Option Informatique

OPTION INFORMATIQUE

Modules Spécifiques
Option Informatique

INFORMATIQUE

COMPUTER SCIENCE AND COMMUNICATION

Lecturers:

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

TECHNOLOGIES INFORMATIQUES DU BIG DATA

JAVA ARCHITECTURES FOR INFORMATION SYSTEMS

Lecturers: Daniel MULLER, Mohsen ARDABILIAN, Stéphane DERRODE

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

In many scientific fields, such as biology or environmental sciences, the rapid evolution of scientific instruments, as well as the intensive use of computer simulation, has led to a significant production of data in recent years. Scientific applications are now facing new problems related to the storage and use of these large volumes of data. The problem is much the same for the management of data collected by social networks, this time with the objective of commercial optimization.

The proposed teaching will allow students to discover 3 major technologies emblematic of big-data processing

Keywords : Big Data, NoSQL, MongoDB, Hadoop, Spark, python

Programme

- 3 sessions of 2 hours each on MongoDB, Hadoop and Spark.
- 3 sessions of 4 hours of practical works on MongoDB, Hadoop and Spark.
- 1 practical work session of 2 hours on Spark MLlib.

Learning outcomes

- - Know how to manipulate No-SQL databases with MongoDB
- - Know how to write a map-reduce algorithm with Hadoop with Python, in an HDFS storage environment.
- - Know how to write a Spark algorithm with Python, in an HDFS storage environment.

Independent study

Objectifs : The pratical works are essentially in autonomy. Additional work is required to write the reports.

Méhodes :

Core texts

Assessment

The average of marks obtained on the reports of 3 practical works.

LES SYSTÈMES D'INFORMATION PAR LA PRATIQUE

SOFTWARE ENGINEERING

Lecturers: Daniel MULLER, Mohsen ARDABILIAN

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

In the job market, the information systems (IT or IT) professions are facing a shortage of talent. Finding and keeping these specific technological talents is a headache for companies around the world. The latter seek engineers capable of understanding the complexity of operations at the business, organizational and social levels, and possessing advanced technical skills. This training action aims to present with a practical approach the information systems present in companies, as well as High Availability principles and techniques.

Keywords : IS/IT (information system), ERP, IMSP (integrated management software package), ISS (security), governance, process, IS/IT architecture, HA (High Availability)

Programme

This training action completes the MOD of Business Information Systems.

Management of IS Project – 4H
Functional and applicative functions of an ERP – 4H
Technical and security management principes – 4H

Due to the complexity of ERPs, a case study of 4 hours will allow students to get a first approach on them.

Learning outcomes

- Understand the key principles behind an ERP (ERP)
- Follow a project to implement an ERP from beginning to end
- Analyse the basic principles of information systems security
- Know about HA implications.

Independent study

Objectifs :

Méhodes :

Core texts

J-L Tomas, Y. Gal., *ERP ET CONDUITE DES CHANGEMENTS.* , Dunod., 2011
J-L Deixonne. *PILOTER UN PROJET ERP.*, Dunod., 2011
F. Pinckaers, G. Gard inier. *OPENERP POUR UNE GESTION D'ENTREPRISE EFFICACE ET INTÉGRÉE.* , Eyrolles., 2008

Assessment

The final evaluation, MCQ, and the score of the case study.

INTERNET DES OBJETS ET SYSTÈMES CONCURRENTS EMBARQUÉS

INTERNET OF OBJECTS AND EMBEDDED CONCURRENT SYSTEMS

Lecturers: René CHALON, Alexandre SAIDI

| Lecturers : 12 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 8 | Project : 0.0 | Language : FR

Objectives

The Internet of Things is based on the continuous progress of microelectronic and network technologies that allow the deployment of distributed services on networks of interconnected communicating objects.

This module will first provide an overview of the Internet of Things, from the norms, standards and technologies on which it is based, to the applications and security issues.

In a second step, the students will be made aware of the notions of concurrent programming as well as of real-

Keywords : Internet of Things, Web of Things, connected devices, smart city, Ambiant Intelligence, home automation, Bluetooth, Zigbee, 6LoWPAN, PLC, Concurrent programming, Real-time computing, Embedded computing, Mobile computing

Programme

- Context, uses and fields of application of IoT: smart cities, ambient intelligence, Big Data (2h)
- Technologies of connected objects (2h)
- Security and physical safety of connected objects (2h)
- Network aspects and identification of objects (2h)
- Notions on concurrent programming, mutual exclusion mechanisms, concurrent schemes (2h)
- Requirements of real time systems and kernels, embedded and mobile computing, robotics (2h)

Learning outcomes

- Understand the field of connected objects, their technologies and applications as well as the notions of concurrency/parallelism.
- Design an application based on the exploitation of data from distributed sensors
- Simulations of concurrent systems for handling and processing data from multiple sensors

Independent study

Objectifs :

Méhodes :

Core texts

N. Bouhaï et I. Saleh , *INTERNET DES OBJETS, ÉVOLUTIONS ET INNOVATIONS*, ISTE editions, 2017
M. Yaynal *CONCURRENT PROGRAMMING: ALGORITHMS, PRINCIPLES, AND FOUNDATIONS*, Springer-Verlag, 2013
A. Burns & A. Wellings*CONCURRENT AND REAL-TIME PROGRAMMING IN ADA*, Cambridge U. Press, 2007

Assessment

Final mark = 50% Knowledge + 50% Know-how
Knowledge N1 = 100% final exam
Know-how N2 = 100% continuous assessment

APPRENTISSAGE AUTOMATIQUE

MACHINE LEARNING

Lecturers: Emmanuel DELLANDREA, Liming CHEN, Mohsen ARDABILIAN

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Deep learning has revolutionized an increasing number of domains, e.g., computer vision, natural language processing, games, etc. Structured learning is machine learning which aims to output data, e.g., sequences, matrix, graphs, which have components under some dependencies, e.g., words in a sentence. In this course, we aim to introduce fundamental concepts, theories and advanced techniques in deep structured learning, covering in particular sequence to sequence learning and Generative Adversarial Network (GAN). A number of practical works will be scheduled, including for instance image generation, image to text generation, text-to-image generation, style transfer, etc.

Keywords : Structured learning, recursive networks, LSTM, Attention-based models, Transformer, Bert, GAN

Programme

Sequence to sequence learning
- Recursive Network, LSTM, GRU
- Attention-based Model
- Transformer
- Language models, ELMO, BERT, GPT

Generative Adversarial Network (GAN)
- Basics
- Conditional GAN

Learning outcomes

- Understand the basic principles of deep structured learning
- Know how to implement state of the art techniques and methods, e.g., LSTM, Transformer, and GANs, for practical structured learning problems
- know how to evaluate the quality of an implemented deep structured learning method

Independent study

Objectifs :

Méhodes :

Core texts

C. M. Bishop. , *PATTERN RECOGNITION AND MACHINE LEARNING.* , Springer., 2006
Goodfellow, Y. Bengio, and A. Courvill e. *DEEP LEARNING.* , MIT Pres., 2016

Assessment

Final exam and scores of BE

VISION PAR ORDINATEUR

PROJECT

Lecturers: Mohsen ARDABILIAN, Liming CHEN

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Computer vision aims to model and automate the visual recognition process by the machine and has many applications (e.g., industrial inspection, robotic navigation, human-machine interaction, etc.). This course introduces the key concepts and techniques of the field and covers the following topics: image formation and filtering, contour detection and segmentation, local descriptors and their matching, stereovision, movement and structure estimation, detection and recognition of objects.

Keywords : Image Filtering and processing, edge detection and segmentation, local descriptors, motion tracking, stereo vision, object detection and recognition

Programme

- Introduction to Computer Vision
- Reminders on image formation and filtering, contour detection by variational techniques
- Reminders on homogeneous coordinates and geometric transformation
- Projective Geometry
- Segmentation of images and objects
- Local Feature's Descriptors and Matching
- Movement tracking and structure estimation
- Camera Calibration and Stereo Vision
- Object detection and recognition

Learning outcomes

- Understand the process of image formation and stereovision
- To be able to implement fundamental techniques to improve and process images
- Develop vision applications for the detection of simple objects

Independent study

Objectifs :

Méhodes :

Core texts

D. Forsyth, J. Ponce., *COMPUTER VISION -- A MODERN APPROACH.*, Prentice Hall., 2002
R. Szeliski. *COMPUTER VISION -- ALGORITHMS AND APPLICATIONS*, Springer, 2010
R. Hartley, A. Zisserman.*MULTIPLE VIEW GEOMETRY IN COMPUTER VISION.*, Cambridge University Press, 2004

Assessment

The final test and scores of BE

CALCUL ET MODÉLISATION GÉOMÉTRIQUE POUR L'INFORMATIQUE GRAPHIQUE

CALCUL ET MODÉLISATION GÉOMÉTRIQUE POUR L'INFORMATIQUE GRAPHIQUE

Lecturers: Mohsen ARDABILIAN

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The popularization of 3D digitization techniques has led to the development of complex digital object models. It is indeed essential to benefit from efficient and fast treatments to obtain, transmit, edit and deform quality models that are produced from raw data that may be very noisy and redundant. The purpose of this course is to introduce the notion of Geometry Processing useful for shape modeling.
In particular, we will examine the problem of generating a surface mesh as a discretization of the geometry of a 2D or 3D shape, and we will present the approaches of Computational Geometry to generate, simplify, refine and manipulate them, by relying on geometric structures. with particular properties.

Keywords : Geometry processing, mesh generation, 3D reconstruction, mesh simplification and refinement, Techniques based on Delaunay triangulation and Voronoi diagram, virtual sculpture.

Programme

Meshes:
- Definitions
- Generation of meshes, 3D reconstruction and virtual sculpture
- Simplification and refinement of meshes
- Meshes improvement, coding

Geometry Processing and Computational Geometry (CG):
- Elementary notions of CG in 2D (planar maps, graphs, triangulation, convex hull)
- Construction of convex hull in 2D: optimal algorithm (divide and conquer)

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Pascal Frey, Paul-Louis George, *MESH GENERATION*, 2nd Edition. Wiley-ISTE, 2008
Mario Botsch, Leif Kobb elt, Mark Pauly, Pierre Alliez, Bruno Levy *POLYGON MESH PROCESSING*, K Peters/CRC Press, 2011
M. de Berg, M. van Kreveld, M. Overmars, O. Schwar*COMPUTATIONAL GEOMETRY ALGORITHMS AND APPLICATIONS*, Springer-Verlag, 1997

Assessment

Final evaluation and score of the BE

APPRENTISSAGE BAYÉSIEN ET EXPLORATION DE TEXTES

BAYESIAN MACHINE LEARNING AND TEXT MINING

Lecturers: Alexandre SAIDI, Stéphane DERRODE

| Lecturers : 10 | TC : 4 | PW : 0.0 | Autonomy : 0.0 | Study : 6 | Project : 0.0 | Language : FR

Objectives

We will focus on the family of Bayesian methods, which is distinguished by its optimality in the sense of certain criteria, by its reduced cost from an algorithmic point of view and by the interpretability of its results. We will also study the solutions available to the data scientist when the learning sample is small in relation to the number of parameters to be learned, or when the learning must be done in an unsupervised manner. In terms of application, we will focus on the exploration of a textual corpus to discover, for example, new customers eligible for the sale of a service/product, to predict the feelings (opinions) of customers or to understand the behaviours that predict fraud.

Keywords : Bayesian decision theory, Unsupervised learning, Hidden Markov models, Text mining, Sentiment analysis, Chatbot, Natural Language Processing, Automatic translation.

Programme

- Bayesian decision (2h)
- Gaussian mixture model (2h)
- Hidden Markov chain (2h)
- Practical work on Bayesian learning (2h)
- Computational linguistic, NLP and practical Text Mining (8h)
- Restitution of a scientific reading by group (4h)

Learning outcomes

- Select the appropriate ML method(s) for their classification problem, considering different criteria.
- Develop programs using these methods to analyze their own data.
- Implement a processing chain to interpret texts (e.g. tweet).
- Become familiar with modern text mining techniques and tools and Read recent research papers on the topics mentioned.

Independent study

Objectifs : The students, divided into groups, will have to read and understand a scientific article on one of the subjects covered in the course. The articles will be proposed by the supervisors or by the students (after agreement with the supervisors).

Méhodes : The work will be done independently and the oral presentation will take place during a group presentation session.

Core texts

M. R. Gupta and Y. Chen, • *THEORY AND USE OF THE EM ALGORITHM*, Foundations and Trends in Signal Processing, Vol. 4(3), pp. 223–296, 2011
M. Watanabe and K. Yamaguchi *THE EM ALGORITHM AND RELATED STATISTICAL MODELS* , Statistics: Dekker series of textbooks and monographs, 2004
Michael W. Berry, Jacob Kogan*TEXT MINING: APPLICATIONS AND THEORY*, Willey, 2010

Assessment

Grade = 50% knowledge + 50% know-how
Knowledge mark = 100% final exam
Know-how mark = 50% for practical and 50% scientific paper restitution

PROJET INFORMATIQUE

PROJECT

Lecturers: Daniel MULLER, Mohsen ARDABILIAN

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

From January to the end of March, students work in teams of four on a project of their choice.
Working sessions are scheduled every Thursday morning to work on these projects.
Two reporting-sessions in January and February and a final presentation of deliverables in March are planned to assess students work.

Keywords :

Programme

From January to the end of March, students work in teams of four on a project of their choice.
Working sessions are scheduled every Thursday morning to work on these projects.
Two reporting-sessions in January and February and a final presentation of deliverables in March are planned to assess students work.

Learning outcomes

- To be able to specify, design and officer innovative projects in the digital world, in the context of increasingly complex systems.

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

Two reporting-sessions and a final presentation of the deliverables, appreciated by the sponsors, tutors and pedagogical team.

OPTION INFORMATIQUE

Filière Informatique