Deep Learning and Neural Networks: The Basics

Seminar of 3 days - 21h
Ref.: DRN - Price 2024: CHF2 890 (excl. taxes)

EDUCATIONAL OBJECTIVES

At the end of the training, the trainee will be able to:

Understand the fundamental keys of a deep or machine learning approach

Master the theoretical and practical basics of neural network architecture and convergence

Know the different existing fundamental architectures and master their fundamental implementations

Master the methodologies for setting up neural networks, the strengths and limitations of these tools

TEACHING METHODS

This seminar is based on presentations, discussions and case studies. Tools such as Lasagne or Keras will be presented.

THE PROGRAMME

last updated: 04/2022

1) Introduction to AI, machine learning and deep learning

- History, basic concepts and applications of artificial intelligence, far from the fantasies promoted by the industry.
- Collective intelligence: Aggregating knowledge shared by many virtual agents.
- Genetic algorithms: Evolving a population of virtual agents by selection.
- Common machine learning: Definition.
- Task Types: Supervised learning, unsupervised learning, reinforcement learning.
- Types of actions: Classification, regression, clustering, density estimation, dimensionality reduction.
- Examples of machine learning algorithms: linear regression, Naive Bayes, random tree.
- Machine learning versus deep learning: Why ML remains the state of the art (random forests & XGBoosts)?

2) Basic concepts of a neural network

- Reminder of mathematical basics.
- The neural network: Architecture, activation and weighting functions of previous activations
- Learning a neural network: Cost functions, back-propagation, stochastic gradient descent
- Modeling a neural network: Modeling input and output data according to the type of problem.
- Understanding a function by a neural network. Understanding a distribution by a neural network.
- Data Augmentation: How to balance a dataset.
- Generalization of the results of a neural network.
- Initializations and regularizations of a neural network: L1/L2 Regularization, Batch Normalization.
- Optimizations and convergence algorithms.

Demonstration : Approximation of a function and a distribution by a neural network.

3) Common machine learning and deep learning tools

- Data management tools: Apache Spark, Apache Hadoop.

TRAINER QUALIFICATIONS

The experts leading the training are specialists in the covered subjects. They have been approved by our instructional teams for both their professional knowledge and their teaching ability, for each course they teach. They have at least five to ten years of experience in their field and hold (or have held) decision-making positions in companies.

ASSESSMENT TERMS

The trainer evaluates each participant's academic progress throughout the training using multiple choice, scenarios, hands-on work and more.
Participants also complete a placement test before and after the course to measure the skills they've developed.

TEACHING AIDS AND TECHNICAL RESOURCES

• The main teaching aids and instructional methods used in the training are audiovisual aids, documentation and course material, hands-on application exercises and corrected exercises for practical training courses, case studies and coverage of real cases for training seminars.
• At the end of each course or seminar, ORSYS provides participants with a course evaluation questionnaire that is analysed by our instructional teams.
• A check-in sheet for each half-day of attendance is provided at the end of the training, along with a course completion certificate if the trainee attended the entire session.

TERMS AND DEADLINES

Registration must be completed 24 hours before the start of the training.

ACCESSIBILITY FOR PEOPLE WITH DISABILITIES

Do you need special accessibility accommodations? Contact Mrs. Fosse, Disability Manager, at psh-accueil@ORSYS.fr to review your request and its feasibility.

- Common machine learning tools: Numpy, Scipy, Sci-kit.
- High level DL frameworks: PyTorch, Keras, Lasagne.
- Low-level DL frameworks: Theano, Torch, Caffe, Tensorflow.

Demonstration : Applications and limitations of the tools presented.

4) Convolutional Neural Networks (CNNs)

- Overview of CNNs: Fundamental principles and applications.
- Basic operation of a CNN: Convolutional layer, use of a kernel, padding and stride, etc.
- CNN architectures that have carried the state of the art in image classification: LeNet, VGG Networks, Network in Network, etc.
- Use of an attention model.
- Application to a usual classification case (text or image).
- CNNs for generation: Super-resolution, pixel-by-pixel segmentation.
- Main strategies for increasing Feature Maps for image generation.

Case study : Innovations brought by each CNN architecture and their more global applications (1x1 convolution or residual connections).

5) Recurrent Neural Networks (RNNs)

- Overview of RNNs: Fundamental principles and applications.
- Fundamental operation of RNN: Hidden activation, back propagation through time, unfolded version.
- Developments towards GRU (Gated Recurrent Units) and LSTM (Long Short Term Memory).
- Convergence problems and vanishing gradient.
- Types of classical architectures: Prediction of a time series, classification, etc.
- RNN Encoder Decoder architecture. Use of an attention model.
- NLP applications: Word/character encoding, translation.
- Video applications: Predicting the next generated frame of a video sequence.

Demonstration : Different states and evolutions brought by the Gated Recurrent Units and Long Short Term Memory architectures.

6) Generational models: VAE and GAN

- Overview of the generational models Variational AutoEncoder (VAE) and Generative Adversarial Networks (GAN).
- Auto-encoder: Dimensionality reduction and limited generation.
- Variational AutoEncoder: Generational model and approximation of the distribution of a data.
- Definition and use of latent space. Reparameterization trick.
- Fundamentals of Generative Adversarial Networks.
- Convergence of a GAN and difficulties encountered.
- Enhanced convergence: Wasserstein GAN, BeGAN. Earth Moving Distance.
- Applications for generating images or photos, generating text, super-resolution.

Demonstration : Applications of generational models and use of latent space.

7) Deep reinforcement learning

- Reinforcement learning.
- Useing a neural network to understand the state function.
- Deep Q Learning: Experience replay and applying it to video game controls.
- Optimizations of the learning policy. On-policy and off-policy. Actor critic architecture. A3C.
- Applications: Control of a simple video game or digital system.

Demonstration : Control of an agent in an environment defined by a state and possible actions.

DATES

Contact us