Nizhny Novgorod State University
Institute of Information Technologies, Mathematics and Mechanics
Department of Computer Software and Supercomputer Technologies

Educational course «Introduction to deep learning using the Intel® neon™ Framework»

Lecture №4
Convolutional neural networks. Deep residual networks

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Content

1 Abstract

The goal of this lecture is to study a group of well-known deep models – convolutional neural networks. ***Convolutional neural networks*** are a kind of neural networks that, at least on one of their layers, use the "convolution" operation as a transform. The concept of the continuous and discrete convolution is introduced in the lecture. The typical structure of a convolutional block and the principle of constructing convolutional networks are considered. A typical layer of a convolutional neural network consists of three stages [3]: ***constructing a set of linear activations*** (convolutions), ***detection*** (application of a nonlinear activation function) and ***pooling***. The general structure of a convolutional neural network is represented by a sequence of convolutional layers (triples consisting of convolution, activation function and pooling), which at the end has a number of fully-connected layers and a classifier (activation function). The lecture considers examples of well-known convolutional networks that are used to solve classical problems of computer vision [5, 7 – 14]. Typical input and output data for convolutional networks are represented. Examples of one-dimensional and two-dimensional data with different number of channels from different application areas are given. The backpropagation method for convolutional neural networks is introduced [6]. A general procedure for evaluating the complexity of a deep model is described by determining the number of training parameters and the amount of memory required to store the model. Recommendations are given regarding the construction of convolutional architectures. The problem of model degradation is considered, ***a deep residual networks*** is introduced [15, 16] to solve this problem. Examples are given of the use of convolutional and residual neural networks to solve the problem of classifying a person's sex by photo using the tools of the Intel® neon™ Framework.

2 Literature

2.1 Books

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2.2 Further reading

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2.3 References

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