Python - Deep Learning

Course code: PYTHON_ML_DP

Deep learning is a set of machine learning techniques that make it possible to learn a complex representation of data using multilayer neural networks. These networks are able to extract and process information from multiple levels of data to recognize complex patterns and perform advanced tasks.Deep learning is typically used to solve problems such as image recognition, natural language processing, content generation, and prediction. Compared to traditional machine learning methods, which often rely on manually determined features, deep learning allows the system to learn the data representation itself, thereby achieving better results and higher accuracy.In deep learning, a model is trained on the basis of a large amount of input data, and the weights and parameters of neural networks are optimized using error backpropagation. This training process can be time-consuming and require a large amount of calculations, which can be solved using modern GPUs.Deep learning has become a key element of artificial neural networks and has made it possible to achieve progress in many areas such as speech recognition, autonomous driving and image recognition.

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
- Knowledge of the basics of neural networks at the level of the PYTHON_ML_NN course
- Knowledge of the basics of convolutional neural networks at the level of the PYTHON_ML_CNN course
- Knowledge of the basics of convolutional neural networks at the level of the PYTHON_ML_BP 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 deep learning and neural networks

- Basics of machine learning
- Introduction to neural networks and their functions
- Training neural networks using backpropagation
- Activation functions and their selection
- Multilayer neural networks and their training
- Introduction to TensorFlow and Keras library

Day 2: Convolutional Neural Networks (CNN)

- Introduction to convolutional neural networks (CNN)
- Convolution layers and image filtering
- Layer pooling and reducing image dimensions
- Editing images before training
- Convolutional network architectures (AlexNet, VGG, ResNet)
- Practical exercises for the implementation of convolutional networks

Day 3: Recurrent neural networks (RNN) and other models

- Introduction to recurrent neural networks (RNN)
- Structure and functioning of RNN
- RNN training for text prediction and generation
- LSTM and GRU networks
- Introduction to generative models (GAN)
- Introduction to autoencoders and their applications

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Day 4: Optimization and tuning of neural networks
- Optimization of hyperparameters of neural networks
- Methods of learning and parameter optimization
- Regularization of networks (dropout, L1, L2)
- Overfitting and its prevention
- Tuning and debugging networks

Day 5: Applications and advanced topics in deep learning
- Application of deep learning in practice (speech recognition, image recognition, machine translation)
- Transfer learning
- Introduction to natural language processing and NLP
- Advanced topics in deep learning (adversarial training, attention mechanism, capsule networks)
- Discussions and course summary

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