TITLE	3D Structure from Visual Motion: Novel Techniques in Computer Vision and Autonomous Robots (Vehicles)
PROFESSOR IN CHARGE	Prof. Matteo Matteucci matteucci@elet.polimi.it Tel. 02.2399 3470 (segreteria int. 3537)
LECTURERS	Prof. Matteo Matteucci Prof. Vincenzo Caglioti Prof. Marco Marcon Prof. Davide Migliore
MISSION AND GOALS	Present modern techniques to simultaneously estimate the unknown motion of a camera while reconstructing the 3D structure of the observed world to be applied un scientific fields such as: 3D reconstruction, autonomous robot navigation, aerial/field surveying, unmanned vehicle manoeuvring, etc.
SUBJECT AND PROGRAMME OF THE COURSE	Simultaneous estimete of the unknown motion of a camera while recontructing the 3D structure of the observed world is a challanging task that has been deeply studied (e.g., autonomous robot navigation, aerial image analysis, unmanned vehicles). The course is organised in modules: Basics in Computer Vision: introduction on projective geometry, the camera model and camera calibration, interesting points anda stable features. Structure from Motion: photogrammetry and the origins of Structure from Motion, Structure form Correspondences, live structure from motion. SLAM and Visual SLAM: Bayesian filtering and recursive state estimation, Simultaneous Lcalization and Mapping, Stereo SLAM, Monocular SLAM
TEACHING ORGANIZATION	Classic lectures by the teachers using both blackboard/whiteboard and overhead projector. Online demos and case studies will be presented
TEACHING MATERIALS	Slides and lecture notes. Thrun, Burgard, Fox. *Probabilistic Robotics* Hartley, Zisserman. *Multiple View Geometry in Computer Vision* Bibliography of selected scientific papers on the topics
LEARNING EVALUATION	There will be a final evaluation; attendees could select one of the following means of evaluation: experimental replica of the results presented in a selected paper, development of novel algorithms, state of art analysis
ACADEMIC CALENDAR AND LOCATION OF THE COURSE	21/05/2009 [14:30-18:30] Sala Seminari (DEI) - Course introduction (M. Matteucci) - Projection model and projection matrix (V. Caglioti) - Fundamental and Essential matrices (V. Caglioti) 25/05/2009 [14:30-17:30] Sala Conferenze (DEI) - Correspondence analysis: tracking and ransac (D. Migliore) 29/05/2009 [14:30-18:30] Sala Conferenze (DEI) - Motion extraction and 3D reconstruction (V. Caglioti) - Visual odometry (V. Caglioti) 03/06/2009 [09:30-13:30] Sala Seminari (DEI) - Correspondences tracking and analysis(M. Marcon) - Combined estiamation of 3D structure and camera egomotion (M.Marcon) 05/06/2009 [14:30-18:30] Sala Seminari (DEI) - Perspective ambiguity (M. Marcon) - Non rigid structure from motion and Hierarchical Shape Priors (M. Marcon) - Implicit formulation (M. Marcon) 08/06/2009 [09:30-13:30] Sala Seminari (DEI) - Bayesian filtering (M. Matteucci) - SLAM Filter implementations (M. Matteucci) 12/06/2009 [09:30-13:30] Sala Seminari (DEI) - Monocular SLAM (M. Matteucci) 15/06/2009 [09:30-13:30] Sala Seminari (DEI) - Stereo SLAM (D. Migliore) - Omnidirectional SLAM (D. Migliore) 19/06/2009 [09:30-13:30] Sala Seminari (DEI) - TBD (TBD) 22/06/2009 [09:30-13:30] Sala Seminari (DEI) - 3D without 3D: plenoptic methods, lumigraph, albedo, non Lambertian surfaces (M. Marcon)
ENROLMENT OFFICE	Prof. Matteo Matteucci matteucci@elet.polimi.it in the object write “3D Structure from Visual Motion”