Title (tentative): Stereo reconstruction techniques applied to surgical microscopy for on-line image navigation and fusion in neurosurgery.

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Motivation and application domain
Integration of different imaging modalities is a critical task in modern surgery. Image Guided Techniques (IGT) are used to plan, guide, and evaluate surgical procedures. The effective integration of multiple imaging modalities provides surgeons with valuable information, capable of improving the outcome of many critical surgical procedures. During tumor resection in neurosurgery two main intra-operative modalities are available: ultrasounds and microscopy.

General objectives and main activities
Accurate calibration procedures and reliable 3D reconstruction techniques need to be developed in order to integrate the imaging data coming from the surgical microscope usually employed in neurosurgery with other existing image-fusion systems already available in the operative room.

The thesis will be focused on the development and validation of such techniques applied to a stereoscopic intra-operative surgical microscope.

The developed techniques will be integrated into a new advanced image guided neurosurgical platform capable of fusing pre-operative and intra-operative information during surgery, providing them to neurosurgeons in an intuitive way. Experiments will be carried on during the thesis in order to validate the developed methods on both synthetic datasets and ex-vivo phantom data.

Training Objectives (technical/analytical tools, experimental methodologies)
- Implementation of computer vision and image processing techniques in C/C++, tailored for stereo-microscopy imaging data.
- Development of experimental setups for evaluation and testing of the developed algorithms on synthetic datasets and ex-vivo phantom data.
- Integration of the developed algorithms in an advanced neuro-navigation software platform.

Place(s) where the thesis work will be carried out: Camelot Biomedical Systems S.R.L. Via al Ponte Reale 2/24-16124 Genova

Pre-requisite abilities/skills: -Good knowledge of C/C++ and/or other object oriented programming languages.
Moderate experience in software development. -Strong interest in the field of computer vision and basic understanding of camera calibration and stereo
reconstruction techniques. Basic knowledge of biomedical image processing techniques

Maximum number of students: 1