3D Structure From Visual Motion

Course Aim & Organization

Simultaneous estimate of the unknown motion of a camera (or the vehicle this camera is upon) while reconstructing the 3D structure of the observed world is a challenging task that has been deeply studied in the recent literature. The PhD course on *3D Structure from Visual Motion: Novel Techniques in Computer Vision and Autonomous Robots/Vehicles* will present modern techniques to simultaneously estimate the unknown motion of a camera while reconstructing the 3D structure of the observed world to be applied in scientific fields such as: 3D reconstruction, autonomous robot navigation, aerial/field surveying, unmanned vehicle maneuvering, etc.

Course Schedule

All lectures are on:

- Friday from 15:15 to 18:15

In the following you find the detailed schedule for the course and the rooms booked for it. In

brackets you find also the lecturer for each specific topic.

- **3d Vision Basics** (9 hours)
  - 30/03/2012 (Sala conferenze - DEI): Course introduction (1h M. Matteucci)
  - 30/03/2012 (TBD): Feature extraction, matching and tracking (2h M. Matteucci)
  - 13/04/2012 (TBD): Projection model and projection matrix (3h V. Caglioti)
  - 20/04/2012 (TBD): Fundamental and Essential matrices (3h V. Caglioti)
- **Structure from Motion and Visual Odometry** (6 hours)
  - 27/04/2012 (TBD): Optical flow (1.5h M. Marcon)
  - 27/04/2012 (TBD): Combined estiamation of 3D structure and camera egomotion (1.5h M.Marcon)
  - 04/05/2012 (TBD): Motion extraction and 3D reconstruction (3h V. Caglioti)
- **Unconventional Visual Odometry** (6 hours)
  - 11/05/2012 (TBD): Uncalibrated visual odometry (1.5h V. Caglioti)
  - 11/05/2012 (TBD): Omnidirectional odometry (1.5h V. Caglioti)
  - 18/05/2012 (TBD): Stereo e Omnidirectional odometry (3h M. Matteucci)
- **Simulataneous Localization and Mapping** (3 hours)
  - 25/05/2012 (TBD): From Bayesian Filtering to SLAM (1.5h M. Matteucci)
  - 25/05/2012 (TBD): EKF-Based SLAM (1.5h M. Matteucci)
- **Visual SLAM** (6 hours)
  - 01/06/2012 (TBD): EKF-based Monocular SLAM (3h D.G. Sorrenti)
  - 08/06/2012 (TBD): Why filters? PTAM and FrameSLAM (3h M. Matteucci)
- **3D without 3D** (3 hours)
  - 15/06/2012 (TBD): Plenoptic methods, lumigraph, albedo, non Lambertian surfaces (3h M. Marcon)