Python - Neural networks

Course code: PYTHON_ML_NN

Neural networks are a set of mathematical models designed to process information similar to how brain neurons work. Neural networks consist of a number of neurons that are interconnected using weights and process input data to produce an output. Each neuron receives input from other neurons or from external sources, processes the input using an activation function and sends the result to other neurons in the network. Neural networks are used to solve many tasks, such as image recognition, prediction and classification. They are typically trained on the basis of a large amount of input data, which is used to optimize the weights and set the parameters of the neural networks so that they are able to solve a certain task. There are many types of neural networks, including single and multilayer perceptrons, convolutional networks, recurrent networks, and others. Each type of neural network is used for different types of tasks and has its own characteristics and advantages. Neural networks have become a key element of machine learning and allow machines to learn from experience and improve their abilities in various areas.

Participant requirements

- Knowledge of Python programming at the PYTHON_INTRO course level, but knowledge at the PYTHON_ADV course level is an advantage
- Knowledge of the basics of data analysis at the level of the PYTHON_DATAAN course
- Knowledge of the basics of machine learning at the level of the PYTHON_ML_INTRO course

Teaching methods

- Professional explanation with practical examples, exercises on computers.

Study materials

- Presentation of the subject matter in printed or online form.

Course outline

Day 1:
- Introduction to neural networks and machine learning
- Basics of linear and logistic regression
- Activation functions for neural networks (sigmoid, ReLU, etc.)
- Design and implementation of a simple one-layer neural network

Day 2:
- Introduction to the TensorFlow library
- Design and implementation of a multilayer neural network using TensorFlow
- Neural network training and performance verification
- Solving the problem of overtraining

Day 3:
- Introduction to convolutional neural networks (CNN)
- Basics of image processing and convolution
- Implementation of a simple CNN on the MNIST dataset
- Visualization and interpretation of results

Day 4:
- Recurrent Neural Networks (RNN)
- Basics of processing sequences and time series
- Implementation of a simple RNN on the stock price forecasting dataset
- Visualization and interpretation of results

Day 5:
- Introduction to autoencoders
- Basics of random models
- Implementation of a simple autoencoder on the MNIST dataset

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- Visualization and interpretation of results

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