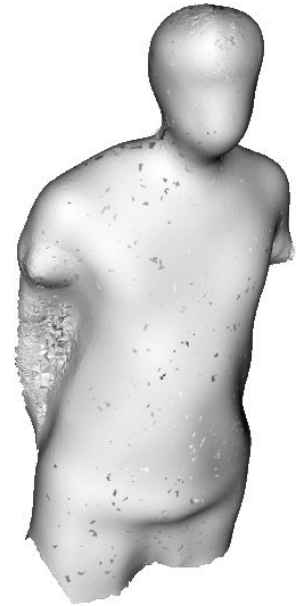




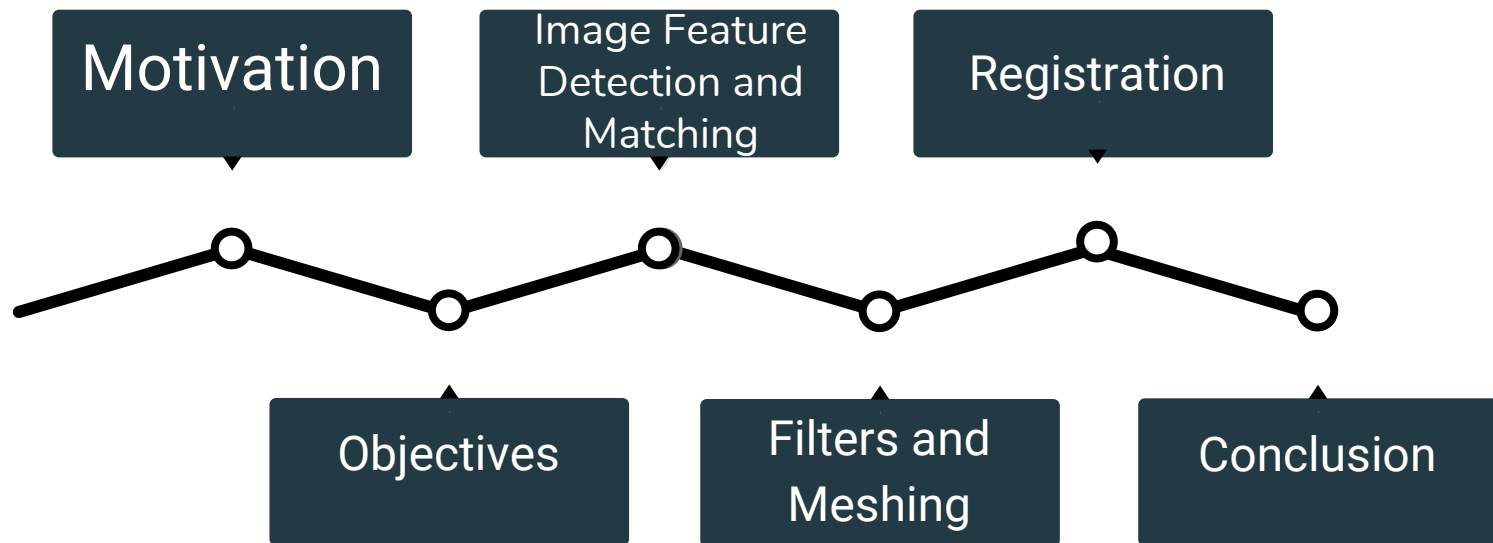
# u2.cloud



## A 3D Scanning Program in C++ for Watertight Surface Reconstruction

Brianna BURTON - Mahlet BIRHANU - Oleh KOZYNETS -  
Doiriel VANEGAS

# Outline



# Motivation

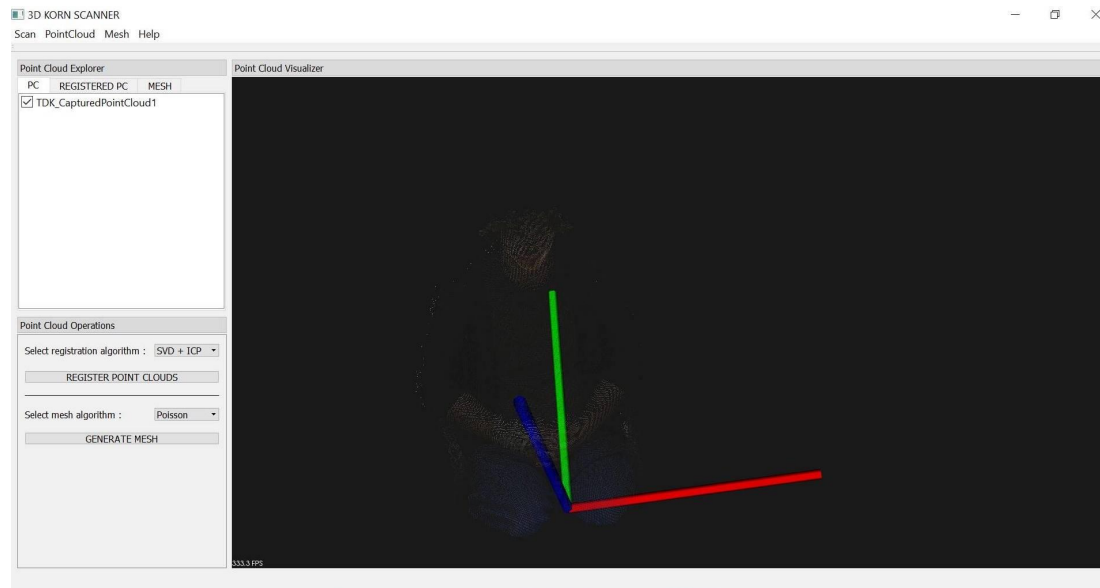
- Reconstructing a scene or object based on 3D data is a common task in computer vision.
- In the last decade, 3D digital scanning devices have become available to the public due to the reduction in price.
- Microsoft Kinect provides both color and depth data of the environment
- Registration of human body is relevant for many fields but it is often challenging and computationally expensive.



# Background Theory: Choosing a Project

## Group 1: 3D-Korn

- ✓ Best documented project
- ✓ Good class definition
- ✓ Most robust
- ✗ Poor registration and meshing
- ✗ Lots of redundant code
- ✗ Many unused and defective functions
- ✗ GUI



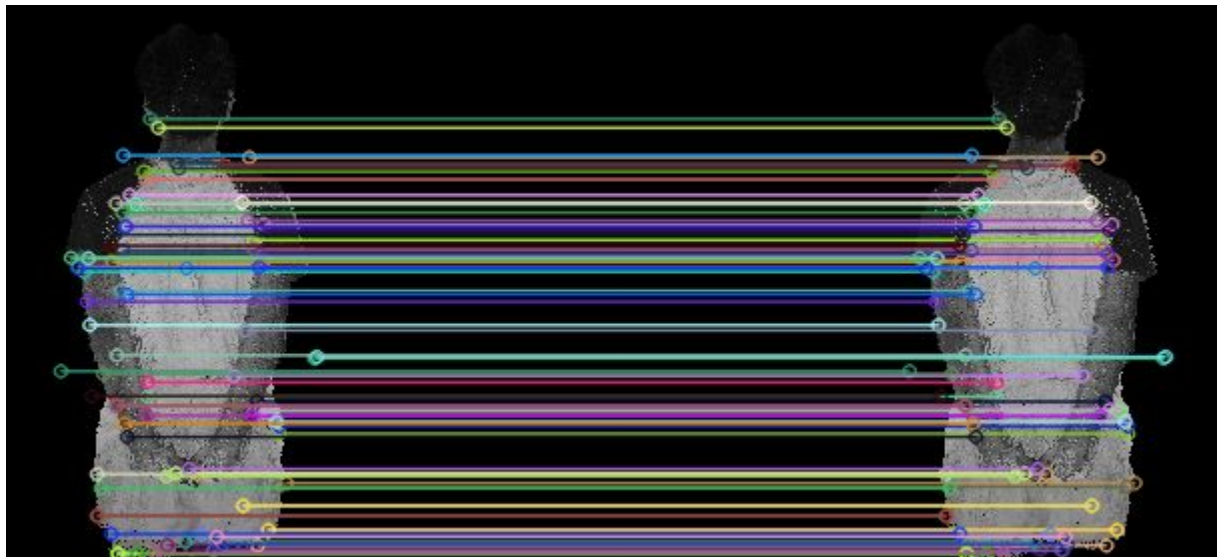
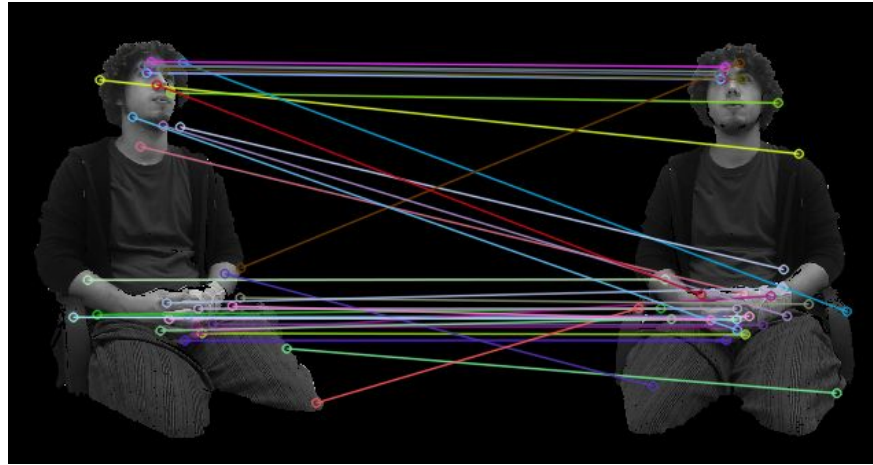
# Objectives

- 1 Improve the field of view of the sensor
- 2 Incorporate Prealignment
- 3 Implement ICP point-to-plane
- 4 Add filters and meshing algorithms
- 5 Improve GUI

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- 1 ~~Improve the field of view of the sensor~~
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# Image Feature Detection and Matching



# Image Feature Detection and Matching



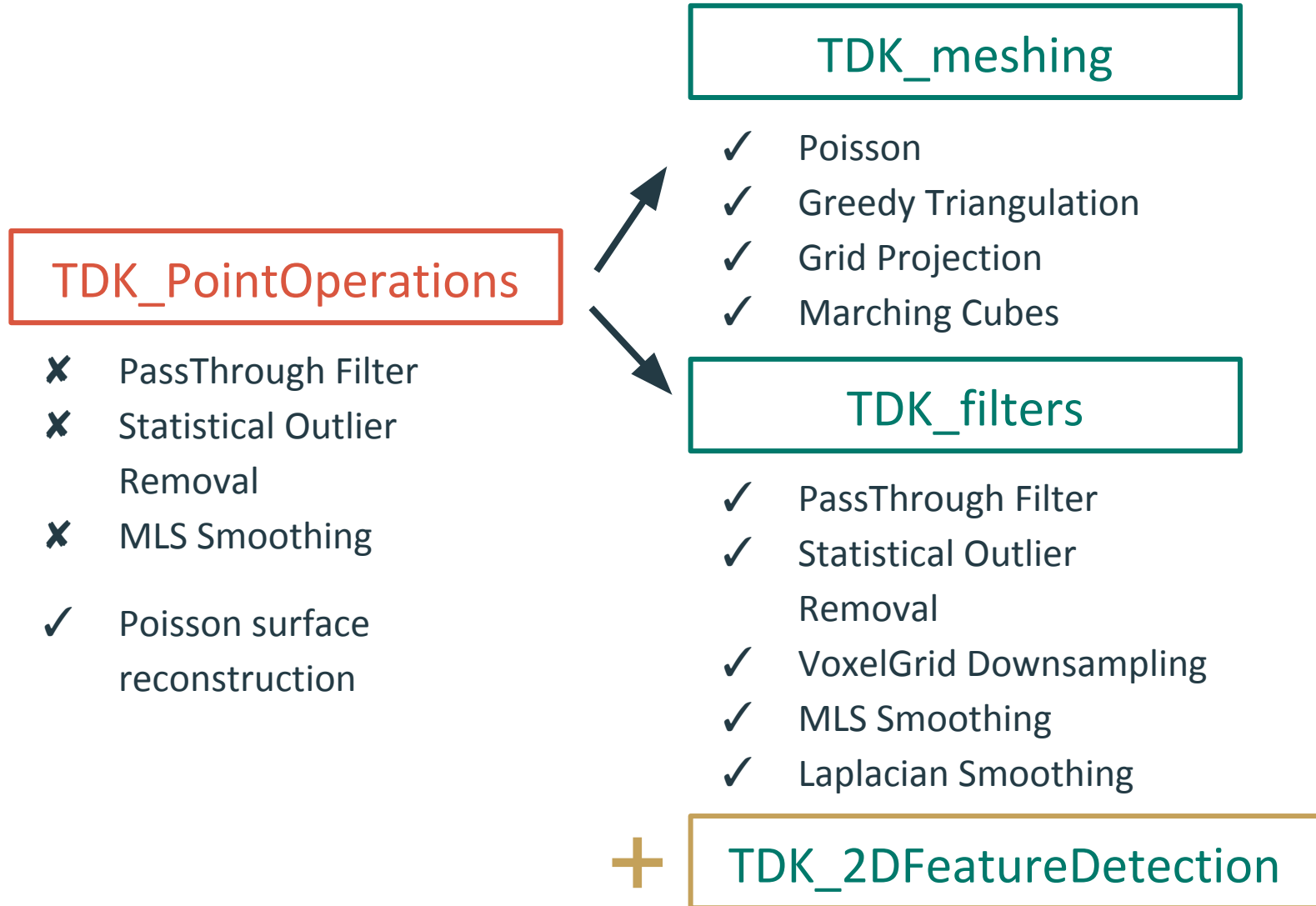
ICP without feature detection



ICP with feature detection



# Filters and Program Design Improvements



# Registration: Background Theory

- **Pairwise** Registration Algorithms

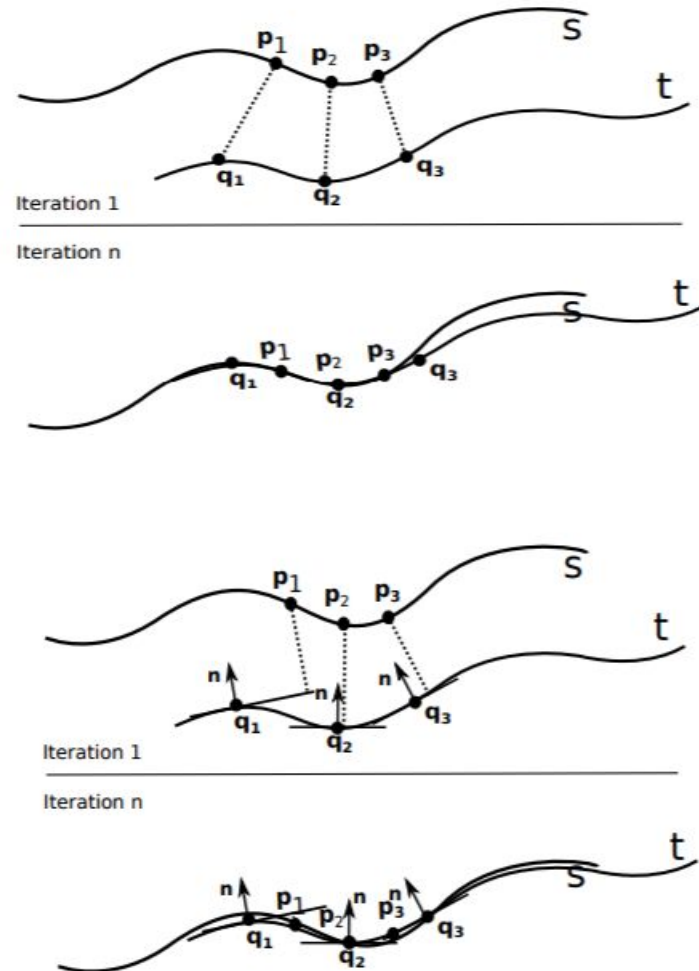
- ✓ PCA

- ✓ SVD

- **Iterative** algorithms

- ✓ ICP (all variants)

ICP in PCL uses SVD.



# Registration: Implementation

## TDK\_scanregistration

- ✓ Register
- ✓ ICP\_Normals
- ✓ ICP
- ✓ MatchRegistration



# Registration: Results



ICP (point to point)

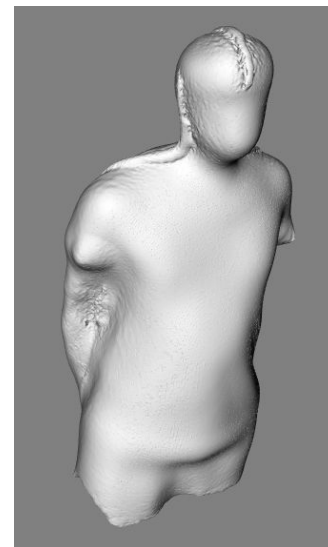


ICP (point to surface)

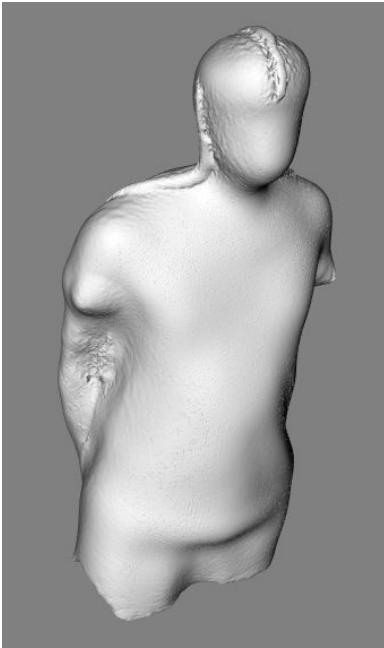
ICP Normals Performs better

# Surface Reconstruction: Improvements

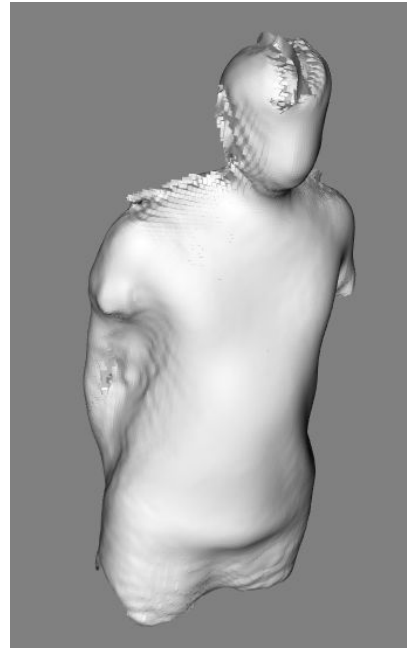
- Only **Poisson** algorithm implemented in 3D Korn
- Other methods included **grid projection** and **greedy triangulation** (implemented by the 3rd group)
- Grid based methods seemed the most effective so **marching cubes** was used



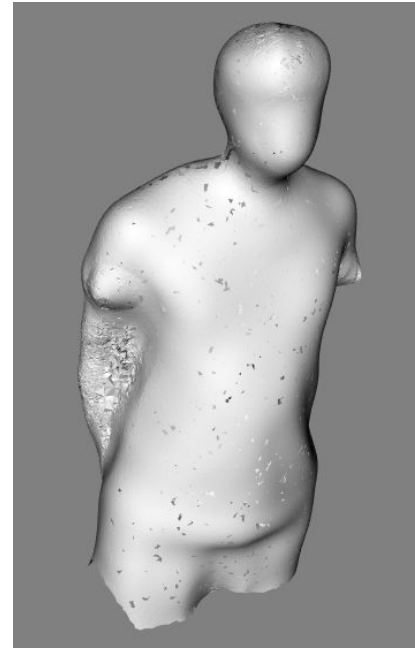
# Surface Reconstruction: Results



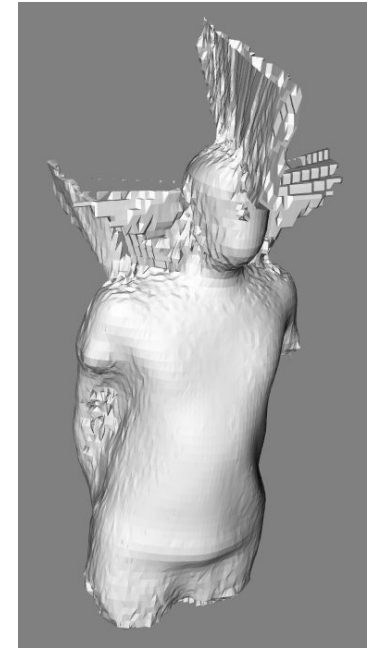
Poisson



Grid Projection



Greedy  
Triangulation

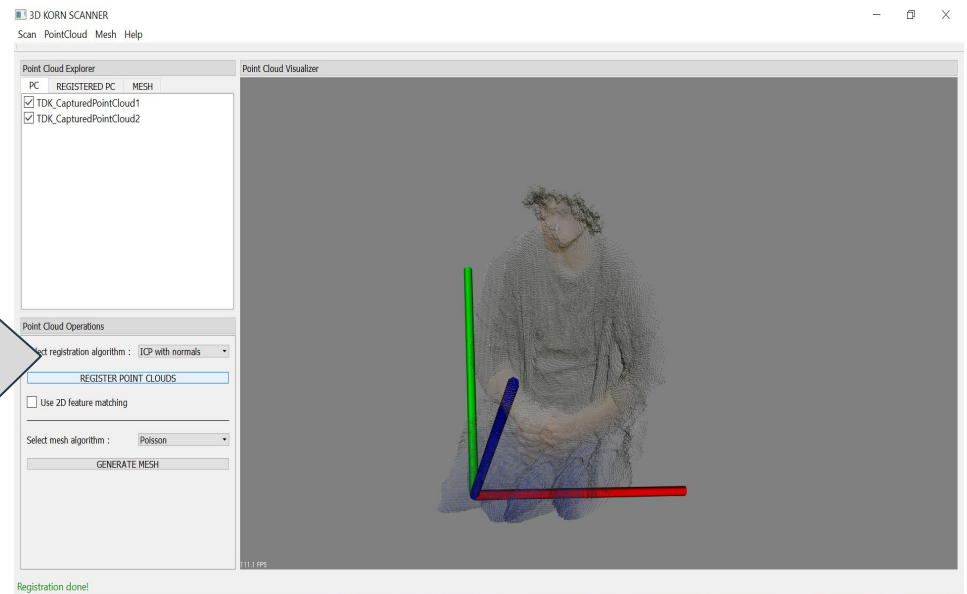
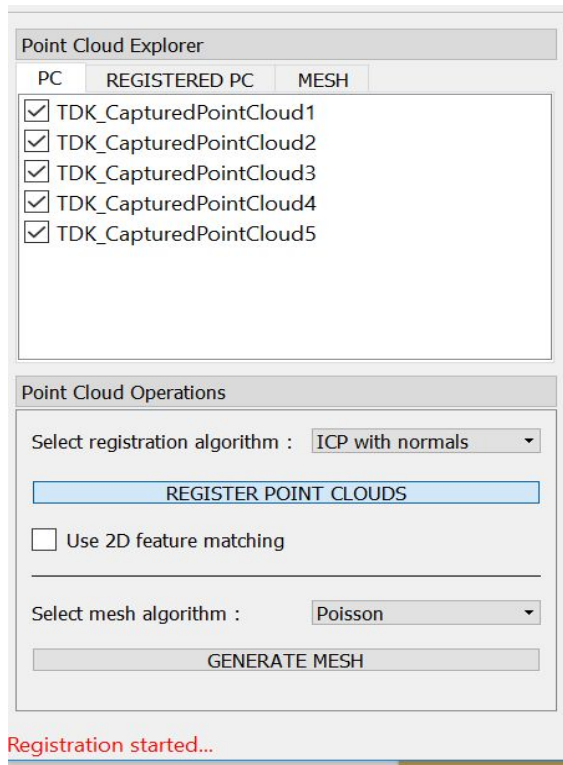


Marching Cubes

Greedy Triangulation is the best result

# GUI Improvements

- 3D Korn GUI was intuitive
- Program state changes
- Enabling of image feature detection



# Conclusions

1 Feature detection

2 ICP with normals

3 New filters class

4 New features in GUI



Thanks  
Дякуємо за увагу  
Gracias  
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