

Instructor: [Dr. Rachid Deriche](#)

Course title: [Variational methods and geometric flows for brain imaging](#)

Course schedule:

- [Thursday 24/05/2012, 09:00-14:00, Room A1](#)
- [Friday 25/05/2012, 09:00-14:00, Room A1](#)

Course description:

My course is concerned with the presentation of some advanced tools and algorithms for studying and modeling brain connectivity anatomy. It relies on state-of-the-art variational methods and geometric flows developed in computer vision and image processing for curves and surfaces and include methods of image regularization through Partial Differential Equations as well as methods of active image segmentation based on the geodesic active contours and regions framework, implemented via the level-set technique. Applied to the images of biological tissues, such as the white matter in the brain, produced in vivo and non-invasively by Diffusion Magnetic Resonance Imaging, the tools and algorithms studied in this course open the possibility of recovering a detailed geometric description of the anatomical connectivity between brain areas and distinguish the anatomical structures of the cerebral white matter.

Various applications to Brain Imaging will be presented and discussed including the estimation, regularization and segmentation of diffusion images as well as the tracking, the reconstruction and the clustering of the bundles of white matter fibers. The well-known Diffusion Tensor Model will be presented and discussed as well as more advanced High Angular Resolution Diffusion MRI models recently proposed to overcome its weakness. The lectures will be supported by some mathematical developments in the blackboard, a set of slides and some videos.

Short Bio:

Dr. Rachid Deriche is Research Director at Inria, a public science and technology institution dedicated to computational sciences, where he leads the Project-Team Athena, located at Inria Sophia Antipolis-Méditerranée Research Center (FR). His research interests include Computational Imaging of the Central Nervous System (CNS), 3D Computer Vision and Mathematical Image Processing, with a particular emphasis on the understanding and the processing of CNS anatomical connectivity through diffusion MRI and its combination with other modalities, such as functional MRI, MEG or EEG. In recent years, he has been mainly

active in developing pioneering algorithms for the analysis and clinical application of diffusion MRI data. Dr Deriche has authored and co-authored more than 250 peer reviewed papers in mathematical image processing, computer vision and computational medical imaging conferences and journals, including over 50 journal publications. Dr. Deriche is an Associate Editor of SIAM Journal on Imaging Sciences (SIIMS) and a member of the editorial board of the Computational Imaging and Vision book series. He recently served as Co-chair of ICPR 2010 Track VI on Bioinformatics and Biomedical Applications, and served for several years as Associate Editor for International Journal of Computer Vision (IJCV). He has also been an area chair for international conferences in computer vision and computational medical imaging, including ECCV, ICCV, CVPR, and MICCAI. Dr Deriche regularly gives invited plenary talks at many conferences and workshops and teaches graduate courses on Biomedical imaging, computer vision and image processing in the Master of Sciences 2: Master of Science in Computational Biology & the engineering school Telecom Sud Paris.