CATALOGUE OF CONTINUING EDUCATION COURSES IN ARTIFICIAL INTELLIGENCE

2020/2021

ANITI
ARTIFICIAL & NATURAL INTELLIGENCE TOULOUSE INSTITUTE

Université Fédérale
Toulouse Midi-Pyrénées

EDITORIAL

"The French Ministry of Higher Education, Research and Innovation and the General Secretariat for Investment, based on the proposal of an international jury, validated the creation of the Artificial and Natural Intelligence Toulouse Institute (ANITI), as one of four interdisciplinary institutes spearheading research on Artificial Intelligence (3IA) in France, announced by French President Emmanuel Macron at the AI for Humanity summit held in March 2018.

This cluster for excellence in artificial intelligence research, selected for France's "Investments for the future" programme and led by Université Fédérale Toulouse Midi-Pyrénées, brings together all the state higher education institutions in the Toulouse education authority, along with several research organisations based in the region (CNRS, INRA, ONERA). The cluster also enjoys backing from world-class industrial partners including Airbus, Continental, the Renault group and Thalès, as well as Capgemini and around twenty more stakeholders from the business community. Their shared ambition is to make Toulouse one of the world leaders in artificial intelligence. ANITI focuses on three major areas: scientific research, higher and continuing education courses and economic development.

ANITI, which is fundamentally interdisciplinary, is made up of 24 chairs which carry out research in two strategic application sectors: mobility / transportation, and robotics/cobotics. Its scope covers subjects as diverse as secure management of distributed data, biological and medical imaging, automatic interpretation of natural language, statistical physics, robotics, cognitive sciences, data science, artificial vision, fairness and ethics, explainability and reliability.

In addition to research programmes, education is one of the fundamental levers for developing artificial intelligence (AI) and it is essential to ensure we significantly increase the number of students and people already in employment who receive training in this field. For that reason, ANITI has set itself the goal of providing a comprehensive set of continuing education courses that meet the competitiveness challenges facing our industrial partners. The underlying purpose of the courses on offer here, at the cutting edge of current technology, is therefore to boost the skills of the people employed by our partners.

The project's strength lies in the concept of co-governance, which enables us to match the needs of our partner companies with the required resources in terms of teaching and academic research. As a result, we provide an appropriate response to the dynamic drive to develop and acquire new skills in the areas covered by ANITI's core purpose.

This first edition of the catalogue contains a description of our continuing education programmes, including training for corporate top management teams, Master's courses and diploma courses, among others. It goes without saying that the current catalogue will be expanded to take account of the future needs of our partners. ANITI staff are on hand to oversee the development of our course catalogue, making sure it reflects your needs as closely as possible and gives your employees the means to tackle the AI challenges of the future!

Philippe Raimbault
Université Fédérale Toulouse Midi-Pyrénées president

Nicolas Viallet
ANITI chief executive officer

ANITI - Maison de la Recherche et de la valorisation - 75, cours des Sciences - 118 Route de Narbonne - 31400 Toulouse
https://aniti.univ-toulouse.fr/

A catalogue of certified courses

Industry has a permanent need for people with a solid background in artificial intelligence. Thanks to the development of training programmes tailored to different levels and needs, ANITI is the single point of entry that gives businesses easy access to all the continuing education courses in artificial intelligence available in the Toulouse education authority.

In this context, the continuing education courses offered by ANITI draw on expertise from all the institutions that make up the Université Fédérale de Toulouse.

As a result, we are able to propose a catalogue of certified courses available as part of a continuing education programme:

- Reflecting all the courses in artificial intelligence offered by the institutions,
- Combining the skills of teacher-researchers from each institution, to provide your organisations with the best solutions to their current economic challenges.

This enables us to develop:

- A core set of regular, frequently updated courses;
- The possibility of "à la carte" courses tailored to your needs and all the skills levels present within your organisation;
- Courses that are at the cutting edge of current research at the ANITI institute.

A host of AI-related subjects covered

Artificial Intelligence // Acceptability // Machine learning // Autonomous systems // Deep learning // Design support // Data // PDecision-making // Management // Optimisation of processes // Data analysis // Hybrid AI // Certification // Regulations // Reliability // Ethics

For any further information:

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Head of Continuing Education

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COURSES INDEX

LEVEL INTRODUCTORY

LEVEL INTERMEDIATE

LEVEL EXPERT

ANITI ARTIFICIAL & NATURAL INTELLIGENCE TOULOUSE INSTITUTE | Université Fédérale Toulouse Midi-Pyrénées

UNDERSTANDING THE MECHANISMS AND STAKES OF ARTIFICIAL INTELLIGENCE: ORIGINS, TYPE OF AI AND APPLICATIONS

Description

This course is run by ANITI (Artificial and Natural Intelligence Toulouse Institute) coordinated by Université Fédérale Toulouse Midi-Pyrénées.

Learning objectives

› Acquire basic knowledge about the way artificial intelligence works
› Understand the main types of artificial intelligence and what is at stake

For whom

› CEOs, executives, managers, business consultants, public organizations and private companies.

Prerequisites

› None

Course content

Sessions 1 and 2

› History of Artificial Intelligence: from its origins to deep learning
› Understand the chronology of the major advances in AI and key concepts
- Weak AI - Strong AI - Symbolic AI - Deep learning - Data and AI
› Understand the stakes related to AI: Myths and reality
- AI and humans - Deep fake - Explainability - Robustness
- AI and ethics - Fairness - Data and software laws

Sessions 3 and 4

› Use cases: Business-oriented AI
- Automatic Language Processing and speech
- Image processing - Health - Robotics
- Predictive maintenance
› AI data and infrastructure
- Collection and annotation
- Hardware and database quality

Registration

Emmanuel Bachelier
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Practical information

Course fees

Sessions 1 and 2: €250 per half-day
Sessions 3 and 4: €350 per half-day
30% reduction for ANITI partners

Duration

4 half-day sessions (14 hours)

Dates

in progress

Location

Université fédérale Toulouse Midi-Pyrénées
41 Allées Jules Guesde
31000 Toulouse

Teaching methods and resources

Number of participants:
20 people

Teaching methods:
theory, use cases

Language

French

UNDERSTANDING THE MECHANISMS AND STAKES OF ARTIFICIAL INTELLIGENCE: ORIGINS, TYPE OF AI AND APPLICATIONS

Targeted skills

› Acquire level 1 understanding of AI. : Its stakes and applications and the resources required for its implementation

Teaching staff

› Marie-José Huguet - Teacher Researcher – Institut National des Sciences Appliquées - LAAS

› Marie-Véronique Le Lann - Teacher Researcher – Institut National des Sciences Appliquées - LAAS

› Mathieu Serrurier - Teacher Researcher – Université Toulouse III Paul Sabatier - IRIT

› Thomas Pellegrini - Teacher Researcher - Université Toulouse III Paul Sabatier - IRIT

DATA SCIENCE (DATA MINING)

Introduction

This course is run by INSA (Institut National des Sciences Appliquées), coordinated by Université Fédérale Toulouse Midi-Pyrénées. Its objective is to introduce and put into practice a selection of recent methods in the field of statistics and machine learning applied to high-dimensional data for data mining. The content can be specified using the key words below, according to the needs and challenges of the company or participants.

Learning objectifs

- Recent techniques for data exploration and unsupervised classification (clustering) and modelling, predictive modelling.
- The applications are performed in the R language or Python in the form of executable Jupyter notebooks.

For whom

- Engineers, computer scientists

Prerequisites

- Basic knowledge of R. Some prior knowledge of C++ or another compiled language would be an advantage

Course content

Introduction:

- Paradigm shifts in statistics : data mining, statistical learning, big data analytics.

Main methods:

- Multidimensional exploration (principle component analysis).
- Unsupervised classification (clustering) using the hierarchical or dynamic partitioning technique.
- Estimating a forecasting error and risk.
- Linear model and logistic regression (selecting a model by selecting variables and/or penalization).
- Linear model and dimension reduction: principle components, PLS regression and sparse versions.
- Linear discriminant analysis and k-nearest neighbours algorithm
- Binary decision trees (CART) for regression or classification
- Artificial neural networks and introduction to deep learning
- Model aggregation (boosting, bagging, random forest)

Registration

fcq@insa-toulouse.fr
Tel: +33 (0)5 61 55 92 53

Practical information

Course fees

From €1,500

Lunches and teaching material included (at INSA Toulouse)

10% reduction for ANITI partners

Duration

3 days - 21 hours

Dates

On request

Location

INSA,
135 Avenue de Rangueil,
31400 Toulouse

Teaching methods and resources

Course material available at:
http:// wikistat.fr

Language

French

DATA SCIENCE (DATA MINING)

- Introduction to SVMs (support vector machines)
- Detection of anomalies or atypical observations * Missing data imputation Case study: Depending on participants' needs and areas of interest. * Practical application of these methods with the R language and/or Python on datasets of varying complexity or volume, ranging from basic to high: customer relationship management (CRM), virtual screening, spectrometric data (NIR, NMR or textual data, character recognition, recommender system).

Targeted skills

- To be able to select and apply recent statisical and machine learning methods for large data sets.

Intervenant

- Philippe Besse

Professor, department Applied Mathematique department at INSA Toulouse Member of the Institut de Mathématiques Statistics & Probabilities Team (UMR CNRS 5219)

CHANGE MANAGEMENT

Description

Since AI techniques and data driven solutions may have a strong impact inside companies, from smallest to biggest, it is important for executives to understand how they can handle with promises, new practices, HR consequences. In particular relevant ecosystems generate advantages that deserve to be analyzed. The purpose of this module, hosted in the major AI ecosystem of Montreal, is to focus on the impacts of AI in change management insidecompanies.

Learning objectives

After completing this course, participants will be able to:
› have keys to manage innovation AI or data based in their own businesses
› understand their interest in joining or developing a performing and "win-win" ecosystem
› know more about collaborative features with startups.

Prerequisites

› Good knowledge of your own business, basic knowledge of strategic interest of data in your business.

For whom

› Recent graduates
› Jobseekers and experienced employees

Course content

Change management
› Organization and management of innovation
› Entrepreneurial ecosystem in AI in Montréal
› Relocation of AI innovation from big business to startups
› Meetings with testimonials of entrepreneurs and major companies

Registration

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Practical information

Course fees
2300 €
5% reduction for ANITI partners

Duration
28 hours, 4 days

Dates
May 2021

Location
ISAE–SUPAERO
Toulouse

Language
English

DATA VALUE CREATION

Introduction

Due to the striking success of young but powerful companies known as the "GAFAM" artificial intelligence generates as many hopes as fears, and among them the fear to be "disrupted". Nevertheless, as any new business resource or model, artificial intelligence begins to be studied by economists who can explain the reasons of success, the impact on business models an employment, the adoption process of ML technologies. The purpose of this module is to focus on the principles of economics and strategy to understand how firms, industries, and management will be transformed by AI.

Learning objectives

After completing this course, participants will be able to:
- know better about what AI means for their business
- understand how firms and industries are deeply being transformed by AI.

Prerequisites

Good knowledge of your own business, basic knowledge of strategic interest of data in your business.

For whom

- Recent graduates
- Jobseekers and experienced employees

Course Content

- AI and the marginal value of data, of algorithms
- Changing the cost of prediction
- Machine learning, market structure and competition;
- Does productivity growth threaten employment?
- The impact of artificial intelligence on innovation

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Practical information

Course fees
2300 €
5% reduction for ANITI partners

Duration
28 hours

Dates
March 2021

Location
ISAE–SUPAERO
Toulouse

Language
English

THE BUSINESS OF DATA

Introduction

"The world's most valuable resource is no longer oil, but data" (The economist, 2017).
Data remain most often the fuel to implement modern AI, and the success of major digital companies relies on the ability to capture high-value data. From those observations many companies have tried to gather their data with the hope to valuate them, but with mixed achievements.
This module will explore various aspects of the use and value of data, through legal, geostrategic, and business perspectives.

Learning objectives

After completing this course, participants will be able to:
- Know about the main legal aspects of data, with international comparisons;
- Know about initiatives that allow business data to be enhanced with opendata;
- Know about business models of "platforms".

Prerequisites

Good knowledge of your own business, basic knowledge of strategic interest of data in your business.

For whom

- Recent graduates,
- Jobseekers and experienced employees

Course content

- AI in the world, a geostrategic point of view through data and cloud;
- Legal environment (RGPD and beyond);
- New economy and the sharing economy;
- Opendata

Registration

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Practical information

Course fees
2300 €
5% reduction for ANITI partners

Duration
28 hours, 4 days

Dates
March 2021

Location
ISAE–SUPAERO
Toulouse

Language
English

INTRODUCTION TO MODERN AI

Introduction

This module introduces the participants to business-oriented modern AI. It gives the basics to start taming the complexity of Data Science and Machine Learning with a special focus on Big Data and Deep Learning.

Learning objectives

After completing this course, participants will be able to:
› understand how a problem needs to be framed to be tackled by Data Science and AI;
› be able to answer most basic questions about AI;
› be acquainted with flagship algorithms and typical business-oriented use-cases;
› understand the major technology trends driving business-oriented AI;
› understand the different phases leading to profitable uses of AI (from solid exploratory data analysis practice to state of the art engineering environment).

Prerequisites

› General knowledge on computer science
› Work experience in a professional environment

For whom

› Recent graduates
› Jobseekers and experienced employees

Course content

AI Basics:
› History and basic principles of AI and more specifically Machine Learning

Machine Learning:
› Landscape and flagship algorithms on Supervised
› Unsupervised and Reinforcement Learning

Fueling AI:
› Understanding the relationship between problem framing,
› Types of data available
› Actual business outcomes and the applicable algorithms

Business intelligence and business models:
› How to deliver insights to end users

Major success stories of Business and AI:
› Targeted publicity and recommendations (such as Netflix's)
› Google's Self-driving car
› IBM Watson's Medical diagnosis
› DeepMind's Alpha Go beating the World champion of Go
› Airbus building the Skywise platform
› How AI can deliver prescription for manufacturing, etc.

Registration

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Practical information

Course fees
2300 €
5% reduction for ANITI partners

Duration
28 hours, 4 days

Dates
On request

Location
ISAE–SUPAERO
Toulouse

Language
English

TOULOUSE TECH CERTIFICATE
DATA SCIENCE AND BIG DATA: TOOLS AND INTRODUCTION

Introduction

This “awareness-raising / introductory” course is aimed at people wishing to gain better understanding of the stakes related to data and learn about some tools and methods applicable to data problems.
This is a blended learning course:
• Remote learning / independent work: 24 hours of teaching in the form of e-learning, 20 hours devoted to projects.
• Classroom learning: 36 hours of classes and practical work (split into 10 half-days),
A related cycle of lectures.

Learning objectives

- Discover and understand the fundamental aspects of Big Data.
- Be able to converse with data scientists.
- Discover the tools and methods applicable to data problems

For whom

CEOs, executives, managers, business consultants, public organizations and private companies.

Prerequisites

Basic knowledge of statistics, probability, differential calculus and numerical linear algebra. Participants are also asked to have basic knowledge of the Linux environment and programming (R, Python), and know how to manage data structures in those languages.

Course content

The course is split into three modules:
- An awareness-raising module, providing an introduction to the fundamental aspects of data science and an understanding of what we mean by big data;
- An immersive module, offering a more in-depth look at the methods and tools used in this field, without expecting learners to acquire full autonomy;
- An information module, including a cycle of lectures.

Awareness-raising module: Introduction to R, introduction to Python, multidimensional exploration, statistical learning, traditional optimization algorithms, virtualization and containerization techniques (AWS).

Registration

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Tel: +33 (0)5 61 00 91 20

Practical information

Course fees
2500 €
30% reduction for ANITI partners

Duration
Classroom learning: 2 full one-day sessions + 6 half-day sessions (option of remote learning)

Dates
16 September 2021- 31 March 2022 (possibility of joining the 2020-2021 session after the official start date)

Times
Full-day sessions:
25 & 26 October 2021
Half-day sessions:
2 PM to 5 PM or 6 PM

Location
Classes are held in several institutions (ISAE-SUPAERO, Toulouse INP-ENSEEIHT, INSA Toulouse)

Teaching methods and resources
theory, use cases, independent e-learning.

Language
French

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https://aniti.univ-toulouse.fr/

TOULOUSE TECH CERTIFICATE
DATA SCIENCE AND BIG DATA: TOOLS AND INTRODUCTION

Immersive module: software infrastructure for Big Data (MapReduce, Hadoop, Spark), learning methods (binary decision trees, neural networks, support vector machines, tree aggregation), more sophisticated stochastic algorithms (sparse optimization, non-negative matrix factorization).

Targeted skills

R programming language:

- An introduction to statistical computing using R (basic statistics, estimates and tests, one- and two-dimensional descriptive analytics).
- Use of classification tools in R

Python programming language:

- Skills in how to set up an exploratory analysis of multidimensional data, and an introduction to statistical modelling using the Python Scikit Learn library.
- Skills in how to set up an exploratory analysis of complex data and understanding of diverse supervised classification methods applied to that data (functional or high-dimensional data) using the Python Scikit Learn library.
- Skills in how to set up standard algorithms for mathematical optimization (without constraints, with equality constraints), and knowledge of the algorithms used for learning.
- Theoretical knowledge of the main learning methods and practical use of those methods in Python.

Software infrastructure for big data:

- Basic knowledge of computing infrastructure for big data processing.
- Ability to design a processing application with Spark.
- Knowledge of infrastructure virtualization techniques and ability to use virtualized infrastructure.

Teaching staff

BOURGEOIS Florent – Teacher Researcher Toulouse INP-ENSIACET
DINH Tu - PhD candidate INP-ENSEEIHT
FILLION Anthony – post-doc ANITI, Université fédérale Toulouse Midi Pyrénées
FLOQUET Pascal – Teacher Researcher Toulouse INP-ENSIACET
GENDRE Xavier – Teacher Researcher ISAE-SUPAERO
GRATON Serge – Teacher Researcher Toulouse INP-ENSEEIHT
HAGIMONT Daniel – Teacher Researcher Toulouse INP-ENSEEIHT
JEATSA Armel - PhD candidate Toulouse INP-ENSEEIHT
LAURENT Béatrice – Teacher Researcher INSA Toulouse
RACHELSON Emmanuel – Teacher Researcher ISAE-SUPAERO
RAJHI Hela – PhD candidate Université Toulouse1 Capitole (UT1), Institut de recherche en Informatique de Toulouse (IRIT)
ROUSTANT Olivier – Teacher Researcher INSA Toulouse
SIMON Ehouarn – Teacher Researcher Toulouse INP-ENSEEIHT
SOURTY Raphaël – PhD candidate Renault Groupe, Institut de recherche en Informatique de Toulouse
TEABE Boris – Teacher Researcher Toulouse INP-ENSEEIHT

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AI AND MULTI-AGENT SYSTEMS, PLANNING, CONTROL, OPTIMIZATION

Description

Current applications in the field of IoT, Big Data, AI, etc. require the design of complex, autonomous systems which are difficult to master. In order to design these inherently heterogeneous, decentralized systems, it is helpful to focus on the interactions between the system components. This course provides expert input on the stakes related to collective AI and the methods/tools used in this field.

Learning objectives

- Understand the stakes related to AI
- Discover the key concepts of multi-agent systems
- Explore the algorithms used in collective AI
- Acquire sound knowledge of self-adaptive multi-agent systems
- Identify use cases related to: planning, control, optimization, etc.

For whom / prerequisites

- Engineers and researchers who want to innovatively design open, dynamic, heterogeneous, non-linear systems, especially in the following areas: robotics, aerospace, smart city, energy, industry 4.0, autonomous vehicles, etc.
- For the first two days, some knowledge of computer science would be helpful. For the third day, knowledge of object-oriented modelling and Java programming is recommended.

Course content

Day 1
- From complex systems to adaptive multi-agent systems

Day 2
- Engineering and design of adaptive multi-agent systems

Day 3
- In practice: setting up cooperative self-organization processes

Targeted skills

- Be able to run a collective AI project
- Apply systems engineering to the development of industrial software projects
- Implement a bottom-up approach to software development
- Develop a self-adaptive SMA prototype with the AMAK framework (day 3)

Registration

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Tel: +33 (0)5 62 25 01 20

Practical information

Course fees

2 days: €800 / person

3 days: €1,000 / person (including lunch)

30% reduction for ANITI partners

Duration

2 days: theory and engineering
+ 1 day of practical work

Dates

On request

Location

Université Toulouse III - Paul Sabatier
118 route de Narbonne - Toulouse

Number of participants

Minimum 6 - maximum: 15 people

On the agenda

Theory classes

Case studies

Getting to grips with the AMAK framework

AI AND MULTI-AGENT SYSTEMS, PLANNING, CONTROL, OPTIMIZATION

Teaching staff

- Abdelkader HAMEURLAIN
- Franck MORVAN
- Shaoyi YIN
- Riad MOKADEM

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https://aniti.univ-toulouse.fr/

INTERMEDIATE

MACHINE LEARNING TRAINING FOR DATA SCIENCE

Introduction

This training course enables the participants to reinforce their theoretical and practical knowledge in order to implement machine learning techniques for the automatic analysis of data. The main statistical methods for data analysis are presented, both for data exploration (non-supervised learning) and for prediction (supervised learning). Each method is first presented and commented on a theoretical level, and then illustrated on numerical experiments run with public datasets using R and/or python/scikit-learn software.

Learning objectives

› To know the main algorithms of automatic data analysis, and to know how to use them with R and/or python/scikit-learn.
› Recognize the type of problem that they are facing: supervised or non-supervised learning, sequential learning, reinforcement learning...;
› Choose the right algorithm to use;
› Use an R or python implementation of this algorithm.

Target participants

› Gengineers, and computer scientists who wish to reinforce or extend their theoretical background and practical knowledge on automatic data analysis by statistical learning algorithms.

For whom

› Recent graduates,
› Jobseekers and experienced employees

Course Content

DAY 1 ML introduction and unsupervised learning:
› General presentation of statistical machine learning
› Principal component analysis
› Agglomerative Hierarchical Clustering, k-means, k-medoids and variants, DBSCAN...
› Tutorials Execute successively the first tutorial and then the episodes one of each notebook: Ozone, Mars, HAR, MNIST. The segmentation of an image of Mars by clustering algorithms is specific to the first day.
› N.B. It would be too long to execute all notebooks. So you can choose then accordingly to your level and / or your field of interest. Their is a complexity progression from Ozone to MNIST

Registration

fcq@insa-toulouse.fr
Tel: +33 (0)5 61 55 92 53

Practical information

Course fees

2500 € Lunches and educational material included

10% reduction for ANITI partners

Duration

28 hours, 4 days

Dates

On request

Location

INSA,
135 Avenue de Rangueil,
31400 Toulouse

Language

English

MACHINE LEARNING TRAINING FOR DATA SCIENCE

DAY 2 Supervised learning 1/2:
- knearest neighbors
- Gaussian linear model, logistic regression, model selection
- Lasso et variants
- Support Vector Machines
- Tutorials Episodes two of: Ozone, HAR, MNIST

DAY 3 Supervised learning 2/2:
- Decision Trees
- Bagging, Random Forests, Boosting
- Neural networks, deep learning
- Tutorials Episodes three of: Ozone, HAR, MNIS

DAY 4 Other ML algorithms
- Sequential learning, multi-armed bandit problems
- Super-learning and expert aggregation
- Reinforcement learning (introduction)
- TutorialsInventory Control

Targeted skills

- Redecognize the type of problem that they are facing: supervised or non-supervised learning, sequential learning, reinforcement learning...;
- Choose the right algorithm to use;
- Use an R or python implementation of this algorithm.

Course Supervisor

Philippe Besse
Professor, department Applied Mathematique department at INSA Toulouse Member of the Institut de Mathématiques Statistics & Probabilities Team (UMR CNRS 5219)

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OPTIMIZATION TOPICS FOR AI

Introduction

Artificial Intelligence is mainly about providing the best information to the right person at the right time. This almost always implies an underlying optimization process. Getting to know the optimization methods behind modern AI is therefore a crucial asset. How to find the most intelligent imaging plan for a satellite constellation, or the best dispatching of aircraft around an airport? How to minimize the number of calls to a CSM solver when looking for the perfect aircraft wing design? Why is convergence in Deep Learning such a critical issue? All these hands-on problematics will drive our discovery of optimization methods for AI.

Learning objectives

After completing this course, participants will be able to:
- Model a decision making problem as an optimization problem;
- Know the main categories of optimization algorithms for AI;
- Choose an appropriate optimization algorithm for a specific problem.

Prerequisites

- General knowledge on computer science, mathematics, and algorithmics;
- The Python programming language will be used throughout the course, but only a prior basic experience in programming is required.

For whom

- Recent graduates
- Jobseekers and experienced employees

Course Content

Introduction:
- Artificial Intelligence, Machine Learning and Optimization: what? why? how?

Gradient Descent Optimization: walking downhill:
- Interactive introduction: linear regression, linear separation;
- Overview of gradient based optimization methods;
- Hands-on: program your own gradient descent;
- Concluding remarks: why is convergence in Deep Learning such a critical issue?

Discrete optimization: solving combinatorial problems:
- Overview of discrete satisfaction and optimization methods;
- Interactive session: Branch and Bound applied to MILP and CSP;
- Hands-on: Modelling exercises;
- Challenge: the Orbit Transition Problem;
- Concluding remarks: Scaling issues, opening on metaheuristics;

Registration

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Practical information

Course fees
2300 €
5% reduction for ANITI partners

Duration
28 hours

Dates
February 2021

Location
ISAE–SUPAERO
Toulouse

Language
English

INTERMEDIATE

DATA INTEGRATION AND EXPLORATION

Introduction

Data is ubiquitous in modern economy. From flight test data to financial reports, from web-based content to scientific computation results, sources of data are heterogeneous, flow at different speeds and vary in volume. The first step in an efficient data-driven business model is the definition of a strong data integration framework, able to cover all the useful data sources, to manage them over time, to report on data quality and to efficiently explore and visualize their contents.

Learning objectives

After completing this course, participants will be able to:
- explain the key components of ETL-based data warehousing
- set up indicators on data quality and management
- perform a simple data visualization task

Prerequisites

- General knowledge on computer science
- Work experience in a professional environment

For whom

- Recent graduates
- Jobseekers and experienced employees

Course Content

Data Warehousing:
- History and recent evolutions
- Extract-Transform-Load process
- Architecture
- Key functions
- Layers

Data quality:
- Indicators
- Improvement
- Assurance
- Control

Data visualisation:
- Visual perception
- Effective graphical display
- Tools

Registration

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Practical information

Course fees
2300 €
5% reduction for ANITI partners

Duration
28 hours, 4 days

Dates
On request

Location
ISAE–SUPAERO
Toulouse

Language
English

BIG DATA PROCESSING

Introduction

Harnessing the complexity of large amounts of data is a challenge in itself. But Big Data is more than that: originally charact rized by the 3 Vs of Volume, Velocity and Variety, it often requires dedicated computing solutions, which will be explored in this module.

Learning objectives

After completing this course, participants will be able to:
implement the distribution of simple operations via the Map/Reduce principle in Spark;
- explain the difference between CPU and GPGPU computation;
- connect on a cloud computing engine (e.g. Google Cloud Platform) and launch a simple task;
- understand the usefulness of containers
- deploy a Docker container.

Prerequisites

- Engineering Degree on Computer Science or a related domain (telecommunications, etc). OR
- Engineering Degree on another subject with a major on Computer Science. OR
- Work experience on Computer science.

For whom

- Recent graduates,
- Jobseekers and experienced employees

Course Content

Distributed computing with Spark:
- History
- MapReduce paradigm
- Hadoop Stack
- Hadoop Distributed File System
- MLlib Machine Learning library

Virtualization and cloud computing:
- Different approaches to virtualization
- Economical models
- Technical benefits (snapshots, dynamic deployment and migration, failover...)
- Cloud engines (principles, deployment examples, node choices)

Docker:
- History,
- Fundamental differences w.r.t. virtualization
- Docker components
- Tools

Registration

Catherine DUVAL
catherine.duval@isae-supaero.fr
Tel: +33 (0)5 61 33 80 37

Practical information

Course fees
2300 €
30% reduction for ANITI

Duration
28 hours, 4 days

Dates
On request

Location
ISAE–SUPAERO
Toulouse

Language
English

EXPERT

MACHINE LEARNING AND DATA ANALYTICS

Introduction

Extracting knowledge and value from finite data (whether scarce or abundant) in an automated way is the goal of Machine Learning. It aims at giving computers the ability to learn -i.e. progressively improve performance on a specific task- with data, without being explicitly programmed. This module offers a hands-on approach, through practical use-cases, at the general landscape of learning algorithms and the main problems they solve.

Learning objectives

After completing this course, participants will be able to:
› Link some field problems to their formal Machine Learning counterparts;
› Know the main bottlenecks and challenges of datadriven approaches;
› Know the main categories of Machine Learning algorithms;
› Know the names and principles of key algorithms in Machine Learning;
› Know the basics of common libraries.

Prerequisites

› General knowledge on computer science
› Work experience in a professional environment

For whom

› Recent graduates;
› Jobseekers and experienced employees

Course Content

› The data analytics workflow;
› General overview of Machine Learning;
› Unsupervised Learning;
› Geometrical approaches in Supervised Learning;
› Probabilistic approaches in Supervised Learning;
› Ensemble methods;
› Anomaly detection;
› Bio-inspired ML, Neural Networks and Deep Learning;
› Feature engineering and data preprocessing.

Registration

Catherine DUVAL
catherine.duval@isae-supaero.fr
Tel: +33 (0)5 61 33 80 37

Practical information

Course fees
2300 €
5% reduction for ANITI partners

Duration
28 hours

Dates
March 2021

Location
ISAE–SUPAERO
Toulouse

Language
English

EXPERT

ADVANCED R COURSE

Description

This course is run by INSA (Institut National des Sciences Appliquées) coordinated by Université Fédérale Toulouse Midi-Pyrénées. The "Advanced R" course is aimed at anyone who has prior knowledge of the R language and wishes to reinforce their programming skills and knowledge of the language. After reviewing the fundamentals of the R language in more depth (data types and structures, operators and functions, language introspection means, etc.), we move on to functional programming, which constitutes one of the great strengths and unequalled flexibility of R. Metaprogramming (or non-standard evaluation), which we look at next, allows us to produce R code using another R code. The course ends by looking at high-performing code writing techniques, such as use of the Rcpp package offering easy interfacing of the C++ language with R code. The course includes regular exercises to allow participants to gain experience of putting the knowledge acquired into practice.

Learning objectives

- Increase your understanding of the R language
- Increase your skills in R language programming

For whom

- Engineers, computer scientists.

Prerequisites

- Basic knowledge of R. Some prior knowledge of C++ or another compiled language would be an advantage

Course content

Day 1 :

- Data structures, attributes, indexation • Vocabulary and style • Functions • Environments • Object models: S3, S4, RC • Errors and debugging

Day 2 :

Functional programming • Functionals, function operators • Metaprogramming • Code performance • Profiling • Memory • Rcpp

Targeted skills

- To be able to master and use the R language in all its dimensions.

Registration

fcq@insa-toulouse.fr
Tel: +33 (0)5 61 55 92 53

Practical information

Course fees

From €1,200, including lunches and teaching material

10% reduction for ANITI partners

Duration

2 days (14 hours)

Dates

On request

Location

INSA
135 Avenue de Rangueil,
31400 Toulouse

Language

French

ADVANCED R COURSE

Teaching staff

- **Delphine Labourdette** Design engineer in bioinformatics
LISBP (Laboratoire d'Ingénierie des Systèmes Biologiques et des Procédés / Biotechnology and processes engineering laboratory), GeT Platform engineer
- **Sergueï Sokol** Scientific computing research engineer
LISBP, Mathematics unit engineer

EXPERT

BIG DATA MANAGEMENT SYSTEMS: ARCHITECTURE, FEATURES AND SELECTION CRITERIA

Description

This course will improve the way you understand and use big data management architecture.

Learning objectives

› Understand the key concepts
› Acquire the main skills
› Make appropriate, coherent choices with regard to developments in the products offered by publishers

For whom

› Computer engineers, Data scientists, Managers, Executives

Prerequisites

› This course is aimed at people who have knowledge of data management systems.

Course content

Theory:
› Introduction to data management problems
- From File Management Systems (FMS) to Database Management Systems (DBMS)
› Parallel processing of large amounts of data
- Parallel DBMSs versus Cloud Data Management Solutions
› Integrating large amounts of heterogeneous data
- Virtual data integration systems versus multi-store-type data management systems
› Key criteria for selecting a data management system

Practice:
› Example of the concept of data-program independence
- Examples of programs via the interfaces of various data management systems (e.g. Relational DBMS, Hadoop MapReduce, Hive, Spark, etc.)
› Case study: select an appropriate data management system based on a set of specifications.

Registration

Emmanuel Bachelier
emmanuel.bachelier@univ-toulouse.fr
Tel: +33 (0)5 62 25 01 20

Practical information

Course fees
800€
30% reduction for ANITI partners

Duration
2 days (14 hours)

Dates
On request

Location
Université Toulouse III - Paul Sabatier
MFCA Entreprise

Teaching methods and resources
Number of participants: 10
The institution reserves the right to cancel the course if the minimum number of participants is not obtained.
Teaching methods: theory, use cases

Language
French

BIG DATA MANAGEMENT SYSTEMS: ARCHITECTURE, FEATURES AND SELECTION CRITERIA

Targeted skills

- Put into practice the data distribution methods used by parallel DBMSs in order to keep communication costs to a minimum and guarantee the scalability of the applications used by an organization.
- Use data management systems well in a parallel, distributed environment, for the decision-support needs of an organization.
- Select an appropriate data management system in a range of homogeneous and heterogeneous environments (single processor, parallel, distributed) to guarantee the optimal running of an organization's applications.

Teaching staff

- Abdelkader HAMEURLAIN
- Franck MORVAN
- Shaoyi YIN
- Riad MOKADEM

ANITI - Maison de la Recherche et de la valorisation - 75, cours des Sciences - 118 Route de Narbonne - 31400 Toulouse
https://aniti.univ-toulouse.fr/

SEQUENTIAL DECISION MAKING IN AI

Introduction

True AI won't come without the ability to reason and plan ahead. Super-human video game playing, Go mastery, autonomous driving, dynamical systems control, supply chain management, are examples of recent AI successes and contribute to the strength of modern approaches. While Reinforcement Learning and AI planning and scheduling techniques appear as an asset for the future of organizations, companies and industries, making efficient strategic choices require a good understanding of their foundations, mechanics, intrinsic difficulties and practice.

Learning objectives

After completing this course, participants will be able to:
› decide which method is relevant to solve a sequential decision problem;
› know the foundations of RL, path planning, scheduling and decentralized decision methods;
› know the names and principles of the most recent algorithms;
› design simple proofs of concept based on these methods.

Prerequisites

› General knowledge on computer science. Work experience in a professional environment.

For whom

› Recent graduates,
› Jobseekers and experienced employees

Course Content

Introduction

Reinforcement Learning (RL):
› Main concepts of modern Deep RL algorithms.
› Hands-on: design a learning agent for autonomous driving.
› Illustration: drone control

Scheduling:
› Main concepts of scheduling and different optimization methods and modeling frameworks.
› Hands-on: airline network optimization.
› Illustration: supply chain management

Path Planning:
› Shortest path algorithms, heuristic search, motion planning.
› Hands-on: flight planning.
› Illustration: sense-and-avoid in robotics

Registration

Catherine DUVAL
catherine.duval@isae-supaero.fr
Tel: +33 (0)5 61 33 80 37

Practical information

Course fees
2300 €
5% reduction for ANITI partners

Duration
28 hours / 4 days

Dates
May 2021

Location
ISAE–SUPAERO
Toulouse

Language
English

SEQUENTIAL DECISION MAKING IN AI

Decentralized decision making:

- Multi-agent concepts and game theory. Collaborative and adversarial decision making.
- Hands-on: multi-agent path planning

ANITI - Maison de la Recherche et de la valorisation - 75, cours des Sciences - 118 Route de Narbonne - 31400 Toulouse
https://aniti.univ-toulouse.fr/

EXPERT

AI CERTIFICATION, ROBUSTNESS AND DEPENDABILITY

Introduction

Industrial groups building critical systems are pressed to take benefit from the performance of modern AI. But in the same time they cannot be satisfied with performance only, they need to "open the black box" and understand the content, qualify their systems, anticipate the creation of norms or certification requirements. This module introduces the state of the art on an hyper but very recent field.

Learning objectives

After completing this course, participants will be able to:
› understand what can and cannot be expected in the perspective of certification or qualification of systems based on AI;
› know about the main legal initiatives on the subject;
› understand the major technology trends underlying norms on AI;
› be able to make links between the usual engineering validation processes performed and their use on AI.

Prerequisites

› Good knowledge and acceptable practice of major Learning algorithms.

For whom

› Recent graduates;
› Jobseekers and experienced employees

Course Content

› When Learning algorithms face the questions of robustness, interpretability and explainability, certificability: examples of successes and failures;
› Presentation of ongoing reflections on the evolution of norms, especially in the aerospace and automotive industries;
› The human/machine couple in the decision process;
› Are we ready to accept a reduced performance?

Registration

Catherine DUVAL
catherine.duval@isae-supaero.fr
Tel: +33 (0)5 61 33 80 37

Practical information

Course fees
2300 €
5% reduction for ANITI partners

Duration
28 hours, 4 days

Dates
June 2021

Location
ISAE–SUPAERO
Toulouse

Language
English

MAP OF LONGER COURSES
IN AI AVAILABLE AS A WORK/STUDY PROGRAMME ANITI

Level	Qualification	Main subject	Course name (studies, pathway, subject)	Reference institutions	Work/study programme Professional training contract	Contacts	For more information
		2020 academic year					
1-Cœur IA							
Bac+5	4-Master	Electronics, energy, automatic systems	Robotics: decision and command (RODECO)	UT3	M2	CADENAT Viviane Viviane.Cadenat@laas.fr	Master RODECO
Bac+5	4-Master	Computer science	Graphical Information and Image Analysis (GIIA)	UT3	M2	PAULIN Mathias mathias.paulin@irit.fr	Master IGAI
Bac+5	4-Master	Computer science	Artificial Intelligence and Pattern Recognition (AIPR)	UT3	M2	PAULIN Mathias mathias.paulin@irit.fr	Master IARF
Bac+5	4-Master	Computer science	Data and Knowledge (DK)	UT3 ENAC	M2	PAULIN Mathias mathias.paulin@irit.fr	Master DC
Bac+5	4-Master	Mathematics and applications	Applied mathematics for engineering, industry and innovation (MAPI3)	**UT3**	M2	LOUBES Jean-Michel loubes@math.univ-toulouse.fr NARSKI Jacek jacek.narski@univ-tlse3.fr	Master MAPI3
Bac+5	4-Master	Econometrics, Statistics / Mathematics and applications	Econometrics and Statistics	UT1 UT3	M2	RUIZ-GAZEN Anne Anne.Ruiz-Gazen@ut-capitole.fr	Master Statistics and econometrics
Bac+5	4-Master	Computer science / Mathematics and applications	Operational Research (OR)	UT3 ENAC INP - ENSEEIHT INSA ISAE - SUPAERO	M2	PAULIN Mathias mathias.paulin@irit.fr CONSTANTINO Francesco francesco.costantino@math.univ-toulouse.fr	Master RO
Bac+5	5-Ingénieur	Computer science	IT systems for the Air Transport sector, “Artificial Intelligence” option (2nd - 3rd year major) (ISAT-AI)	ENAC	M1+M2 (commun avec SITA ISI)	JACQUEMIN Alexis alexis.jacquemin@enac.fr	Ingénieur SITA-IA ENAC Alternance

Bac+5	5-Ingénieur	Mathematics	Core maths module for ENAC Engineers (1st - 2nd year) (ENACE)	ENAC	-	JACQUEMIN Alexis alexis.jacquemin@enac.fr	Ingénieur SITA-IA ENAC Alternance
Bac+5	5-Ingénieur	Computer Science and Networks	Distributed systems and Big data	INSA	-	fcd@insa-toulouse.fr	Ingénrieur FC Informatique et réseaux
Bac+5	ingénieur	Applied mathematics	Mathematical modelling and statistics	INSA	-	DAUXOIS Jean-Yves jean-yves.dauxois@insa-toulouse.fr	Ingénieur Math. Appli.
Bac+5	5-Ingénieur	Computer science and applied mathematics	Data and Decision Sciences (DDS) pathway	ISAE - SUPAERO	M2	contact@isae-supaero.fr	Filière Sciences des Données et de la Déci
Bac+5	5-Ingénieur	Computer science and neuroscience	Neuroscience and AI	ISAE - SUPAERO	M2	contact@isae-supaero.fr	Ingénieur ISAE SUPAERO
Bac+5	5-Ingénieur	Robotic and interactive systems	Robotic and interactive systems (RIS)	UT3 -Upssitech	5A (CP)	LERASLE Frédéric upssitech-sri.contact@univ-tlse3.fr	Systèmes Robotiques et Interactifs
Bac+5	5-Ingénieur	Computer science and applied mathematics	High Performance Computing (HPC) and Big Data (in partnership with the ENM)	INP - ENSEEIHT	5A (CP)	diplomant.fc@inp-toulouse.fr	Ingénieur Science du Numérqiue
Bac +5	5-Ingénieur	Computer Science and Telecommunications / Applied Mathematics	Modelling & Artificial Intelligence (ModAI) - combined degree - 5.5 years) *(Traineeship only - recruitment midway through the 3rd year) - 24 students*	INP - ENSEEIHT INSA	4A - 5A	modia-apprentissage@enseeiht.fr	Ingénoeur ModIA
Bac+6	4-Mastère Spécialisé	Computer Science and Applied Mathematics	Use of Big Data (UBD)	INSA INP - ENSEEIHT	5A (CP)	Conseiller Formation diplômante diplomant.fc@inp-toulouse.fr	Mastère ValDom
Certificat	L-M-D		Certificat BIG DATA	TOULOUSE TECH	(M1-M2)	certificatbigdata.tech@univ-toulouse.fr	Certificat BigData
2-Intégration IA							
Bac+5							
Bac+5	4-Master	Computer science methods applied to business administration - CSMABA	Information systems engineering for decision support (ISEDS)	UT1	M2	VALLES-PARLANGEAU Nathalie nathalie.valles-parlangeau@ut-capitole.fr	Master MIAGE ISIAD
Bac+5	4-Master	Computer science methods applied to business	Functional processes engineering (FPE)	UT1	M2	VALLES-PARLANGEAU Nathalie nathalie.valles-parlangeau@ut-capitole.fr	Master MIAGE IPM

		administration - CSMABA					
Bac+5	4-Master	Computer science methods applied to business administration - CSMABA	Data and Protection Engineering (DPE)	UT1 UT3	M1-M2	TEYSSIE Cédric Cedric.Teyssie@irit.fr	Master MIAGE IDP
Bac+5	4-Master	Mathematics and computer science applied to human and social sciences - MCSAHSS	Collaborative Computer Science for Business (CCSB))	UT2	M2	HAMID Brahim hamid@univ-tlse2.fr	Master MIASHS ICE
Bac+5	4-Master	Mathematics and computer science applied to human and social sciences - MCSAHSS	Computer Science, Statistics and Mathematics Applied to Production Management (CSSMAPM)	UT2	M1+M2	GUILLAUME Romain romain.guillaume@univ-tlse2.fr	Master MIASHS ISMAG
Bac+5	4-Master	Computer science/ Applied mathematics	Statistics and Business Intelligence (SBI-Big Data)	UT3	M2	CHOUQUET Cécile HUBERT Gilles sid@math.univ-toulouse.fr	Master SID - Big Data
Bac+5	4-Master	Applied mathematics	Research and Innovation (RI)	UT3 INSA ISAE - SUPAERO	-	CONTANTINO Francesco francesco.constantino@math.univ-toulouse.fr	
Bac+5	4-Master	Electronics, energy, automatic systems	Signals, Imaging and audio-video, medical and space applications (SIA-AMS)	UT3	M2	BERMUDES Catherine catherine.bermudes@univ-tlse3.fr	Master SIA-AMS
Bac+5	4-Master	Computer science	Ambient, Mobile and Embedded Computer Systems (AMECS)	UT3	M2	PAULIN Mathias mathias.paulin@irit.fr	Master SIAME
Bac+5	4-Master	Computer science	Software development	UT3	M2	PAULIN Mathias mathias.paulin@irit.fr	Master DL
Bac+5	4-Master	Computer science	Computer Science for Aerospace (CSA)	UT3	M2	PAULIN Mathias mathias.paulin@irit.fr	Master CSA
Bac+5	5-Ingénieur	Computer science / Applied mathematics	Data science for engineers (2nd year minor) (DATA)	ENAC	5A (CP)	JACQUEMIN Alexis alexis.jacquemin@enac.fr	Ingénieur ENAC alternance
Bac+5	5-Ingénieur	Computer science / Applied mathematics	Optimization for Air Transport (3rd year minor) (OPAT)	ENAC	5A (CP)	JACQUEMIN Alexis alexis.jacquemin@enac.fr	Ingénieur ENAC alternance
Bac+5	5-Ingénieur	Applied mathematics	Mathematical and digital modelling *(ML, optim, signal, stat)*	INSA	5A (CP)	DAUXOIS Jean-Yves jean-yves.dauxois@insa-toulouse.fr	Ingénieur Math. Appli.

Bac+5	5-Ingénieur	Computer science / Networks / Automatic systems-electronics	Critical embedded computer systems (2)	INSA	-		
Bac+5	5-Ingénieur	Computer Science and Telecommunications	Image & Multimedia	INP - ENSEEIHT	5A (CP)	diplomant.fc@inp-toulouse.fr	Ingénieur Science du numérique
Bac+5	5-Ingénieur	Computer Science and Telecommunications	Infrastructure of Big Data & IoT	INP - ENSEEIHT	5A (CP)	diplomant.fc@inp-toulouse.fr	Ingénieur Science du numérique
Bac+5	5-Ingénieur	Computer Science and Telecommunications	Software systems	INP - ENSEEIHT	5A (CP)	diplomant.fc@inp-toulouse.fr	Ingénieur Science du numérique
Bac+5	5-Ingénieur	Computer Science and Telecommunications	Embedded systems and networks	INP - ENSEEIHT	5A (CP)	diplomant.fc@inp-toulouse.fr	Ingénieur Science du numérique
Bac+5	5-Ingénieur	Computer Science and Telecommunications	Wireless Telecommunications & Connected Objects	INP - ENSEEIHT	5A (CP)	diplomant.fc@inp-toulouse.fr	Ingénieur Science du numérique
Bac+5	5-Ingénieur	Electronics, Electrical Energy & Automatic Systems	Signal and Image Processing	INP - ENSEEIHT	5A (CP)	diplomant.fc@inp-toulouse.fr	Ingénieur Electrique, Electronique
Bac+5	5-Ingénieur	Fluid Mechanics, Energetics & Environment	Digital Modelling and Simulation	INP - ENSEEIHT	5A (CP)	diplomant.fc@inp-toulouse.fr	Ingénieur Hydraulique et Mécanique des
Bac +5	5-Ingénieur	Computer science and robotics	Autonomous systems engineering	ISAE - SUPAERO	M2	contact@isae-supaero.fr	Ingénieur ISAE SUPAERO
Bac +5	5-Ingénieur	Computer science and industrial automation	Industrial engineering (3rd year pathway)	ISAE - SUPAERO	M2	contact@isae-supaero.fr	Ingénieur ISAE SUPAERO
Bac +5	5-Ingénieur	Vision and signals	Signals and systemspathway	ISAE - SUPAERO	M2	contact@isae-supaero.fr	Ingénieur ISAE SUPAERO
Bac +5	5-Ingénieur	Applied mathematics	Subject: Modelling and simulation of complex systems	ISAE - SUPAERO	M2	contact@isae-supaero.fr	Ingénieur ISAE SUPAERO
Bac+6	4-Mastère Spécialisé	Data science and digital transformation	Artificial intelligence and business transformation (AIBT)	ISAE - SUPAERO	-	info-masters@isae-supaero.fr	Mastère AIBT
Certificat	5-X		BIG DATA certificate (M1-M2)	TOULOUSE TECH	-		

CONTACT

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ANITI
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