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UBO Université de Bretagne Occidentale

ENSTA Bretagne

IMT Atlantique

2020 Summer School

New Trends in Information Technologies

Courses Information

Name:	New Trends in Information Technologies
Teaching Institutions:	Wasaa Consortium
Location:	Brest, France
Dates:	13th -31stJanuary
Duration:	3 weeks
Course contact hours:	24 hours of academics classes, 12 hours of professional visits to industrial companies, including Thales and Naval Group, 12 hours of cultural activities, including initiation to French language.
Pre-requisites:	The program is accessible to students having completed one year in engineering sciences.
Course equivalencies:	6 European Credits (ECTS)
Language of instruction:	English

Wasaa Consortium

The six universities participating in the 2020 Summer School (UBO, UBS, ENIB, ENSTA Bretagne, IMT Atlantique and Naval Academy) are members of the Wasaa group.

Wasaa (Western Alliance for Scientific Actions with Australia) is a consortium of French higher education institutions in Western France interested in establishing partnerships with higher education institutions in South Australia. The cooperation is based on the inter-governmental agreement signed on 20 December 2016 in Adelaide between Australian Prime Minister Malcolm Turnbull and the French Defense Minister Jean-Yves Le Drian. Wasaa's objectives are to strengthen research partnerships between signatory institutions and encourage student exchanges between France and Australia.

The program has obtained the label "Creative France short program" awarded by the Embassy of France in Australia.

Instructors Information

The courses are taught by:

- Prof. Jean-Louis de Bougrenet (IMT Atlantique): Optics
- Prof. Cédric Buche (ENIB): Artificial Intelligence and Robotics
- Prof. Christine Cauvin, (UBS): Human Factors
- Prof. Dominique Duhaut (UBS): Mechatronics and Robotics
- Prof. Thierry Duval (IMT Atlantique): Virtual Reality, HCI
- Asso. Prof. Nicolas Farrugia (IMT Atlantique): Machine Learning and Neuroimaging
- Dr Sylvain Guilley (Secure IC): Trusted Computing, Mathematical Methods
- Asso. Prof. Mikael Guegan (ENIB): Optical Fibre Communications
- Asso. Prof. Sophie Le Bris (Naval Academy): Team Management
- Asso. Prof. Sorin Moga (IMT Atlantique): Physiological Sensors
- Asso. Prof. Panagiotis Papadakis (IMT Atlantique): Robotics Vision
- Asso. Prof. Benjamin Potelon (UBO): Space Communications
- Prof. Ronan Querrec (ENIB): Virtual and Augmented Reality
- Asso Prof. Jérémy Rivière (UBO): Artificial Intelligence
- Asso. Profs. Catherine Sablé and Nadia Zeini (IMT Atlantique): French Langage and Intercultural Skills
- Prof Sandrine Vaton (IMT Atlantique): Computer Sciences and Networks
- Asso. Prof. Johanne Vincent (IMT Atlantique): Cybersecurity

Materials

Students will be provided with all learning materials (including relevant reading lists) on arrival at IMT Atlantique. During the program students will have access to computing facilities, though students are advised to bring their own laptop if they have one.

Course Description and Learning Outcomes

The course will allow students to explore the latest trends in information technologies, including virtual reality, artificial intelligence, human factors, robotics, cybersecurity, optical and satellite communications.

The summer school will also be a first introduction to laboratory research work as well as a discovery of the French academic environment.

For their research project, the students will be integrated into the research laboratories of IMT Atlantique, ENSTA Bretagne UBO or ENIB where they will carry out research work in small groups (maximum 5 students) supervised by professors and PhD students.

It will finally be an opportunity for the students to discover French Language and French Culture (12 hours of courses) including a supper in a gourmet restaurant.

For the technical courses, the students will have to choose one set of three courses among 4 possible tracks:

- A- Artificial Inteligence and Robotics
- B- Virtual Reality and Augmented Reality
- C- Communication Systems
- D- Human Factors

TRACK	**A**	**B**	**C**	**D**
	Artificial Intelligence and Robotics	**Virtual and Augmented Reality**	**Communication Systems**	**Human factors**
Thursday 16 9-12	Introduction to Artificial Inteligence and Robotics 1	Initiation to Virtual and Augmented Reality 1	Principle of RF Space Communications systems 1	Introduction to Physiological Measurements 1
Friday 17 14-17	Introduction to Artificial Inteligence and Robotics 2	Initiation to Virtual and Augmented Reality 2	Principle of RF Space Communications systems 2	Introduction to Physiological Measurements 2
Monday 20 14-17	Mechatronics and RoboCup 1	Collaborative Virtual Reality 1	Introduction to Optical Communication Systems 1	Machine Learning applied to Brain Signals 1
Thursday 23 14-17	**Keynote lecture : Human Factors applied to Naval Applications Christine Chauvin**			
Friday 24 14-17	Introduction to Mobile Robots 1	Multiagent Systems and Interactive Simulation 1	Communications Cybersecurity 1	Team and Leadership Modelling 1
Tuesday 28 9-12	**Keynote lecture : Cyber Optics Jean-Louis de Bougrenet**			
Tuesday 28 14-17	Introduction to Mobile Robots 2	Multiagent Systems and Interactive Simulation 2	Communications Cybersecurity 2	Team and Leadership Modelling 2
Wednesday 29 9-12	Mechatronics and RoboCup 2	Collaborative Virtual Reality 2	Introduction to Optical Communication Systems 2	Machine Learning applied to Brain Signals 2
Wednesday 29 14-17	**Keynote lecture : Challenges in Cybersecurity Sylvain Guilley**			

Track A: Artificial Intelligence and Robotics

Title of the module	Artificial Intelligence and Robotics
Teacher	Cédric BUCHE
Institution	École Nationale d'Ingénieurs de Brest (ENIB)
Number of hours	6 hours

Presentation:

In this course, students will experience the basics of modern Artificial Intelligence (AI) applied to robotics. For labs, they will manipulate NAO robot. NAO is humanoid: two arms, two legs, eyes, ears, he can walk and talk. Two types of demonstration will be available: NAO playing soccer and PEPPER (a human-shaped robot) welcoming people.

Requirements

No requirements

Organisation:

1 hour of lecture + 4 hours of labs + 1 hour demo @ENIB/CERV

Title of the module	Introduction to Mobile Robots
Teacher	Panagiotis PAPADAKIS
Institution	IMT Atlantique
Number of hours	6 hours

Presentation:

Having revolutionized industrial manufacturing, mobile robots are being increasingly deployed alongside humans and are nowadays exploited by the tertiary sector. This course will present methods and tools used in contemporary mobile robots that are fundamental for basic perception and navigation in such environments. Depending on the actual robot skills and the assumptions for the operational environment, the course will highlight the applicability of algorithms commonly used within the Robot Operating System (ROS), notably, for localization and path planning.

Requirements

No requirements

Organisation:

6h Lectures

Title of the module	Mechatronics and RoboCup
Teacher	Dominique DUHAUT
Institution	University Bretagne Sud
Number of hours	6 hours: 3 hours lecture + 3 hours practice

Presentation:

The courses will first start with the definition of Mechatronics and Robotics.

A first part will then introduce the different skills requested to build and use robots. The second part will detail the RoboCup competition and show the state of the art in robotics today through the different leagues of RoboCup.

The practice will be two fold: first understanding how the robot is built, second programing a simple football application.

Requirements:

Practice of a programing language.

Recommended reading:

Introduction to AI Robotics Robin R. Murphy. ISBN: 9780262133838

Track B: Virtual Reality and Augmented Reality

Title of the module	Initiation to Virtual Reality and Augmented Reality (VR/AR)
Teacher	Ronan QUERREC
Institution	École Nationale d'Ingénieurs de Brest (ENIB)
Number of hours	6 hours

Presentation:

During this class, the basic concepts of virtual reality and augmented reality will be introduced. We will also discuss the different types of interaction and immersion devices. A small project will be done under Unity3D to implement some concepts discussed during the class. Finally, we will suggest to test different types of devices.

Requirements

No special requirement.

Organisation:

2h lecture and 4h labs

Title of the module	Multi-Agents Systems and Interactive Simulation
Teacher	Jérémy RIVIÈRE
Institution	UBO
Number of hours	6 hours

Presentation:

Describing, explaining, predicting and simulating the behaviour of natural or artificial complex systems is, for scientists, one of the major challenges of the 21st century. In this class, we will focus on the multi-agent paradigm to model and simulate complex systems. Agent-based models allow us to reproduce the behavior of a system as the result of micro level dynamics (interactions and agents' behavior), therefore understanding the mechanisms behind the properties of emergence, self-organization and self-adaptation. In order to allow a human user to tackle the complexity and comprehend/understand these mechanisms, the need for an immersive, intuitive and interactive simulation is discussed.

Requirements

Basic programming skills in object-oriented languages

Organisation:

3 hour of lecture + 3 hours of labs

Title of the module	Collaborative Virtual Reality
Teacher	Thierry DUVAL
Institution	IMT Atlantique
Number of hours	6 hours

Presentation:

During this class, we will introduce the basic concepts of Collaborative Virtual Reality (a.k.a Collaborative Virtual Environments) which aim at enabling several users to cooperate within a virtual environment. First, we will outline the requirements of such systems from the point of view of the end-users who want to collaborate in a shared virtual environment. Then we will discuss the most common metaphors used to make a user aware of the activity of the other users, and the different kinds of software and network architectures able to meet these requirements for such shared virtual environments. We will also carry-out a small project with Unity3D to implement some concepts discussed during the class, making it possible to share a virtual environment between several users distributed over a Network.

Requirements:

Basic knowledge of Object Oriented Programming in C# (or any “Java-like” language)

The course « Introduction to Virtual Reality » from Professor Ronan Querrec

Organisation: lectures VS Labs

3h lectures and 3h labs

Recommended reading:

https://docs.unity3d.com/Manual/UnityOverview.html

https://www.photonengine.com/en-us/Photon

Track C: Communication Systems

Title of the module	Introduction to Fiber-Optic Communications and Power over Fiber Systems
Teacher	Mikaël GUEGAN
Institution	École Nationale d'Ingénieurs de Brest (ENIB)
Number of hours	6 hours

Presentation:

The main goal of this class is to introduce students to the field of fibre-optic communications and to the recently developed power over fibre systems for sensors monitoring and feeding. An overview on a typical optical communication link will be presented involving the description of the main used devices such as the optical fibre characteristics, the transmitter and receiver (modem) properties. A specific focus will be made about the power over fibre systems used to transmit energy and to exchange data with a network of sensors: it is an interesting solution within the framework of hostile environments.
Mainly devoted to the dissemination of the key concepts, this course will lean on practical classes and laboratories of demonstration using a dedicated simulation tool and specific material equipment and instrumentations (optical spectrum analyser, reflectometer…).

Requirements

No special requirements as this course is mainly an introduction and dissemination about the key concepts of fibre-optic communications systems.

Organisation:

3 hour of lecture + 3 hours of labs

Title of the module	Cybersecurity Awareness
Teacher	Johanne VINCENT and Sandrine VATON
Institution	IMT Atlantique
Number of hours	6 hours

Presentation:

In the past few years, cyber-attacks have increased drastically against states, companies or the public. In this brief introduction to cybersecurity, you will learn the basic concepts of cybersecurity and will learn about the best practices in computer security.

Goals:

- Understand the motivations behind the need for security
- Understand methods and norms for security
- Learn the basic definitions and typology of threats
- Learn the best practices for both personal and professional IT
- Understand basic system and network vulnerabilities
- Introduction to cryptography
- Grasp the difficulties of implementing security mechanisms in organizations

Requirements:

- Basic knowledge in information systems
- Basic knowledge in computer networks, OS, and applications

Organisation:

6 hours of lectures

Title of the module	Principle of RF space communications systems
Teacher	Benjamin POTELON
Institution	Université de Bretagne Occidentale
Number of hours	6 hours

Presentation:

The main goal of this course is to introduce students to the field of Radio-Frequency communications and particularly microwave systems dedicated to space applications. An overview of the paradigm of microwave links will be detailed and key RF link budget issues will be introduced.
Focus will then be made on the architecture of the transmitter and receiver systems and specific features of the main components will be highlighted (antennas, filters, amplifiers, mixer).

Requirements: no specific requirements.

Organisation: lecture

Track D: Human Factors

Title of the module	Practical Machine Learning Applied to Brain Signals
Teacher	Nicholas FARRUGIA
Institution	IMT Atlantique
Number of hours	6 hours

Presentation:

This course is hands-on tutorial on machine learning applied to brain signals. We will begin by a short course on basics of scientific data analysis, including basic statistics on temporal and spatial signals, as well as basic modelling. We will directly apply these techniques to brain signals, such as functional Magnetic Resonance Imaging (fMRI) with human participants. Next, we will introduce the basics of machine learning with a practical approach using the python packages sk-learn and nilearn. Students will work on machine learning problems on open fMRI datasets, such as (A) predicting object categories from brain activity of subjects looking at pictures, (B) modelling whole brain activity of subjects watching videos, (C) predicting age from brain structure, or (D) classifying brain disorders using spontaneous brain activity.

Requirements:

Basics in Python programming

Optional: Scientific Python (Numpy – Scipy - Matplotlib)

Organisation:

6 hours of interatctive lab sessions including 2 short introductory lessons. 2x (20 min + 2h40)

Title of the module	Models of Teams and Leadership
Teacher	Sophie LE BRIS
Institution	French Naval Academy
Number of Hours	6 hours: 2 lectures of 3 hours

Presentation:

During this course, we will present the basic concepts of leadership (transformational, transactional leadership, traits of personality….) and their influence on team management. First we will introduce/outline the requirements of such an approach from the point of view of organizational resilence and reliability in particular in situations where the level of complexity, uncertainty is high (extreme contexts).

Then we will discuss, from a case study, the reasons of a leader failure leading to the disruption of a group based on a true story raising the questions: under what conditions does a team resist a "cosmological" episode, i.e. a brutal event where all the usual landmarks of the action shatter?

We will also analyse the sources of reliability through real experiments in the French Navy to implement some concepts discussed during the course, making it possible to best practices for team management.

Requirements: no specific requirement

Recommended reading:

Weick K.E. (1993) “The Collapse of Sensemaking in Organizations: the Mann Gulch Disaster”, *Administrative Science*

Title of the module	Introduction to Experimental Design with Physiological Measurement
Teacher	Sorin MOGA
Institution	IMT Atlantique
Number of hours	6 hours

Presentation:

This interactive teaching aims at introducing the different steps of an experimental plan.

- How to formulate a hypothesis based on literature basis or pragmatic conviction?
- What are the different issues when setting up an experimental plan?

Feasible measured variables in ecological situation will be identified and examples of data set and results analysis to verify hypothesis will be tackled.

We will keep a special focus on sleep studies and physiological data collection.

After presenting experimental concepts and examples, we will manipulate real time physiological measurement tools (HR, EEG and/or breath rhythm …) and students will be asked to imagine original studies on their own.

Requirements: no special requirements.

Organisation: 2 hours of lectures + 4 hours of labs

*General Timetable**

Date	AM	PM
Monday 13	Welcome Presentation of the program	Reception at City Hall Visit of Brest
Tuesday 14	Introduction to French Language 1	Visit of Thales
Wednesday 15	Visit of Naval Academy	Visit of Naval Academy
Thursday 16	Technical Course 1	Research projects presentation Visit of the CERV
Friday 17	Introduction to French Language 2	Technical Course 2
Samedi 18	Market of St-Renan	
Monday 20	Introduction to French Language 3	Technical Course 3
Tuesday 21	Research Projet	Visit of Naval Group
Wednesday 22	FabLab Open Factory (half group) or free time	FabLab Open Factory (half group) or free time
Thursday 23	Introduction to French Language 4	Keynote lecture 1
Friday 24	Research Project	Technical Course 4
Samedi 25		Abbaye of St-Mathieu
Monday 27	Introduction to French Language 4	Visit of CLS
Tuesday 28	Keynote lecture 2	Technical Course 5
Wednesday 29	Technical Course 6	Keynote lecture 3
Thursday 30	Research Project	Research Project
Friday 31	Research Project	Research Project

*The schedule may be slightly modified to take into account organizational constraints

Visits

The industrial visits will focus mainly on companies involved in the shipbuilding and defense sectors including Thales and Naval Group.

The students will also have the opportunity to visit CLS a company dedicated to innovative space-based solutions and the European Virtual Reality Centre.

From the first week they will be informed of the research project they will be able to work on during the three weeks and the defense of which will set the end of the summer school.

A dedicated half day will allow the students to discover UBO's FabLab and build their own prototype.

Another day will be dedicated to the visit of the Naval Academy located on the breathtaking site of the bay of Brest.

Cultural activities

Cultural visits will give the students a chance to discover Brest and its beautiful surroundings including:

- The bulky Ruins of the Medieval Abbey of St-Mathieu
- The historical Market of St-Renan
- Les Capucins, the historical mechanical workshops of the arsenal of Brest

During all the three weeks the students will also be proposed evening activities such as wine tasting or crêpes making as well as many social activities with French and international students.

Projects

The assignment of research projects will be based on the students' background and their professional project. It will be confirmed during the first week of the summer school.

Examples of topics that may be addressed:

- Cooperative Virtual Reality
- Fatigue and under-vigilance analysis of operators
- Underwater autonomous vehicles
- Optical and microwave devices
- Artificial intelligence, robotic vision and learning

Learning outcomes

The objective of the course is:

1) To introduce students to the diversity and attractiveness of new developments in information technologies and to raise their awareness of their impacts on industry and society.

2) To introduce them to French companies based in Australia and to acculturate them to the French higher education system.

3) To raise their awareness of research work in this field by immersing them in the research laboratories of partner universities.

Validation and Credits

Students will be required to comply with IMT Atlantique's policies regarding plagiarism and academic integrity.
Students will receive an academic record for the course as well as a certificate.
Students who meet the requirements of the three weeks will be awarded 6 credits (ECTS).

Visits: Regular participation in the proposed activities 30%
Courses: Small MCQ at the end of each course module 30%
Project: Twenty minutes of oral presentation of their project results 40%

Grade description

Excellent achievement **Participation:** ● Exceeded expectations ● Participated actively in all classes conferences and site visits; asked relevant questions ● Contributed to class with relevant information. ● Demonstrated cross cultural understanding **MCQ : 75-100%** **Project Defense:** ● Exceeded expectations ● Demonstrated above average knowledge of topic. ● Innovative: used variety of materials to convey information ● Conveyed information in clear, informative and entertaining manner. ● Presentation was engaging for classmates.	75-100%
Good achievement **Participation:** ● Participated actively in class and visits ● Was engaged ● Some participation was not clearly focused **MCQ : 50-75%** **Project Defense:** ● Presentation was interesting and engaging, but lacked some clarity and explanation ● Failed to engage the full class ● Was unable to answer some of the questions	50-75%
Fail **Participation:** ● Scarcely participated ● Showed no engagement in class ● Student was engaged in other activities during classes and visits ● Demonstrated no cross cultural understanding **MCQ < 50%** **Project Defense:** ● Presentation lacked clarity and was not engaging of fellow students in the classroom	59-0%