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Introduction to artificial intelligence: tools & challenges

2 days (14 hours)

Presentation

Artificial intelligence has revolutionized many scientific fields, and is now beginning to revolutionize a large number of economic sectors (industry, medicine, communications, etc.). Nevertheless, the way it is presented in the mainstream media is often nothing more than a fantasy, far removed from what Machine Learning and Deep Learning actually are. The aim of this training course is to present these approaches and their contribution to solving problems considered as "intelligent".

A wide range of applications are presented, from the processing of raw data to the creation of "original" content, including agent control, automated classification and the approximation of data to make it easier to understand and manipulate.

Finally, we'll look at the timeliness and methodology of implementing such projects. Like any tool, Deep Learning has many limitations, and its application requires a real method for understanding, controlling and guaranteeing a high-quality end result.

Objectives

- Introduction to the fundamental concepts of deep learning
- Study of the main algorithms and practical applications of deep learning
- Details of the various stages in implementing a project, from dataset construction to industrialization

Target audience

Developers, Project managers, Architects, Big Data Data analyst / Data Scientist

Prerequisites

- Basic knowledge of mathematics and statistics

Further information

- As an introduction to Artificial Intelligence, we offer you the following training course
- Complementing Facebook's Pytorch or Google's TensorFlow technology

Our training program: Introduction to artificial intelligence, tools & challenges

[Day 1]

1. What is artificial intelligence (up to and including neural networks)?

- The fantasy of artificial intelligence versus today's realities.
- Disappearance of algorithms, new problem modeling.
- Machine learning: an introduction to learning.
- Main approaches: supervised learning, unsupervised learning, reinforcement learning, self supervised learning.
- Main actions: classification, regression, clustering, density estimation, reduction of dimensionality, prediction, generation.
- Evolutionary algorithms: introduction and current status.

2. Neural networks and Deep Learning

- What is a neural network? From single neuron to Multi Layer Perceptron, shallow to deep network.
- What is neural network learning? Cost function, Back propagation and convergence.
- Neural network generalization: how to ensure a model is useful? Train, validation, test sets. Occam's razor and optimal capacity.
- Dependence on input data: possible models, bias research and neutralization.
- Data augmentation: improving a dataset by identifying invariances.
- Generation of internal representations within a neural network.
- The Deep Learning revolution versus Machine Learning.

3. Deep Learning applications: review of the state of the art and examples of applications

- Data classification
  - Understand data classification in different scenarios: raw data, images, sound, text, etc.
  - Understand the challenges of data classification and the choices implied by a model classification.
  - Presentation of common classification tools, in particular MLP (Multilayer perceptron) or CNN (Convolutional neural network) networks VS Machine Learnig tools (Random Forest, Naïve bayes)
  - Presentation of examples of existing solutions (e.g. image classification) customer history, texts written by users, etc.).
  - Clustering: a special case of unsupervised learning. Overview of different algorithms (k-means, Random Forests, etc.).
  - Anomaly detection: tools and limits.
- Information prediction and sequential/temporal data
  - Stakes and limits of information prediction. Search for structural rules within the data that can enable predictive logic.
  - Prediction as classification or regression.
  - Common pitfalls of a predictive approach.
  - Presentation of common prediction tools: RNN (Recurrent Neural Networks), LSTM (Long Short Term Memory).
  - Examples: image prediction following a video sequence. Pollution prediction in urban environments, and more.
- Data transformation/Generation
  - What exactly is data transformation? What are the barriers and challenges?
  - Re-interpretation of the same data: de-noising, text summary generation, image segmentation.
  - Transformation operations on the same format: translation of text from one language to another other (brief presentation of the Google Machine Translation or BERT architecture by Google).
  - Original" data generation operation: neural style, super-resolution, generation images from text presentations.
- Reinforcement Learning: controlling an environment
  - Introducing Deep Reinforcement Learning
  - Experience Replay and video game learning using a neural network
  - Applications: control of numerical simulations, automatic cars, robotics

[Day 2]

4. What problems can Machine/Deep Learning address?

- Data requirements: volumetrics, dimensioning, class balance, description. (Curse of dimensionality, No Free Lunch theorem)
- Raw data VS processed features: which to choose? How to create features Using intermediate states of a neural network.
- Machine Learning VS Deep Learning: when to prefer older Machine Learning algorithms to neural networks? Volume, complexity, etc.
- Qualifying a problem: unsupervised learning? Supervised learning? Reinforcement learning?
- Qualify a solution: understand the distance between a business assertion and the result of an algorithm. Case studies, study of common analysis tools for model results.

5. Setting up a project, step 1: generating a dataset

- What is a Dataset? What separates it from a conventional database? Data modeling VS technological choices
- Accumulate and control data: monitor bias, clean or convert data on a incremental architecture
- Understanding data: statistical tools for an initial view of data, its distribution, aberrant behavior, etc. Best practices for monitoring massive data.
- Formatting data: possible models for business uses.
- Data preparation: definition of train set, validation set and test set. Results control structure. Cross validation.
- Protecting and anonymizing data: best practices, differential privacy, etc.

6. Project implementation, step 2: successive iterations

- Review of technical choices, advantages and disadvantages. Frameworks: Tensorflow, PyTorch, Caffe. Cloud services: Google Cloud Service, Microsoft Azure, Amazon SageMaker
- Methodology for moving towards the best solution for an ML/DL problem.
- Transfer Learning: reuse an existing model and transfer its parameters to a new problem.
- Successive iterations from the simplest algorithms to the most advanced architectures complexes
- Simplification and division of the problem into sub-problems for a multi-model solution
- Model ensembling on a problem
- Debugging/controlling the operation of a neural network. Existing approaches (GradCam, Contextual Decompositions, RNN cell or attention model analysis)

7. Project implementation, stage 3: industrialization

- Industrializing a neural network through strict process control and continuous monitoring
- Technical solutions: TensorFlow Serving, Kubernetes, Docker.
- Management of a first version and monitoring of results.
- Successive relearnings to keep the network up to date and optimized in terms of response quality.
- Training users to understand and use the network.
- Optimization of a neural network: pruning strategy for inference on a mobile or limited device
- Neural network security: Adversarial attacks

Companies concerned

This training course is aimed at both individuals and companies, large or small, wishing to train their teams in a new advanced computer technology or to

acquire specific business knowledge or modern methods.

Positioning on entry to training

Positioning at the start of training complies with Qualiopi quality criteria. As soon as registration is finalized, the learner receives a self-assessment questionnaire which enables us to assess his or her estimated level of proficiency in different types of technology, as well as his or her expectations and personal objectives for the training to come, within the limits imposed by the selected format. This questionnaire also enables us to anticipate any connection or security difficulties within the company (intra-company or virtual classroom) which could be problematic for the follow-up and smooth running of the training session.

Teaching methods

Practical course: 60% Practical, 40% Theory. Training material distributed in digital format to all participants.

Organization

The course alternates theoretical input from the trainer, supported by examples, with brainstorming sessions and group work.

Validation

At the end of the session, a multiple-choice questionnaire verifies the correct acquisition of skills.

Sanction

A certificate will be issued to each trainee who completes the course.