VISION MEETS TELEDIAGNOSTIC ROBOTICS

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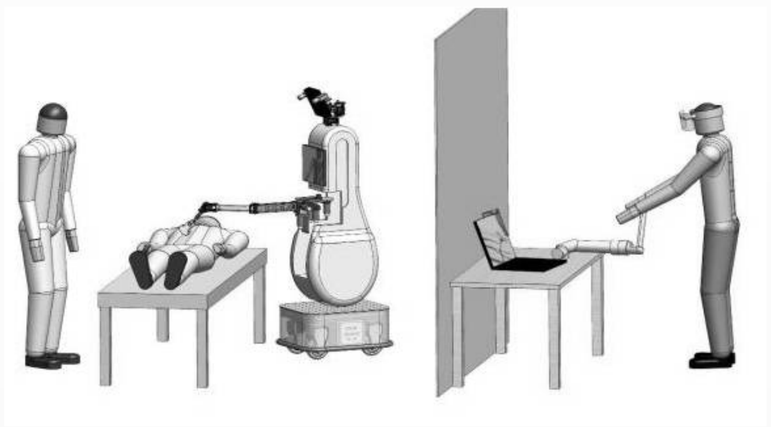
Project *ReMeDi*

- Goal: develop a tele-operated robotic system for telemedicine
- Enable doctors to remotely perform examinations such as:
  - Palpation
  - Ultrasonography
- Multifunctional robotic device at the patient side
- Mimic the real examination process through:
  - Teleconferencing
  - Haptic interfaces & force-feedback at doctor side
  - Multisensory data represent the remote environment



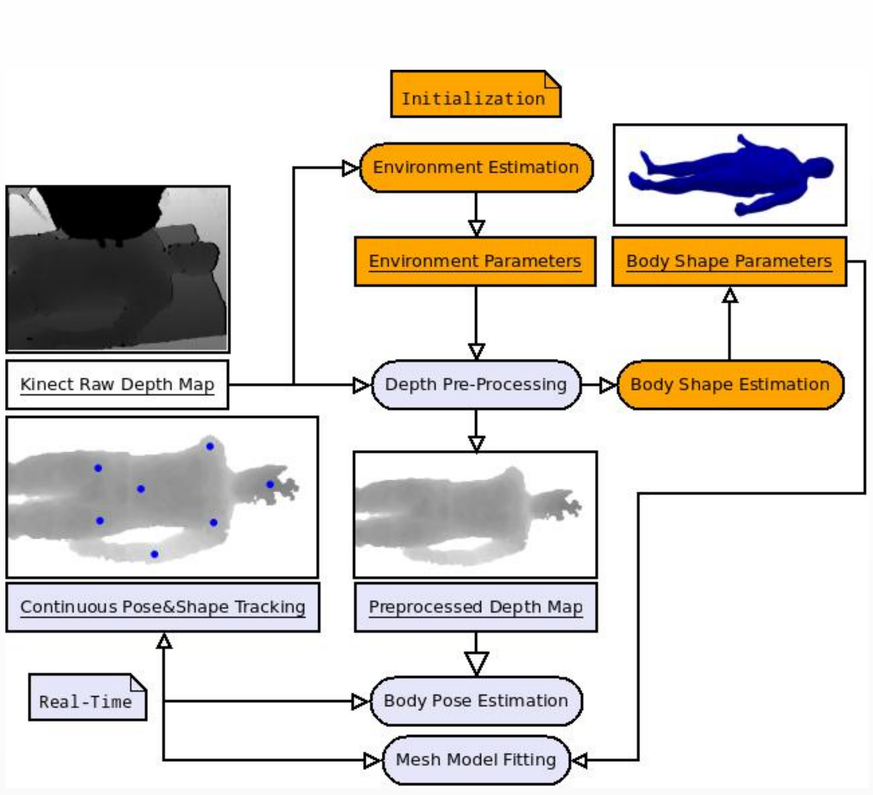
Peer et al., "Towards a remote medical diagnostician for medical examination", NextMed/MMVR21, 2014.

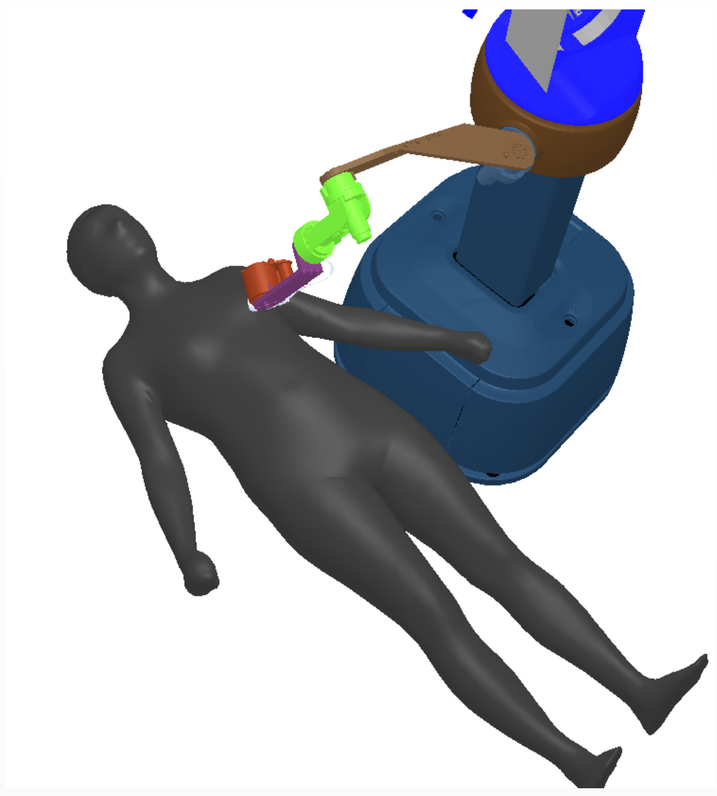
Abstract

The European FP7 project *ReMeDi* (grant 610902) aims to develop a system that allows doctors to remotely perform physical and ultrasonography examinations by teleoperating a multifunctional robotic device. In order to perceive the patient and to estimate his/her pain sentiment, the body pose as well as the patient's facial expression is recognized using CV methods. The interactive nature of the application requires the RGB-D data to be processed in real-time. Our research focus lies on developing and evaluating both efficient and robust algorithms to meet these demands.

3D Body Tracking

- Fast, random forest-based pose and shape estimation pipeline





Girshick et al., "Efficient regression of general-activity human poses from depth images", CVPR 2011

Challenges

Perceiving the patient in the examination context

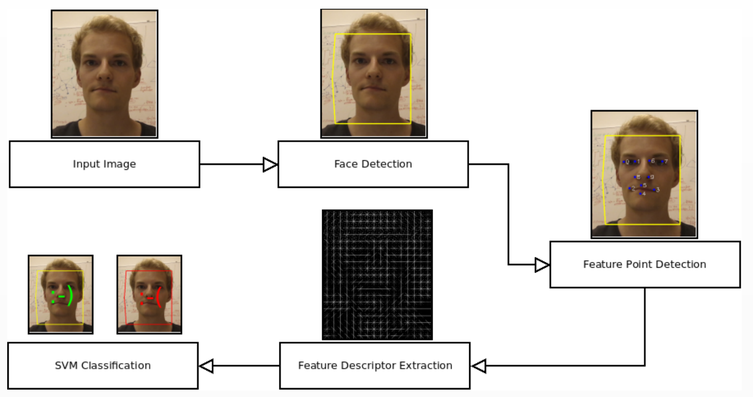
- Localize patient & estimate body pose
- Estimate patient's body shape
- Analyse & monitor facial expression

Constraints

- Kinect RGB-D sensor mounted on robot
  - Viewpoint limitations
  - Self-occlusions (robot arm)
- Real-time processing
  - Run-time efficiency
  - Limited hardware capacity on the patient's side

Facial Expressions

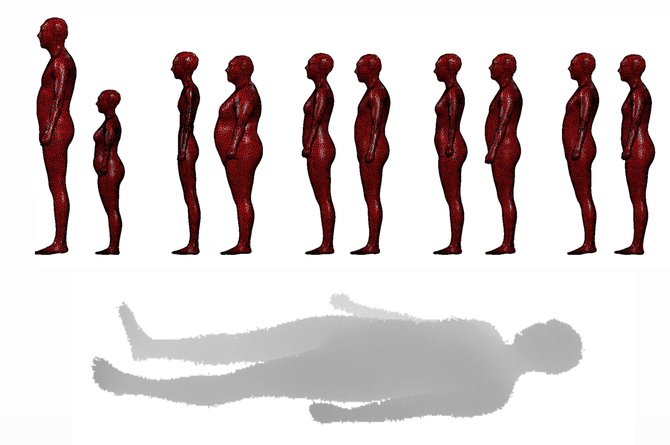
- Real time monitoring of discomfort/pain level during examination



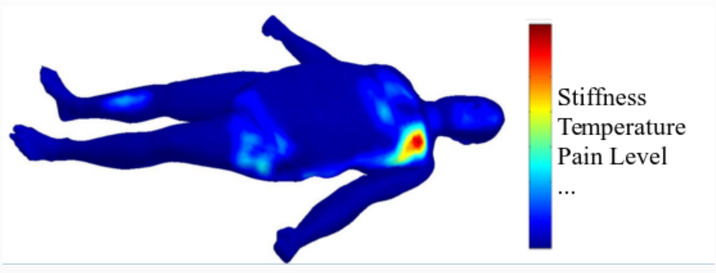
Dantone et al., "Random Forests for Real Time 3D Face Analysis", ICJV 2012

Body Shape Model

- Statistical body shape models to synthesize realistic training data



- Map measurements to 3D model for improved analysis, storage, visualization



Pishchulin et al., "Building Statistical Shape Spaces for 3D Human Modeling", arXiv:1503.05860 2015