



UNIVERSITÉ DE NANTES

Master 2 M2 Visual Computing (VICO)

Année universitaire 2018-2019

Information générale

Objectifs	
Responsable(s)	PEIRREIRA DA SILVA Matthieu RICORDEL VINCENT
Mention(s) incluant ce parcours	master Informatique
Lieu d'enseignement	
Langues / mobilité internationale	
Stage / alternance	
Poursuite d'études / débouchés	
Autres renseignements	
Conditions d'obtention de l'année	L'année est validée si la partie théorique est validée en première ou deuxième session (moyenne supérieure ou égale à 10/20) et si l'UE correspondant au stage est également validée avec une note supérieure ou égale à 10/20.

Programme

1 ^{er} SEMESTRE	Code	ECTS	CM	CI	TD	TP	Distanciel	Total
Groupe d'UE : S3 VICO (30 ECTS)								
Advanced image and video processing ()	923 18 MA 3 INF UE 234	6	0	28	0	14	6	48
Perceptual computing ()	923 18 MA 3 INF UE 235	6	0	28	0	14	6	48
Machine learning for computer vision ()	923 18 MA 3 INF UE 236	6	0	28	0	14	6	48
3D Computer Graphics ()	923 18 MA 3 INF UE 237	6	0	28	0	14	6	48
Multimedia Communication ()	923 18 MA 3 INF UE 238	3	0	14	0	7	3	24
Human-Computer Interaction ()	923 18 MA 3 INF UE 239	3	0	14	0	7	3	24
Groupe d'UE : Option pour non francophones (0 ECTS)								
French language and European culture ()	923 18 MA 3 INF UE 955	0	0	0	48	0	0	48
	Total	30						

2 ^{ème} SEMESTRE	Code	ECTS	CM	CI	TD	TP	Distanciel	Total
Groupe d'UE : S4 VICO (30 ECTS)								
Internship (VICO) ()	923 18 MA 4 INF UE 949	30	0	0	0	0	0	0
	Total	30						

Modalités d'évaluation

Advanced image and video processing	Nb d'ECTS	6							
			Contrôle continu			Examen			
REGIME	Session	Ecrit	Pratique	Oral	Ecrit	Pratique	Oral	Total coef	
Ordinaire	1	3	0	0	3	0	0	6	
	2	3	0	0	3	0	0	6	
Dispensé d'assiduité	1	0	0	0	6	0	0	6	
	2	0	0	0	6	0	0	6	

Perceptual computing	Nb d'ECTS	6							
			Contrôle continu			Examen			
REGIME	Session	Ecrit	Pratique	Oral	Ecrit	Pratique	Oral	Total coef	
Ordinaire	1	1	1	1	1.5	0	1.5	6	
	2	0	0	0	3	0	3	6	
Dispensé d'assiduité	1	0	0	0	3	0	3	6	
	2	0	0	0	3	0	3	6	

Continuous assessment based on presentations that will allow the evaluate the capacity of the student to write a scientific document (presentation material), his/her oral presentation skill and the quality of the work done. Final exam is an individual presentation of a scientific article that the student has to study beforehand.

Machine learning for computer vision	Nb d'ECTS	6							
			Contrôle continu			Examen			
REGIME	Session	Ecrit	Pratique	Oral	Ecrit	Pratique	Oral	Total coef	
Ordinaire	1	0	1.8	1.2	3	0	0	6	
	2	0	1.2	0	4.8	0	0	6	
Dispensé d'assiduité	1	0	0	0	6	0	0	6	
	2	0	0	0	6	0	0	6	

Continuous assessment in the form of a project that allows to judge of the capacity of developing a pattern recognition algorithm as well as the capacity to write a scientific communication material. The continuous assessment is also done through scientific articles presentations (oral skills). Written exam for the 1st and 2nd sessions.

3D Computer Graphics	Nb d'ECTS	6							
			Contrôle continu			Examen			
REGIME	Session	Ecrit	Pratique	Oral	Ecrit	Pratique	Oral	Total coef	
Ordinaire	1	0	2.4	1.2	2.4	0	0	6	
	2	0	2.4	1.2	2.4	0	0	6	
Dispensé d'assiduité	1	0	0	0	6	0	0	6	
	2	0	0	0	6	0	0	6	

Each student will make one or two presentation during the course.
Projects will imply 2 or 3 students designing an experimental application related to VR or AR.

Multimedia Communication	Nb d'ECTS	3							
			Contrôle continu			Examen			
REGIME	Session	Ecrit	Pratique	Oral	Ecrit	Pratique	Oral	Total coef	
Ordinaire	1	0	0	1.5	1.5	0	0	3	
	2	0	0	0	3	0	0	3	
Dispensé d'assiduité	1	0	0	0	3	0	0	3	
	2	0	0	0	3	0	0	3	

Session 1 - Continuous assessment for the « cryptography » part of the cours, based on scientific articles presentations. Written exam for the « image and video coding part ». Session 2 - Continuous assessment scores of first session are not reused for 2nd session. Written exam for the whole teaching unit.

Human-Computer Interaction	Nb d'ECTS	3							
			Contrôle continu			Examen			
REGIME	Session	Ecrit	Pratique	Oral	Ecrit	Pratique	Oral	Total coef	
Ordinaire	1	0.6	0.9	0.45	1.05	0	0	3	
	2	0.6	0.9	0.45	1.05	0	0	3	
Dispensé d'assiduité	1	0	0	0	3	0	0	3	
	2	0	0	0	3	0	0	3	

Each student will make one or two presentation during the course.
Projects will imply 2 or 3 students designing an experimental setting and running à small evaluation to answer an HCI related question
Written exam at the end.

French langage and European culture	Nb d'ECTS	0							
			Contrôle continu			Examen			
REGIME	Session	Ecrit	Pratique	Oral	Ecrit	Pratique	Oral	Total coef	
Ordinaire	1	0	0	0	0	0	0	0	
	2	0	0	0	0	0	0	0	
Dispensé d'assiduité	1	0	0	0	0	0	0	0	
	2	0	0	0	0	0	0	0	

Internship (VICO)	Nb d'ECTS	30						
		Contrôle continu			Examen			
REGIME	Session	Ecrit	Pratique	Oral	Ecrit	Pratique	Oral	Total coef
Ordinaire	1	7.5	15	7.5	0	0	0	30
	2	7.5	15	7.5	0	0	0	30
Dispensé d'assiduité	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0

Description des UE

923 18 MA 3 INF UE 234	Advanced image and video processing ()
Information générale générales	
Intitulé de l'unité d'enseignement	Advanced image and video processing ()
Langue d'enseignement	Anglais
Lieu d'enseignement	Polytech Nantes
Niveau	master
Semestre	3
Responsable de l'unité d'enseignement	GUEDON JEAN-PIERRE
Place de l'enseignement	
Unité(s) d'enseignement pré-requis(s)	
Parcours d'études comprenant l'unité d'enseignement	M2 Visual Computing (VICO)
Programme	
Objectifs (résultats d'apprentissage)	<p>At the end of this course, the students will be able to:</p> <ul style="list-style-type: none"> • Understand the digital objects that constitutes the basis for computation in any image field. Discrete topology theorems, algorithms for line drawing, convex shape or distance maps, morphological tools and discrete reconstruction are presented in order to be able to manage an image problem via these tools • Manipulate the discrete geometry concepts in a real applicative environment either for medical imaging (image acquisition, tomography, quantizing image information) or for image analysis (medical, materials, ...). A large set of examples is available from the teams projects and are applied with the previous concepts in real time constraints environments
Contenu	<p>Discrete geometry topics :</p> <ul style="list-style-type: none"> • Discrete topology • Discrete line, surface and volume • Mathematical morphology • Discrete measures • Discrete reconstruction <p>Image analysis applications topics:</p> <ul style="list-style-type: none"> • medical imaging • materials imaging • art imaging
Méthodes d'enseignement	
Volume horaire total	TOTAL : 42h Répartition : CM : 0h TP : 14h TD : 0h CI : 28h
Enseignement à distance	oui (6h)
Bibliographie	

923 18 MA 3 INF UE 235	Perceptual computing ()
Information générale générales	
Intitulé de l'unité d'enseignement	Perceptual computing ()
Langue d'enseignement	Anglais
Lieu d'enseignement	Polytech Nantes
Niveau	master
Semestre	3
Responsable de l'unité d'enseignement	PEIRREIRA DA SILVA Matthieu

Place de l'enseignement	
Unité(s) d'enseignement pré-requis(s)	
Parcours d'études comprenant l'unité d'enseignement	M2 Visual Computing (VICO)
Programme	
Objectifs (résultats d'apprentissage)	At the end of this course, the student will be able to design an experiment that allows him to measure some properties of the human visual system. He should be able to analyse these measure in order to create some theoretical or computational models. He / she will also be able to reuse the theoretical and practical knowledge acquired during this course in order to design and evaluate image and video processing algorithms that take into account the properties of the human visual system.
Contenu	<ol style="list-style-type: none"> 1. Visual perception: physiology and theories <ul style="list-style-type: none"> • The physics of vision and physiological basis of visual perception (retina, visual pathways, visual cortex) • Spatial vision, Color perception, Depth perception, Visual motion perception • Shape and object perception. Visual perception theories: Gestalt, Brunswik's probabilistic functionalism, neurophysiological approach, Gregory's theory, Gibson's theory, Marr's computational approach 2. Visual Experiments and modeling <ul style="list-style-type: none"> • Fundamentals of psychophysics, visual perception experiments with humans • Visual attention and eyetracking experiments, cognitive aspects 3. Applications: perceptual based processing <ul style="list-style-type: none"> • Perceptual watermarking, Video and image quality assessment, Perceptual image and video coding • 3D, stereo and autostereo applications
Méthodes d'enseignement	
Volume horaire total	TOTAL : 42h Répartition : CM : 0h TP : 14h TD : 0h CI : 28h
Enseignement à distance	oui (6h)
Bibliographie	

923 18 MA 3 INF UE 236	Machine learning for computer vision ()
Information générale générales	
Intitulé de l'unité d'enseignement	Machine learning for computer vision ()
Langue d'enseignement	Anglais
Lieu d'enseignement	Polytech Nantes
Niveau	master
Semestre	3
Responsable de l'unité d'enseignement	MOUCHERE HAROLD
Place de l'enseignement	
Unité(s) d'enseignement pré-requis(s)	
Parcours d'études comprenant l'unité d'enseignement	M2 Visual Computing (VICO)
Programme	
Objectifs (résultats d'apprentissage)	<p>At the end of this course, the student will be able to go through the different steps of a computer vision process :</p> <ul style="list-style-type: none"> - define the subtasks a complete process - choose the appropriate datasets, apply necessary preprocessings - train, optimize and use classical machine learning tools (GMM, MLP, SVM, deeplearning) - evaluate the spatial relations between objects - understand a grammar based system to parse complex objects

Contenu	<ul style="list-style-type: none"> • Data preprocessing (normalization), Feature extraction • Classification : <ul style="list-style-type: none"> - Mixture models (GMM), Bayesienne decision - Neural Networks (from MLP to deep-learning), Kernel Machines (SVM), Semi-supervised learning - Structure recognition (spatial relation analysis, 1D / 2D grammar based system, CYK parsing) - Data set properties (size, diversity, labeling cost) • Applications : <ul style="list-style-type: none"> - Offline and Online Handwriting recognition - Visual object recognition
Méthodes d'enseignement	
Volume horaire total	TOTAL : 42h Répartition : CM : 0h TP : 14h TD : 0h CI : 28h
Enseignement à distance	oui (6h)
Bibliographie	

923 18 MA 3 INF UE 237	3D Computer Graphics ()
Information générale générales	
Intitulé de l'unité d'enseignement	3D Computer Graphics ()
Langue d'enseignement	Anglais
Lieu d'enseignement	Polytech Nantes
Niveau	master
Semestre	3
Responsable de l'unité d'enseignement	PICAROUGNE FABIEN
Place de l'enseignement	
Unité(s) d'enseignement pré-requis(s)	
Parcours d'études comprenant l'unité d'enseignement	M2 Visual Computing (VICO)
Programme	
Objectifs (résultats d'apprentissage)	At the end of this course, the student must know the visual human mechanisms involved in the depth perception. He will be able to use basic lightning algorithms and basic shaders programming. The student will also be able to take a critical look to 3D application and their use: he will be able to choose the interaction devices adapted to the type of rendering used and he will be able to choose a visual representation mode adapted to the a defined task with defined interaction device.
Contenu	<ol style="list-style-type: none"> 1. Realtime 3D general concepts 2. 3D Perception <ul style="list-style-type: none"> • Visual depth perception • 3D and Interaction 3. Computer graphics <ul style="list-style-type: none"> • Overview and Basic Math for 3D programming • OpenGL, Lighting and shadowing • Introduction of Shaders programming 4 Camera calibration <ul style="list-style-type: none"> • Extrinsic and intrinsic parameters • Multi camera 5 Applications (projcet) <ul style="list-style-type: none"> • Virtual reality at scale 1:1 • Augmented Reality with dedicated peripherals
Méthodes d'enseignement	
Volume horaire total	TOTAL : 42h Répartition : CM : 0h TP : 14h TD : 0h CI : 28h
Enseignement à distance	oui (6h)
Bibliographie	

923 18 MA 3 INF UE 238	Multimedia Communication ()
Information générale générales	
Intitulé de l'unité d'enseignement	Multimedia Communication ()
Langue d'enseignement	Anglais
Lieu d'enseignement	Polytech Nantes
Niveau	master
Semestre	3
Responsable de l'unité d'enseignement	RICORDEL VINCENT
Place de l'enseignement	
Unité(s) d'enseignement pré-requis(s)	
Parcours d'études comprenant l'unité d'enseignement	M2 Visual Computing (VICO)
Programme	
Objectifs (résultats d'apprentissage)	<p>Multimedia communications require a careful design of source coding and security. For this purpose, this module gives advanced notions in Image and Video Coding, and in Cryptography.</p> <p>At the end of this course, the student will be able :</p> <p>In the Cryptography domain:</p> <ul style="list-style-type: none"> • To know the fundamental principles, theory and methods for designing data security and chaos-based data security. • To be able to design, realize and analyse a chaos-based cryptographic systems. • To know applications: Images and videos security ; Network security and Network access control ; Internet of Things (IoT) security ; Mobile security. <p>In the image and video coding domain:</p> <ul style="list-style-type: none"> • To know the fundamental principles, methods and technics of image and video compression • To describe the characteristics of the main image/video compression standards (JPEG, JPEG2000, H26X, MPEG-X video) • To implement a complete video coding/decoding chain
Contenu	<p>Cryptography:</p> <ul style="list-style-type: none"> • Pseudo-chaotic number generators • Symetric and Asymetric Ciphers • Hash Functions • Steganography Systems <p>Image and video coding :</p> <ul style="list-style-type: none"> • Principles, methods and technics of image and video compression • Image and video compression standards • Advanced image/video coding (scalability, rate-distortion optimization, coding strategy, multi-views) • Next generation of image and video coding (for immersive video formats)
Méthodes d'enseignement	
Volume horaire total	TOTAL : 21h Répartition : CM : 0h TP : 7h TD : 0h CI : 14h
Enseignement à distance	oui (3h)
Bibliographie	

923 18 MA 3 INF UE 239	Human-Computer Interaction ()
Information générale générales	
Intitulé de l'unité d'enseignement	Human-Computer Interaction ()
Langue d'enseignement	Anglais
Lieu d'enseignement	Polytech Nantes

Niveau	master
Semestre	3
Responsable de l'unité d'enseignement	PRIE YANNICK
Place de l'enseignement	
Unité(s) d'enseignement pré-requis(s)	
Parcours d'études comprenant l'unité d'enseignement	M2 Visual Computing (VICO)
Programme	
Objectifs (résultats d'apprentissage)	At the end of this course, the student will be able to design an interactive system using adequate design methods. He will be able to choose an evaluation method and to carry out the evaluation of the system. He will be able to reuse the theoretical (HCI discipline, its history, its main concepts, principles and methods) and practical knowledge acquired during this course in order to write a paper in HCI.
Contenu	<p>1- Human Computer Interaction: from intervention to UX to interaction to interfaces 2- Designing HCI: understanding situations and humans, modeling users and interaction, prototyping and iterating 3- Evaluating HCI: the many facets of HCI evaluation, from expert evaluations to experiments 4- Novel interactions: gesture, voice, touch, haptic-based interactions + AR/VR (see 3D computer graphics) 5- Project.</p> <p>10 sessions of 2 hours each, 20 hours individual work, 20 hours project work Each student will make one or two presentation during the course. Each project will imply 2 or 3 students designing an experimental setting and running a small evaluation to answer an HCI related question</p>
Méthodes d'enseignement	
Volume horaire total	TOTAL : 21h Répartition : CM : 0h TP : 7h TD : 0h CI : 14h
Enseignement à distance	oui (3h)
Bibliographie	

923 18 MA 3 INF UE 955	French language and European culture ()
Information générale générales	
Intitulé de l'unité d'enseignement	French language and European culture ()
Langue d'enseignement	Français
Lieu d'enseignement	
Niveau	master
Semestre	3
Responsable de l'unité d'enseignement	
Place de l'enseignement	
Unité(s) d'enseignement pré-requis(s)	
Parcours d'études comprenant l'unité d'enseignement	M2 Visual Computing (VICO),M2 Data Science (DS)
Programme	
Objectifs (résultats d'apprentissage)	<p>Upon completing the course in French as a foreign language, students will be able to :</p> <ul style="list-style-type: none"> • introduce themselves giving basic information about their country, family, studies • greet native speakers in an appropriate way • interact with native speakers in routine basic tasks (shopping, ordering at a restaurant) • fill in registration forms

Contenu	<p>Grammar</p> <ul style="list-style-type: none"> tenses : présent, futur proche, passé proche, the imperative questions and negations pronouns (subject and object) some irregular verbs (être, avoir, prendre, faire, aller, venir) <p>Vocabulary</p> <ul style="list-style-type: none"> days of the week, months, numbers, jobs, food items, clothes, modes of transportation, nationalities... <p>Phonetics</p> <ul style="list-style-type: none"> difficult vowel and consonant sounds liaisons <p>Culture and civilization</p> <ul style="list-style-type: none"> the outdoor market, Christmas, food and meals, the pace of life in France
Méthodes d'enseignement	
Volume horaire total	TOTAL : 48h Répartition : CM : 0h TP : 0h TD : 48h CI : 0h
Enseignement à distance	non
Bibliographie	

923 18 MA 4 INF UE 949	Internship (VICO) ()
Information générale générales	
Intitulé de l'unité d'enseignement	Internship (VICO) ()
Langue d'enseignement	Anglais
Lieu d'enseignement	Polytech Nantes
Niveau	master
Semestre	4
Responsable de l'unité d'enseignement	
Place de l'enseignement	
Unité(s) d'enseignement pré-requis(s)	
Parcours d'études comprenant l'unité d'enseignement	M2 Visual Computing (VICO)
Programme	
Objectifs (résultats d'apprentissage)	<p>At the end of the intership, the student should be able to:</p> <ol style="list-style-type: none"> 1. Identify and refine a research question or puzzle within an existing field of scientific inquiry and devise a plan for investigating it. 2. Formulate a program of reading in consultation with a professional scientist to provide context for the investigation 3. Develop a time-line for the research project and manage work to that time-line 4. Communicate research results -both orally and in writing - in a style consistent with scientific standards 5. Work as part of a research team
Contenu	During the internship, the student will conduct a research work either in a university lab or in a private companie's R&D department.
Méthodes d'enseignement	
Volume horaire total	TOTAL : 0h Répartition : CM : 0h TP : 0h TD : 0h CI : 0h
Enseignement à distance	non
Bibliographie	

