preparation of data
2. Choice of topology
3. Selection of characteristics
4. Selection of training parameters
5. Training
6. Checking the quality of training
7. Adjustment
8. Verbalization

When training a neural network for pattern recognition with a teacher, there is a sample with true answers to the question, what is shown in the picture - class labels. Neural networks are fed into these images, after which an error is calculated that compares the output values with the true class labels. Depending on the degree and nature of the inconsistency in the prediction of the NN, its weights are adjusted, the NN responses are adjusted to the true answers until the error becomes minimal [1].

Neural networks can find a variety of applications, not only for image and text recognition, but also in many other areas. NNs are capable of learning, so they can be optimized and maximized functionality. The study of neural networks is one of the most promising areas at the present time, since in the future they will be used almost everywhere, in various fields of science and technology, since they can greatly facilitate work and sometimes protect a person.

List of used literature

1Markova S.V., Zhigalov K.Yu. Application of a neural network to create an image recognition system // Fundamental research. - 2017. - No. 8 (part 1) - P. 60-64

2Jain, V. and Seung, S. H. (2008). Natural image denoising with convolutional networks. In NIPS’2008.