Monocular SLAM from Endoscope Image Sequences

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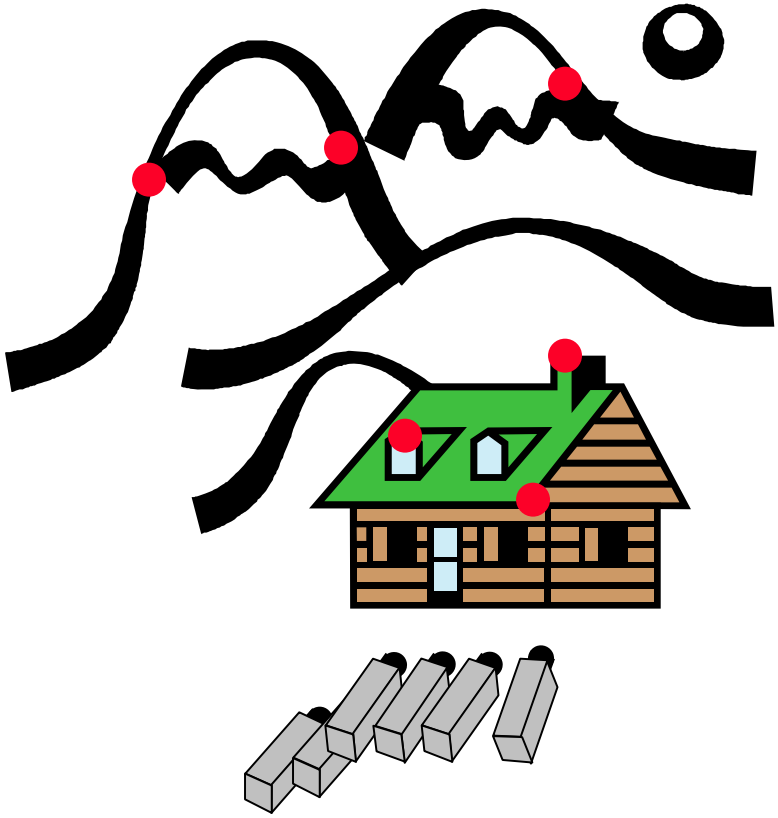
Thanks to:
• A. Güemes, M.A. Bielsa (Hospital Clínico Universitario “Lozano Blesa”, Zaragoza, Spain) and V. Muñoz (Universidad de Málaga, Spain) for the endoscope sequences.
• Imperial Collegue of London, University of Oxford and Universidad de Zaragoza for the demo software.

Monocular SLAM. Problem Statement



What is SLAM?

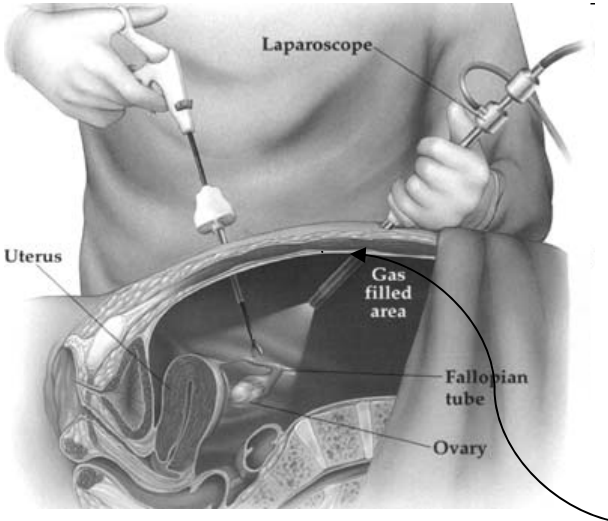
- Simultaneous sensor localization and mapping.
- A sensor in an unknown environment follows an unknown trajectory.
- Goal: Estimate, simultaneously, both the environment structure (a map of the environment) and the sensor location respect to that map.

What is monocular SLAM?

- The sensor is a monocular camera.
- The camera moves freely in 3D with 6 dof.
- Assumes that the scene is rigid and a smooth constant velocity model of the camera.
- Problem automatized thanks to automatic matching.
- EKF + JCBB + ID

ROBOTICS

Goal



State of the Art

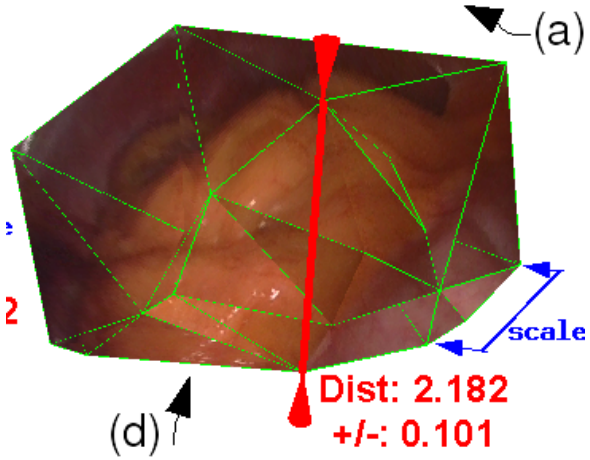
- [Morgues et al. 2001], [Stoyanov et al. 2005] 3D reconstruction from stationary stereo endoscope.
- [Mountney et al. 2006] reconstruction from a mobile stereo endoscope.
- [Burschka et al. 2005] seminal work in using discrete set of monocular images to produce 3D models
- [Wu et al. 2006] classical two view RANSAC + Bundle Adjustment applied to mannequin images.

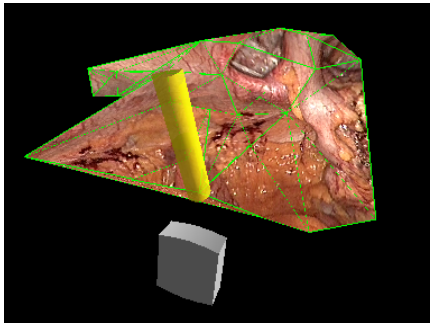
Translating camera

- **Apply monocular SLAM methods to endoscope medical images.**
- **Rotation around fulcrum produces well conditioned camera motion.**

Monocular SLAM allows...

- **Photorealistic reconstruction.**
- **Augmented reality.**
- **3D distance measurement.**





My Future Work

- **Dealing with non rigid body structures.**
- **Support sudden motions of the camera.**
- **Support motion clutter.**
- **Accuracy assessment with respect to ground truth measurements and Extensive validation over real medical imagery.**