**Master project Process**

**Initial situation**

2 – 4 cameras (low Resolution)

model puppet

OpenCV

CUDA

**Main Goal**

The main goal is to take a model puppet as an input for the 3D animation process. The movement of the puppet should be displayed in real-time on a digital 3D character to directly examine the posing. If the user is satisfied with a pose a key frame is set digitally. After the motion capture process the interpolation between those key poses result in a digital 3D animation of the digital character.

**Possible Steps**

Based on the paper *“Real-Time Marker-free Motion Capture from multiple cameras“*

1. Camera calibration
2. Silhouette recognition by background subtraction
3. 3D shape construction by combining the different camera views (voxels)
4. Ellipsoid fitting for pose recognition
5. Joint recognition
6. Joint Tracking
7. Transfer of movement on a digital character

***Termin, 30.10.17- 15:00 Uhr***

Focus on the 3D reconstruction, fitting process

- No motion

- No occlusion

Dr. Cremers (Computer Vision)

- Articulated body segmentation

- Articulated Shape reconstruction

- Pose Capture method

Research terms: articulated body segmentation, shape reconstruction, 3D reconstruction, skeleton fitting, shape fitting, 3D scanner, Dr. Cremers

**ToDo:**

3D Reconstruction (Code zur Publikation) - Shape

Research for terms!

**Research findings:**

**3D Scanning**

* RecFusion (Imfusion) RS300 Sensor
* Artec Studio
* Skanect
* KinectFusion

🡪 take a depth camera as input (kinect)

**Steps of “Pose capture” process**

1. Scan Process (3D Reconstruction)

* Depth camera
* Multiple cameras (Shape-from-Silhouette, Structure-from-Motion)
* Moving camera (Turn-table, Shape-from-Shading)
* Single camera

1. Shape Fitting

- Ellipsoid Fitting

1. Skeleton Fitting
2. Transfer on Object

***Termin, 14.11.17- 15:00 Uhr***

Focus on 3D Segmentation (Shape Fitting/Skeleton Fitting)

🡪 non-rigid parts (ICP)

Segmentation of body parts by having two different poses of one object 🡪 learn the skeleton of the object

*Paper “Recovering articulated object models from 3D Range Data”*

**ToDo:** Take a point to segment into rigid parts and find the perfect match of Transformation and point correspondences

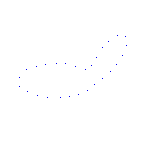
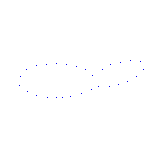
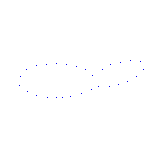
Fit? 🡪 Right segmentation (point correspondence/transformation) found, points that belong to one body part share the same transformation

Use PCL/OpenCV

***Termin, 29.11.17 – 10:00 Uhr***

Start with 2D non-rigid registration

2 Ellipses in different poses (ImageJ)



Segment parts by a point 🡪 find affine transformation of the two rigid parts (ICP)

Orient objects on its main axis (central moments), ellipsoid fitting, …

Masterthesis:

1. State of the art (non-rigid pose estimation)
2. Methods applied by myself

**ToDo:** 2D Segmentation (Research & Implementation), PCL, OpenCV setup

**LRP (Largest rigid part)**

Correspondance estimation for non-rigid point clouds with automatic part discovery

1. Find sparse correspondence (ICP)
2. Use RANSAC on corresponding points to find transformation that leads to most amount of corresponding points (which is then the LRP)
3. Enlarge cluster by taking into account points next to cluster points
4. Recursively find other body parts by starting with parts next to LRP

**Masterproject ToDo**

* Improve algorithm (points located at joints 🡪 ignore, weights, ellipse, …)
* TESTING (find test data and TEST)
* Implementation in 3D (PCL)
* Writing related work & results
* Rewrite master thesis