Extended virtual and augmented reality for ideal oncologic surgery

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Translational Surgical Oncology
Computer-assisted Surgery

- **Diagnosis**
  - [Image of medical scans]
- **Planning**
  - [Image of medical planning]
- **Surgery**
  - [Image of surgical procedure]
Virtual Reality: Technology

VIVE

oculus

PlayStation VR
Potential of Virtual Reality in Surgery

Planning

Training

Patient Communication
Virtual 3D-Model

CT Images

Segmentation

3D-Model
Preoperative VR-Assistance
Computer-assisted Surgery

Diagnosis

Planning

Surgery
Challenges in the OR

Challenges in the OR

Navigation: Virtual Model -> Patient

Intraoperative

Preoperative
Preoperative: Biomechanical Model

• Information about the mechanical behavior of organs to compute volumetric displacements

Respiratory deformation pattern
Intraoperative Model

S. Röhl ... S. Speidel MedPhys 2012 „Dense GPU-enhanced surface reconstruction ... for intraoperative registration”
S. Speidel et al. SPIE Medical Imaging 2015 “Image-based tracking of the suturing needle during laparoscopic interventions”
D. Reichard ... S. Speidel Journal of Medical Imaging 2015 “Intraoperative on-the-fly Organ-Mosaicking for Laparoscopic Surgery”
Navigation: Virtual Model -> Patient

S. Suwelack ... S. Speidel MedPhys2014: „Physics-based shape matching for intraoperative image guidance“
Navigation: Virtual Model -> Patient

S. Suwelack ... S. Speidel MedPhys2014: „Physics-based shape matching for intraoperative image guidance“
Biomechanical soft-tissue registration

D. Reichard, ... S. Speidel IJCARS 2017 (IPCAI): „Projective biomechanical depth matching for soft-tissue registration in laparoscopic surgery”
AR Assistance: Bowel Measurement
EndoVis Challenge @MICCAI 2017

https://endovis.grand-challenge.org/