Augmented Reality (AR)-guided intraoperative Navigation

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// Introduction

Medical Image Processing
- **Increasingly important / helps to analyze medical image data**
- **Improved imaging / faster hardware enables reasonable data processing**

Medical decisions
- **Computer-aided support in all treatment stages**
- **Diagnosis, monitoring, therapy planning, execution and follow-up examinations**

Motivation for this work
- **Apply Augmented Reality to medical applications**
- **Support the intraoperative navigation**

// Augmented Reality (AR)

- Real-world is augmented by computer-generated objects
- With computer vision and object recognition AR becomes interactive
- Examples: Microsoft HoloLens, Apple's ARKit, Google Glass

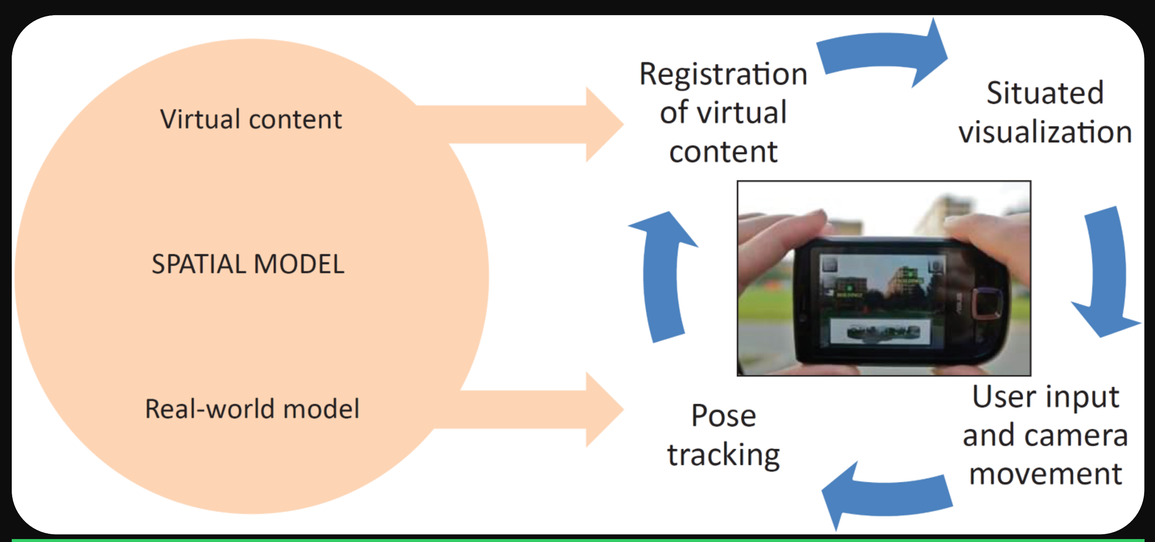

Figure 1 – AR principle: feedback loop between human user and computer system

Figure 2 – iPhone example of Apple's ARKit

// Example Applications

- Augmented Reality positioning of facial implants, like Miniplates
- Intraoperative Augmented Reality supported hip replacement
- Augmented Reality-guidance of ablation needles inside the liver
- Intraoperative Augmented Reality navigation during brain surgery

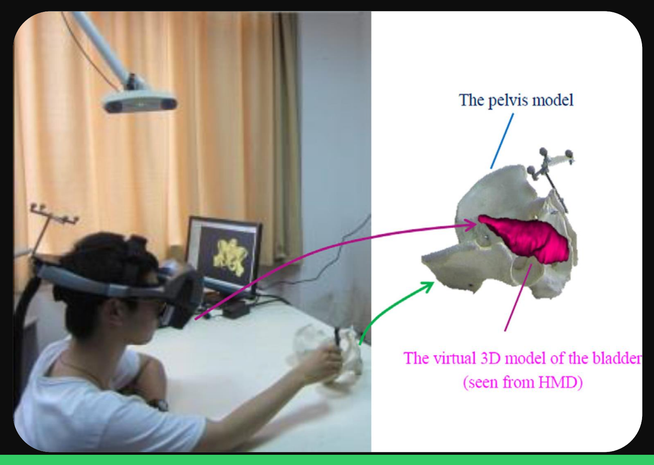

Figure 3 – AR-based surgical navigation with an 3D printed pelvis

// Tracking

- Real-time via device, e.g. iPad
- Face / head recognition
- Other body parts, like arm or leg

// Registration

- 3D model of patient scan
- Surface model of MRI or CT
- Overlaying anatomical structures
- Example: DTI fiber tracts in the brain

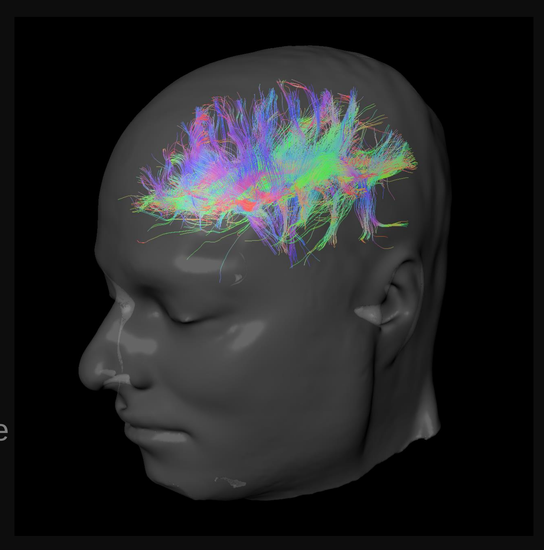

Figure 4 – Superimposing anatomical structures

// Conclusion

- Strong collaboration with clinical partners from the Medical University of Graz
- Research and development (R&D) of several clinical prototypes
- Evaluation and testing with real patient datasets from the clinical routine
- Successful completion of student projects and bachelor / master theses
- Several publications in national and international conferences and journals

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Videos and Video Tutorials

https://www.youtube.com/c/JanEgger/videos

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