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VARIETY OF NEURAL NETWORKS

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Even though many people consider that neural networks are an emerging technology, its mathematical model was developed in 1943, but back then they were too computationally expensive. With modern technologies new researches on neural networks are developed every month, and in spite the fact that it is impossible to cover all of them in this essay, I would like to review some notable models.

Generative adversarial networks are one of the most widely used nowadays. Its operation principle is based on using of two competitive neural networks. For instance in Prisma generative part is modifying given image, so that it looks like a paint of a certain artist, and a discriminative network is trying to distinguish generated picture from original paints. Projects using that type of network can generate non-existing images of faces or cats (“This person does not exist”, “This cat does not exist”), enhance resolution of pictures (Fig. 1) (ESRGAN), generate flowers on its text description (StackGAN) and create landscapes from simple sketches (GauGAN).



Fig. 1. Examples of results of GANs

Convolutional neural networks are commonly used to classify images, their distinguishing feature is a use of convolution layers. It is almost impossible to classify image depending on values of certain pixels so what convolution layer do is move window with values for the shape we are looking for and it multiplies values of convolution with values of pixels, where the black color is one and white is zero, and sends summary of that values to the next convolutional level. For example if we want to classify whether this image contains doughnut or not we would use convolution layer with ones on edges and zero in center, so that if we find round shape it would give next layer high value, which means that there is a high probability that that part of picture contains doughnut. Next level produces one more convolution, but because all the values are fitted by algorithm it is not always clear how exactly it chooses features to recognize picture (Fig. 2, 3).

Long short-term memory network can use context of event unlike other networks, which reacts only on event itself. It can predict stock prices depending on previous values and seasonal changes, or predict weather based on past. One of the most remarkable use of that network is analyzing natural language, it can spell-check text depending on context, plausibly imitate human speech (Alice, Siri) and even answer questions about plot of the book it read.

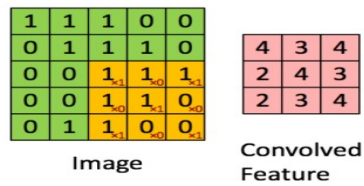


Fig. 2. Model of convolution layer



Fig. 3. Example of layers for multiclass classification

In conclusion, in this essay were considered certain types of neural networks to demonstrate the variety of methods using in machine learning.

References

1. Andrew Ng. Machine Learning Yearning. Available at: <https://www.deeplearning.ai/machine-learning-yearning/> (accessed 15 March 2019)
2. CS231n: Convolutional Neural Networks for Visual Recognition, lecture notes. Available at: <http://cs231n.stanford.edu/> (accessed 16 March 2019)
3. Machine learning, lecture notes. Available at: <https://www.coursera.org/learn/machine-learning> (accessed 10 March 2019)