

# Master of Science in Informatics

M1

M2

A master  
8 tracks

INFO & MoSIG



Génie Informatique



Computer engineering classic or *apprenticeship*

CSI



Cybersecurity and computer forensics  
*apprenticeship*

MoSIG



Master of Science in Informatics at Grenoble

- Data science and Artificial intelligence (DSAI)
- Distributed computing (DC)
- Human and digital world interactions (HDWI)
- Software and hardware components engineering (SHCE)

ORCO



Operations Research, Combinatorics and Optimization

Cybersecurity



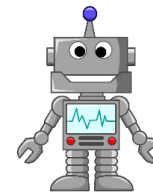
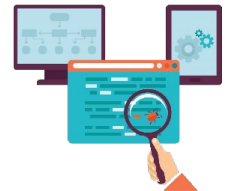
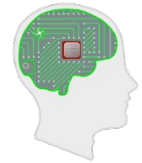
# Application process

- You have 8 choices : 4 (GI, CSI, Cyber, ORCO) + 4 MOSIG (DSAI, DC, HDWI, SHCE) and if you want to stay in this master : **you have to apply**
- 1 form for all applications : will be available April 5th
- You have to choose : 3 tracks
- mandatory for MOSIG students : You have to do at least **1 application in M2 MOSIG**
- mandatory for Informatique students : You have to do an **application in M2 GI**
- **Please rank ALL your choices in the form**
- **Dead-line : May 1st**
- **Our reply : week of May 14th or 15th**
- **The answer for your 1st choice can be : YES, NO, Waiting for 2<sup>nd</sup> semester results.**
- **If you change your mind : Inform us about your final choice : **before** July 6th**

Question and discussion about the process

# Master of Science in Informatics

- High level training in computer science
  - **Artificial Intelligence** and **data science**: machine learning technics, knowledge representation, AI architecture
  - **Distributed computing**: cloud computing, distributed systems, networking, parallel system
  - **Cybersecurity**: security, cryptography, data protection
  - **Software and hardware components**: software and hardware, quality, software engineering
  - **Human & digital world** : robotics, virtual reality, perceptions
  - **Modelisation and optimisation of complex systems**: combinatorial optimization, heuristics, problem solving Methods



# Master of Science in Informatics 2<sup>nd</sup> year

Main topics of the programs

	GI	CSI	MoSIG	ORCO	Cyber security
Artificial Intelligence and data science				DSAI	
Distributed computing				DC	
Cybersecurity					
Software and hardware components				HDWI	
Human & digital world				SHCE	
Modelisation and optimisation of complex systems					

GI : Génie Informatique

CSI : Cybersecrurité et informatique légale

MOSIG : Master of Science in Informatics at Grenoble

ORCO : Operations Research, Combinatorics and Optimization

# Organisation of 2<sup>nd</sup> year tracks

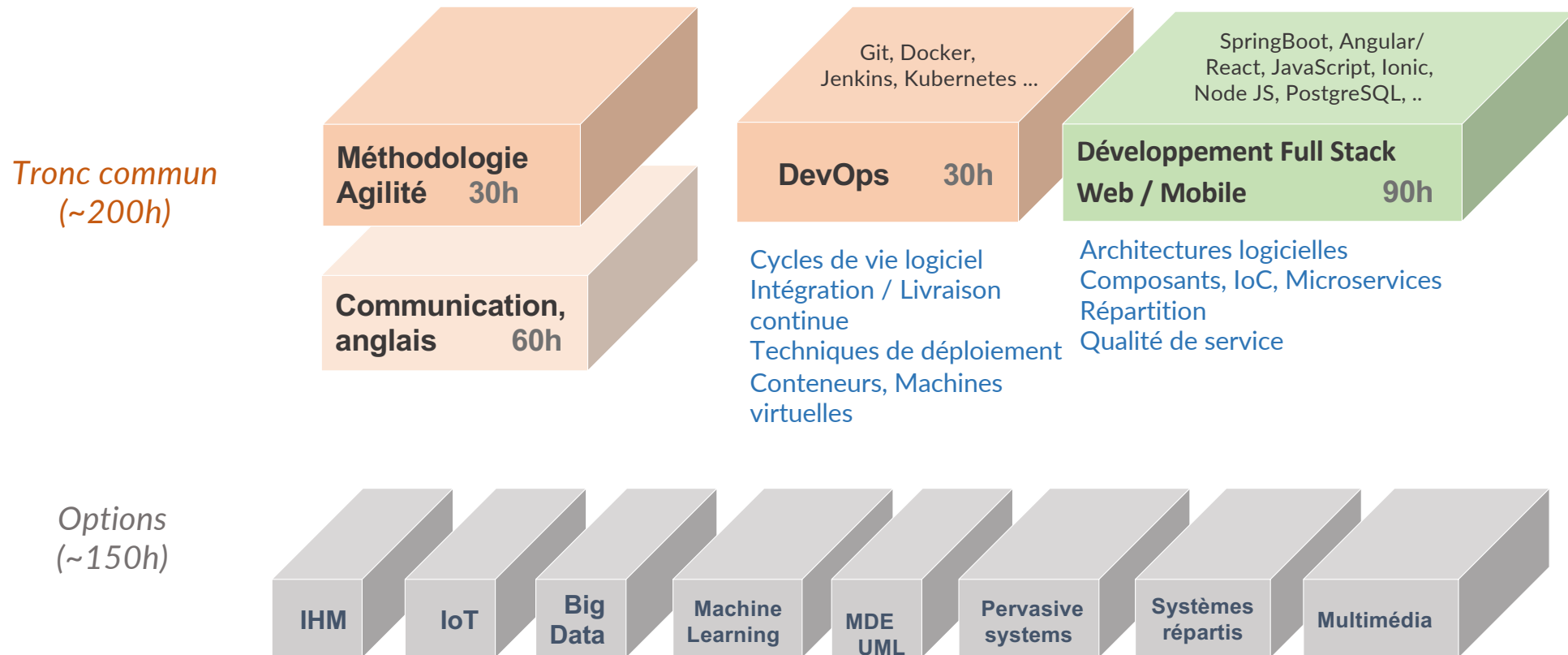
- Organization ( except GI and CSI apprenticeship)
  - 30 ects : courses 1<sup>st</sup> semester,
  - 30 ects : research or professional project, 2<sup>nd</sup> semester
- Usual calendar ( Sept.-Jan.: lectures + training, Feb.-Sept.: project / internship)
  - End Sept- Beginning Oct to mid January (year+1) : classes
  - End January : Exam
  - Master thesis defense (end of June or beginning of September)
- Presentation and specific questions about each program
  - GI in French
  - CSI in French
  - Cyber-Security
  - ORCO
  - MOSIG

# Génie Informatique (M2GI)

- Points clés
  - Formation généraliste bac+5
    - Développement logiciel (Web/Mobile)
    - Ingénierie DevOps
    - Méthodologies (Agilité)
  - Associée à des notions de base dans des domaines spécialisés
    - Big data, Machine learning, IoT, ..
  - Orientation pratique
    - Apprentissage par projets
    - Usage de technologies/platformes actuelles

# Génie Informatique (M2GI)

- Programme pédagogique





# Génie Informatique (M2GI) - Modalités



- Alternance et classique
  - Alternance :
    - Début des cours mi-septembre – soutenance mémoire fin août
    - 7 mois à 3/5ème en entreprise
    - puis 5 mois plein-temps entreprise
    - Salaire minimum 61% du Smic soit 1064,16€
  - Classique :
    - Début des cours début octobre
    - stage de 6 mois plein temps en entreprise
    - Salaire minimum 567€
- Public
  - M1 Informatique ou M1 MoSIG/ Formation Continue
  - Promotions ~ 40 à 50 étudiants (moitié alternants)
- Equipes pédagogiques mixtes
  - 60 % enseignants-chercheurs
  - 40 % intervenants industriels (Cap Gemini, Samse, Redhat, ..)

# Cybersecurity – two programs

- M2 CSI (Cyber-Sécurité et Informatique Légale)
  - 100% en alternance
  - francophone
  - orienté entreprise
  
- M2 Cybersecurity [cybersecurity.imag.fr](http://cybersecurity.imag.fr)
  - Goals: formation of experts in security and coding technologies
  - Cryptology: mathematical primitives and protocols (RSA, AES, ECC, SHA3, PKI...)
  - Security: software/hardware (network, system, integration), audit, pen-testing
  - Applications: watermarking, multimedia, smartcard, ...

# Cybersecurity and CSI - Course content

- Security architectures/ administration secure network
  - OS security, network, system, key managements, cybersecurity of industrial IT, blockchains, cloud, PKI
- Audit and treat and risk analysis
  - Methods et standards (ISO2700x, EBIOS, FAIR, etc.), Tools
- Software components and device security
  - software/hardware vulnerabilities (detection/protection), tools
- Cryptographic engineering and protocols
  - primitives and crypto protocols (principle and implementation), block-chain
- Informatique Légale (CSI)
  - cadre législatif, protection de la vie privée, investigation numérique (forensics)
- Cryptographic engineering, protocols and security models, data privacy, coding and applications (Cybersecurity)
  - post-quantum crypto, GDPR, smartphone security

# Cybersécurité - M2 CSI - Modalité

- Formation en alternance
  - 13 semaines de formation (455 heures)
  - Alternance « 1 ou 2 semaines de formation » / « 2 ou 3 semaines en entreprise »
  - Évaluation : contrôle continu intégral (« projets ») et stage en entreprise
- Public
  - ~ M1 Informatique et M1 MoSIG, Licence Pro + expérience, cursus en mathématiques, ...
  - promotions  $\leq 16$  apprentis
- Intervenants
  - 50 % enseignants-chercheurs : informatique, mathématique, automatique
  - 50 % intervenants extérieurs : experts sécurité et/ou info légale

# Cybersecurity - M2 Cybersecurity - Modality

- Public
  - M1 Informatique and M1 MoSIG, M1 Maths, M1 MathsApplis, International, ENSIMAG, PHELMA,
  - 30-40 students
- Teaching members
  - 50 % Academic : informatic, math, automatic
  - 50 % external speakers : experts security and/or forensics

# Operations Research, Combinatorics and Optimization (M2 ORCO)

- <http://orco.imag.fr>
- Operations Research : the science of better, prescriptive analytics:
  - Scientific methods to solve optimization problems in real life organizations
  - A toolbox of models and methods for solving optimization problems
  - Modeling and optimization of complex problems: sustainable issues and scientific challenges
- Combinatorial Optimization
  - Find a "best" solution among a very large set of possibilities
  - Scientific fundamental

# Operations Research, Combinatorics and Optimization – ORCO – course content

- Courses
  - 3 core courses
    - Advanced Methods in Operations Research
    - Combinatorial Optimization and Graph Theory
    - Optimization under Uncertainty
  - Elective courses (should give 12 ECTS in total):
    - Academic and Industrial Challenges (3 ECTS)? Advanced Heuristic and Approximation Algorithms (3 ECTS), Constraint Programming, Applications in Scheduling (3 ECTS), Machine Learning Fundamentals (3 ECTS), Graphs and Discrete Structures (3 ECTS), Logistics and Transport (6 ECTS), Advanced Parallel Systems (MoSIG; 6 ECTS), SAT / SMT solving (MoSIG; 3 ECTS)
    - Multi-Agent Systems (MoSIG; 3 ECTS), Non-smooth Convex Optimization Methods (MSIAM; 3 ECTS), Efficient Methods in Optimization (MSIAM; 3 ECTS), Another course in Mosig or MSIAM (up to 6 ECTS)

# Operations Research, Combinatorics and Optimization – ORCO - Modality



- Origine
  - M1
    - informatique and MoSIG,
    - Applied mathematics,
    - mathematics
  - ENSIMAG/Génie Industriel/ESISAR
  - Continuing studies
  - PhD
  - Erasmus



# M2 MoSIG

- Two semesters
  - Semester 9 – from September until February
    - About 25 lectures
  - Semester 10 – from February until end of June or end of september
    - Project 5 months (minimum)
    - Professional of Research.
    - It is allowed to go abroad (~5%)
- Semesters are validated separately
  - Semester 9 is validated if the average grade is greater than 10 and no grade is below 7

# M2 MoSIG – course content

Program MoSIG M2 2021-2026

## Software and hardware components engineering ; quality engineering, models of computation

- Test, verification and proofs for correctness, safety, security (ORCO)
- Advanced software modeling and engineering
- Embedded systems: from high-confidence design to safe execution
- Process engineering

## Distributed computing: from cloud to edge computing, embedded systems and networking

- Advanced networking
- Virtualization, cloud, micro-services
- Advanced parallel system
- System design: concurrency, real-time, stochastics, and analog/digital (1/2 mutualisée avec 3A - Ensimag)

## Data science and Artificial intelligence

- ML Fundamentals\* (MSIAM)
- Adv. Algo. in ML and DM\*(MSIAM)
- Reinforcement Learning\*(MSIAM)
- Info. Retrieval & Access (MSIAM)
- Fundamentals of Data Processing and Distributed Knowledge\*
- Knowledge Representation and Reasoning\*
- Large scale Data Management\* Distributed Systems
- Scientific Methodolgy Regulatory and ethical data usage\*
- AI & applications (choice of an even nb of UEs within 4)
- Multiagent systems
- Natural Language Processing
- Information Visualization\*
- Deep Learning for Image&Texte proc\*

## Human and digital world interactions: Robotics, augmented and virtual reality, Perception

- Robotics
- Human in the Loop  
Human Capabilities for computing  
Methods to bring the HiL
- Vision
- Augmented and virtual reality:  
innovative interaction techniques
- Computer graphics

\* Proposed in long training courses in AI of [MIAI](#) Institute

Total : 126 ECTS

# M2 MoSIG - DSAI

## Artificial Intelligence and Data-Science: DSAI

Advanced Machine Learning: Applications to Vision, Audio and Text		-> MSIAM
Natural Language Processing and Information Retrieval		-> MSIAM
Mathematical Foundations of Machine Learning		-> MSIAM
From Basic Machine Learning models to Advanced Kernel Learning		MSIAM ->
GPU computing		MSIAM ->
Statistical learning: from parametric to nonparametric models		MSIAM ->
Fundamentals of Data Processing and Distributed Knowledge		
Knowledge Representation and Reasoning		
Large scale Data-Management and Distributed systems	DC	
Scientific Methodology and Experimental Evaluation	DC	
Multi-agent systems (3 ECTS)		
Information Visualization (3 ECTS)		

# M2 MoSIG - SHCE

**Software and hardware components engineering ;  
quality engineering, models of computation: SHCE**

Advanced networking		
Advanced parallel system	SHCE	
System design: concurrency, real- time, stochastics, and analog/digital	SHCE	3A ENSIMAG
Cloud Computing, from infrastructure to applications	SHCE	
Information Security	SHCE	
SAT/SMT solving	SHCE	ORCO
Program testing and verification	SHCE	3A ENSIMAG
Large scale Data-Management and Distributed systems	DSAI, SHCE	
Scientific Methodology and Experimental Evaluation	DSAI	

# M2 MoSIG - HDWI

**Human and digital world interactions:  
robotics, augmented and virtual reality, perception: HDWI**

Augmented and virtual reality: innovative interaction techniques		
Computer graphics		
Human in the Loop		
Robotics		
Computer Vision		
Scientific Methodology and Experimental Evaluation	DSAI, DC	

# M2 MoSIG – DC

## Distributed computing: DC

Advanced software modeling and engineering		
Information Security	DC	
Process engineering		
SAT/SMT solving	DC	ORCO
Program testing and verification	DC	3A ENSIMAG
System design: concurrency, real- time, stochastics, and analog/digital	DC	
Large scale Data-Management and Distributed systems	DSAI, DC	
Cloud Computing, from infrastructure to applications	DC	
Advanced parallel systems	DC	

# M2 MoSIG - Modality

- Students origin
  - ~70% local (MoSIG M1 ~90% , M1 Info ~8%, 2% autres (Poly'tech, redoublants))
  - ~30% international (Europe ~15%; Middle East ~10%, Africa ~3%; 2% Far East);
- Objectives
  - Train specialists in AI; Robotics, vision & human interactions; Networks and operating systems; Software engineering, testing and verification => according to the 4 themes out of 7 offered by the computer science master's degree
- Jobs
  - Research (~25%)
    - Academic and industrial (CIFRE)
  - Industry (~73%)
  - An other master M2 (~2%)