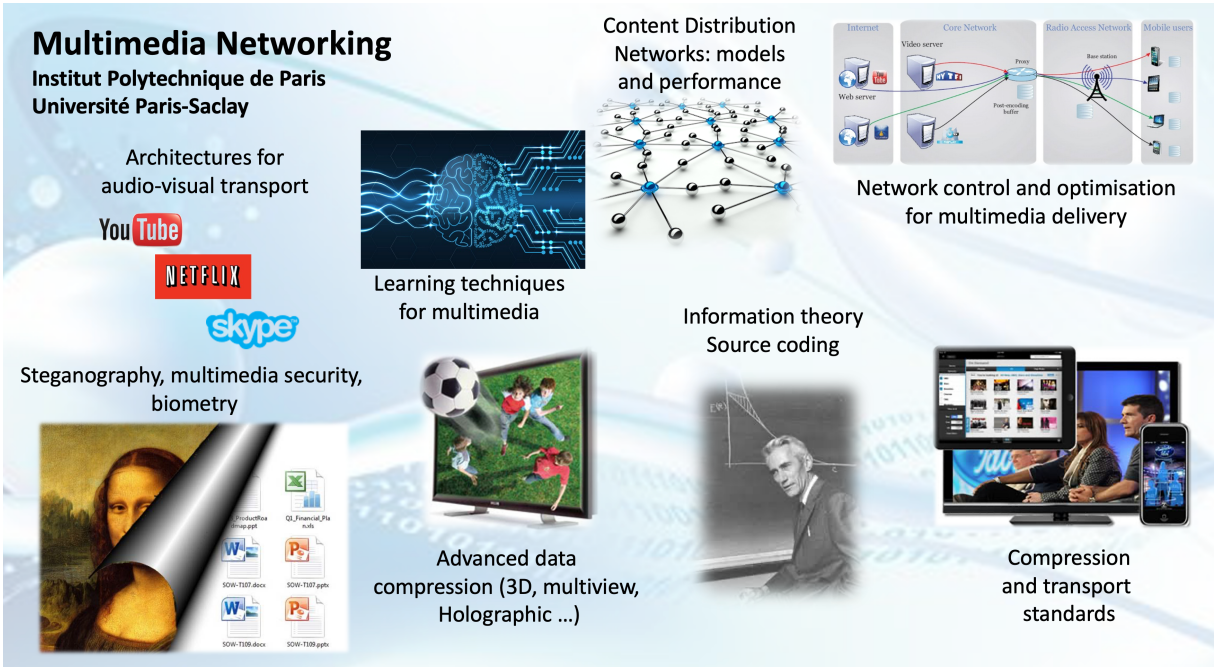

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Track name / objective	Volume	ECTS
Refreshers		
Refresher in Networking This course recalls the main notions related to internet, its architecture and its protocols.	18	0
Refresher in Probability, Random Processes, Estimation and Signal Processing Remind and reinforce knowledge from probability theory, stochastic processes, exploring Discrete Fourier Transform, Z-transform and applications to signal processing and digital filter design.	18	0
Refresher in Source Coding This course provides an introduction to information theory focused on source coding (lossless source coding, lossy source coding, transform coding). The various building blocks of actual source coders are presented (sound coder, still image coder, video coder). The notions will be explained on various source coding standards such as JPEG, JPEG 2000, H264, MPEG 2 layer 3. The labs will illustrate all theoretical concepts.	18	0
Refresher in Optimization (continuous variables and discrete optimization) This course aims at providing some basic knowledge in optimization. The theoretical tools will be recalled. Algorithms and techniques will be presented with the goal to help students identify which one is the most appropriate to the situation of interest. Some illustrative applications will be presented.	18	0
1st semester		
Mathematics of Information and Source Coding Provide solid theoretical foundations in information theory for source coding.	25 h	5
Multimedia Compression This course aims to give students an overview of the panorama of modern techniques for compressing audio-visual signals. Based on an introduction to the physiology of perception, this course shows the most recent compression techniques for sound (perceptual coders) and images (wavelet transform). The course also provides a sufficiently comprehensive introduction to video encoding to allow students to profitably follow the transport modules in the 2nd semester.	25 h	5
Content Distribution Networks: Performance and Models Define the necessary mechanisms, protocols and architectures which enable IP networks to provide the Quality of Service (QoS) that is essential for the multimedia applications support. This course also defines the technical and theoretical background required to understand the architecture and the networking mechanisms of Content Distribution Networks.	25 h	5
Multimedia Content Security: Basic Concepts This track will give the students the opportunity (1) to master the fundamental concepts and the incremental challenges related to the security of the networked media (protection, integrity, certification, traceability, forensics); (2) to initiate to the underlying scientific paradigms and (3) to have a global view on their applications in the R&D world.	25 h	5
Deep Learning for Multimedia Deep learning based approaches have recently outperformed existing techniques in a number of signal processing and multimedia applications. The availability of large sets of annotated data, powerful yet affordable GPUs and novel optimization techniques are at the core of such revolution. The present course will cover topics such as convolutional, recurrent and adversarial neural networks, the relative training procedures and the existing frameworks for deep learning. The course will focus on the application of such technologies to problems such as image classification, object segmentation, text reading and video compression.	25h	5

2nd semester		
Advanced Compression Techniques This course complements the Multimedia Compression module, introducing advanced coding techniques. Mathematical models of quality are shown, as well as vector quantization techniques. Then the most important video coding standards are analyzed in terms of mathematical tools for compression. The mathematical models are used for optimizing the encoding techniques, and for allowing rate control. Coding techniques for upcoming video formats (3D, HDR) and for a better adaptation to transmission (scalability, multiple descriptions, distributed coding) are also shown. The course ends with an overview of the techniques used for compressing 3D graphic content.	25 h	5
Audio-Visual Transport (Principles, Protocols and Advanced Techniques) Learn the fundamentals of transport techniques for audio-visual contents, Understand how these concepts are used in the transport architectures, protocols and existing formats. Experiment with these protocols and standards. Get some insights in emerging techniques and research in progress in the field.	25 h	5
Multimedia Content Security: Advanced Methods This track completes the basic aspect in security by presenting advanced techniques required when the multimedia is delivered and consumed in networks and by presenting the related standardisation framework. The interactions and synergies between basic techniques (compression-protection, watermarking-cryptography, biometry) are also presented.	25 h	5
Reinforcement Learning for Multimedia Applications In this course, the tools for modelling and estimating audio/visual streaming characteristics are provided. Control theory techniques for end-to-end regulation mechanism of content distribution on a network are illustrated.	25 h	5
Transversal activities		
Joint project and Seminars Present more advanced research topics linked to multimedia networking in general (High dynamics range imaging, Image Quality Evaluation, Multimedia Networks for Gaming, Emerging Video Encoding and Streaming standards). Present some open research directions. Help students defining their own research topics. Give the opportunity to students to apply the theoretical notions studied in at least two different courses on a practical problem. Provides an introduction to research problems.	48	5
Internship 5-6 months internship in academia or industry, in fields related to MN topics.		10