USING THE OPTIMIZATION TECHNIQUE OF NEURAL STYLE TRANSFER

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Introductions. In the world of information and communication technologies, artificial intelligence is now a hot topic. An artificial neural network is a programming method, which mimics the work of the human brain. The network's neural units are linked together, allowing it to learn and solve complex tasks. In a number of fields, artificial neural networks have recently gained acceptance as a useful model for clustering, pattern recognition and prediction. One of the main network part is the learning algorithm, which modifies the parameters of the neural network, in order for a given input to the network to produce a favored output. The learning process typically amounts to modifying the weights and thresholds. There are many interesting applications of the neural networks [1-3].

The aim of the work is to analyze the optimization technique of neural style transfer and to do experimental researches.

Materials and methods. First of all, it should be noted, that we do not use the neural network in its direct purpose, it does not learn to perform a specific task. In general, the advantages of the backpropagation algorithm are used to minimize two defined values: loss and style. The input data for a neural network is an image (style image), the style of which we want to adapt to another image (content image). Styling is initially initialized as random white noise in the image. Then, together with the

content image and style image, it passes through several layers of the neural network, which was previously trained to classify images. The initial data of different intermediate layers was used to calculate two types of losses (style loss and content loss). It is determined how close the obtained result (stylization) to the style of the style image and content of the content image [4].

First, the content image and stylization go through the network, in which each subsequent layer receives the original data from the previous layer, calculates the square of the difference between the corresponding values and finds their sum by multiplying by the scaling factor (content weight). This process is repeated for each layer of the network. Next, the style loss is calculated. To do this, the Gram matrices of the original data are compared. As a result, the Gram matrix will contain non-localized information about the image (texture, size and weight). Next we need to find the Euclidean distance between the Gram matrices, in order to determine how similar they are to the style. Euclidean distances are found between each corresponding pair of values in Gram matrices, which are formed on each layer in a predetermined list. A scaling factor (style weight) is also used for this purpose [4, 5].

Now we defined the content loss (how close the stylization to the content image) and the style loss (how close the stylization to the style image). So, we can add them to get the total loss. Then backpropagation algorithm is used to reduce the total loss (a gradient is obtained on the stylized image and iteratively changed to make it more similar to the desired stylized image) [5].

Results and discussion. The results of the experimental researches are shown in Fig. 1 for 2 style and content images.

Conclusions. The design of presented technique requires from the neural architect the relevant theoretical knowledge, empirical experience and the ability to apply software packages for modeling.

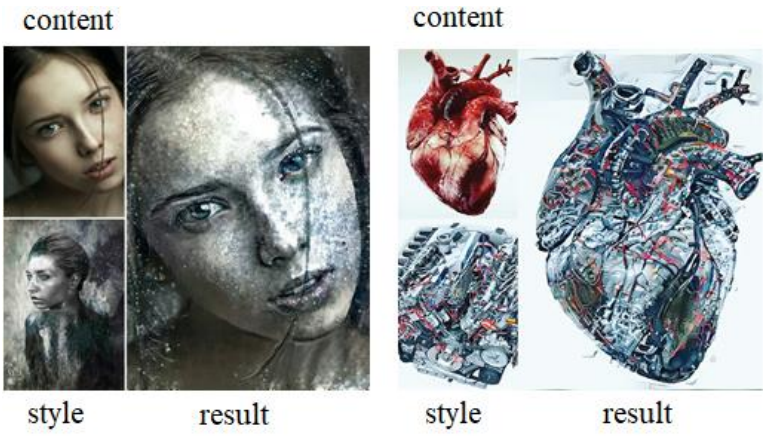

Fig. 1. Example of using the optimization technique of neural style transfer

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