

## REAL-TIME 3D RECONSTRUCTION: APPLICATIONS TO COLLISION DETECTION AND SURGICAL WORKFLOW MONITORING

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### Abstract:

In the last decades robots have entered the operating rooms both to assist the surgeons in performing minimally invasive procedures and to improve intra-operative medical image acquisition. Most of these robots do not perform at full speed and are often required to be telemanipulated. One of the main reasons is the safety. It is therefore important for such systems to recognize their dynamic environment and thus predict and avoid collisions. This requires us to not only reconstruct and recognize the objects within these dynamic environments, but also recover, model and monitor the workflow of each interventional and/or surgical procedure.

In this talk we present the development of our multi-camera real-time 3D reconstruction system and its applications towards the enhancement of safety within interventional environment. Three applications of this system are discussed. The first two focus on the reconstruction of the environment within an angiographic suit equipped with a robotic angiographic C-arm, e.g. Zeego produced jointly by Siemens and Kuka. In the first application, we show within our laboratory setting that the system is able to perform collision detection in real-time. The second one allows us to track every visible patch on the staff working within interventional suit and estimate the accumulated X-ray radiation exposure to each of their body parts. Finally the third application of the real-time reconstruction, which could increase the safety of the usage of robots within any surgical environment, is focusing on the recovery, modeling and monitoring of surgical environment.

### Publications:

- [1] Ladikos, C. Cagniart, R. Ghotbi, M. Reiser, N. Navab, "Estimating Radiation Exposure in Interventional Environments", Medical Image Computing and Computer-Assisted Intervention MICCAI, September 2010.
- [2] N. Padoy, D. Mateus, D. Weinland, M.O. Berger, N. Navab, "Workflow Monitoring based on 3D Motion Features" ICCV Workshop on Video-oriented Object and Event Classification, Kyoto, Japan, September 2009 (IBM Best Paper Award).
- [3] A. Bigdelou, A. Ladikos, N. Navab, "Incremental Visual Hull Reconstruction", British Machine Vision Conference (BMVC), September 2009.
- [4] A. Ladikos, S. Benhimane, N. Navab, "Real-time 3D Reconstruction for Collision Avoidance in Interventional Environments" Medical Image Computing and Computer-Assisted Intervention, MICCAI, September 2008.