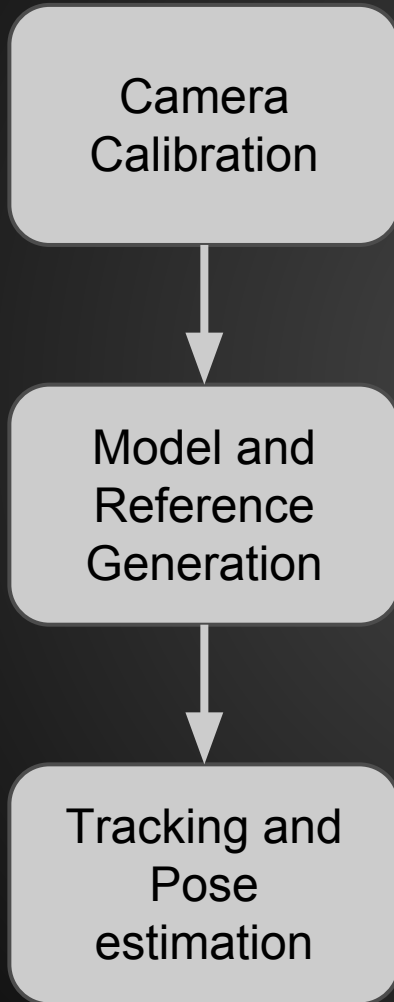


CVR - Final Project

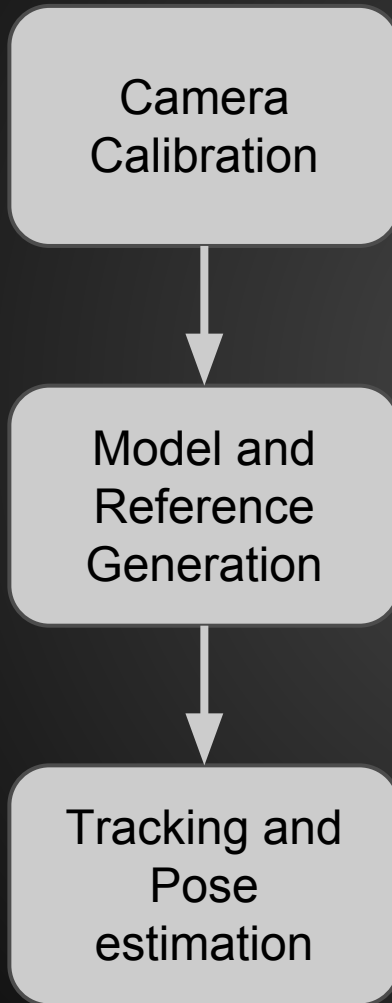
Object Detection and Pose Estimation

Team Lenna

Goals

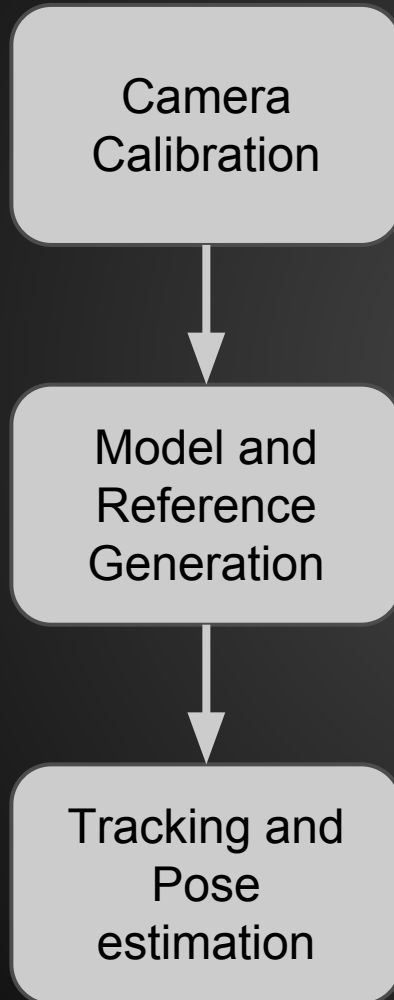


Goals



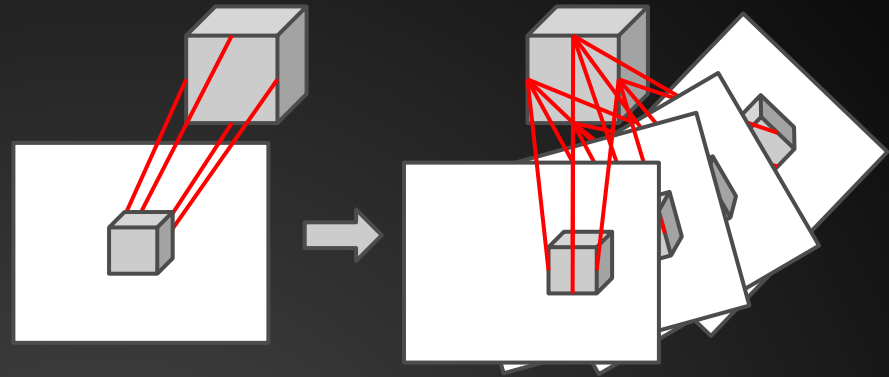
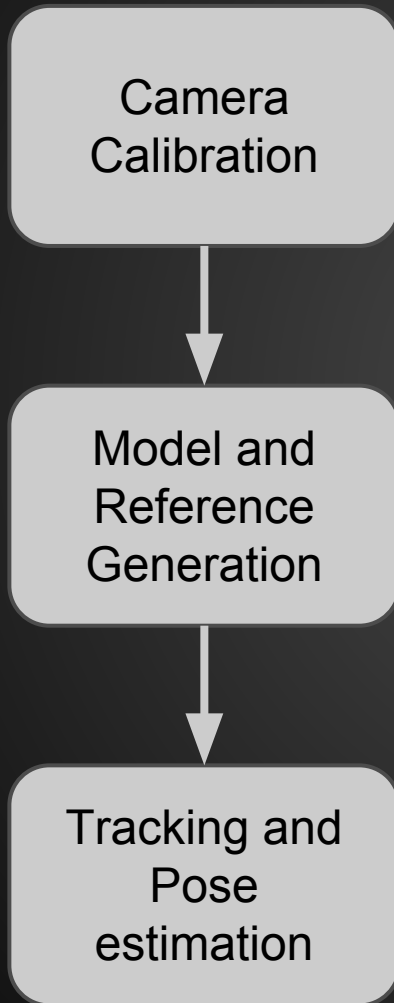
- quick and reliable
- on the fly
- using openCV calib3d

Goals



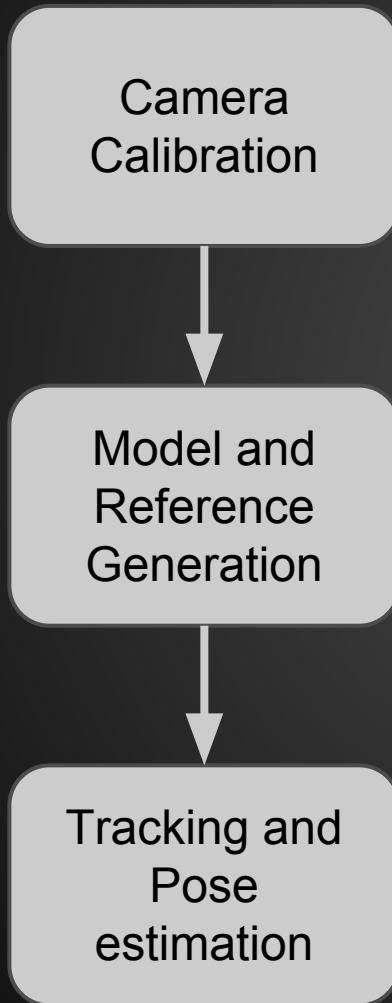
- manual generation of one reference image and corresponding 3D model
- manual generation of multiple references and one 3D model
- automatic generation of a 3D model and arbitrary number of reference images

Goals



- feature detection on reference and sample
- feature matching
- pose estimation via 2D-3D correspondences
- extension by multiple reference images

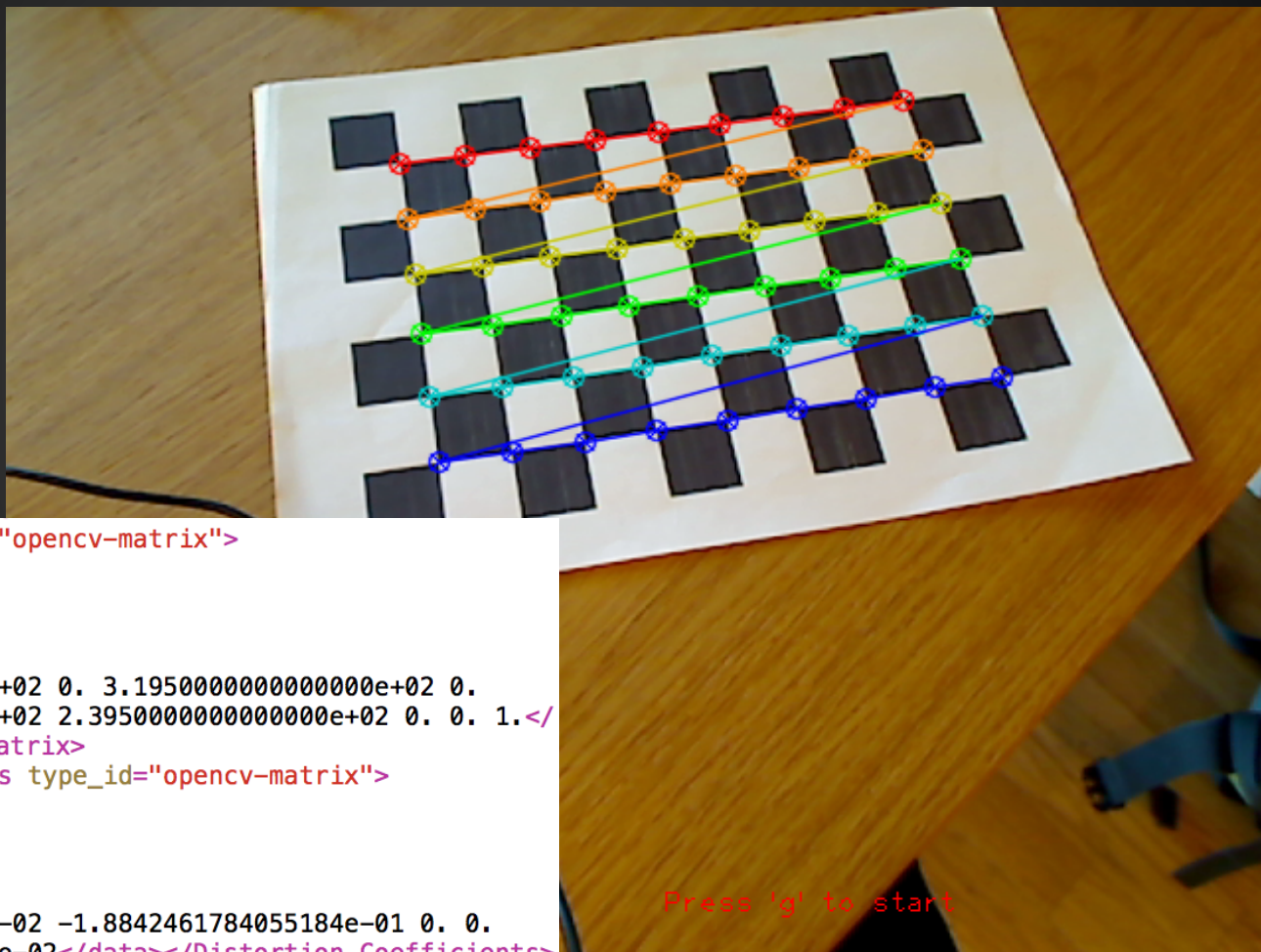
Achievements



- quick and reliable
- on the fly
- using openCV calib3d

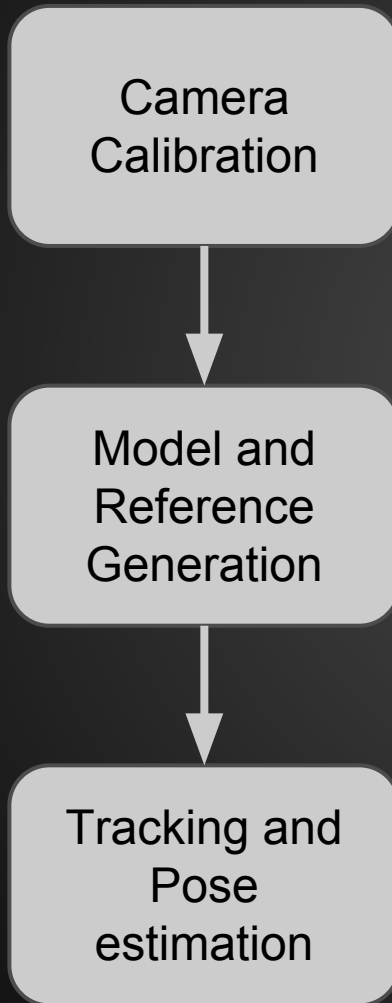


Intrinsics and Distortion Calibration



```
<Camera_Matrix type_id="opencv-matrix">
  <rows>3</rows>
  <cols>3</cols>
  <dt>d</dt>
  <data>
    5.3252115366679107e+02 0. 3.1950000000000000e+02 0.
    5.3252115366679107e+02 2.3950000000000000e+02 0. 0. 1.</
  data></Camera_Matrix>
<Distortion_Coefficients type_id="opencv-matrix">
  <rows>5</rows>
  <cols>1</cols>
  <dt>d</dt>
  <data>
    9.8724926081221021e-02 -1.8842461784055184e-01 0. 0.
    -8.4766064340681832e-02</data></Distortion_Coefficients>
```

Achievements



- manual generation of one reference image and corresponding 3D model ✓
- manual generation of multiple references and one 3D model ✓

Reference Image Generation

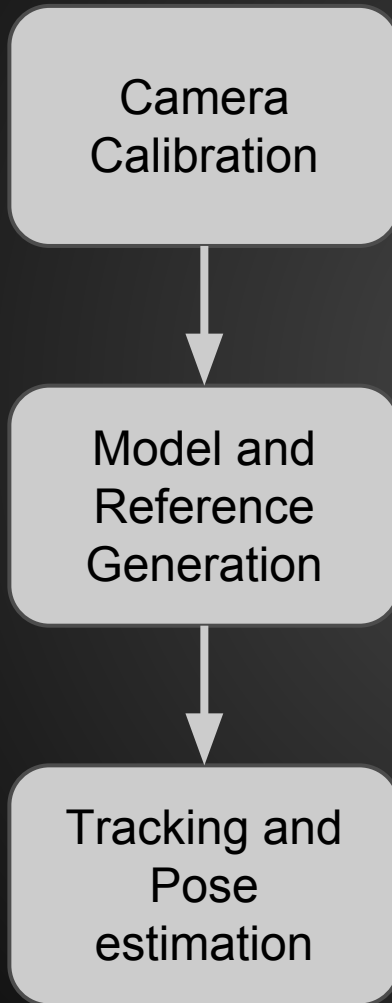
- using Blender



- Problem: matching performs poorly, due to different scene illumination

→ using manually captured reference images from webcam

Achievements

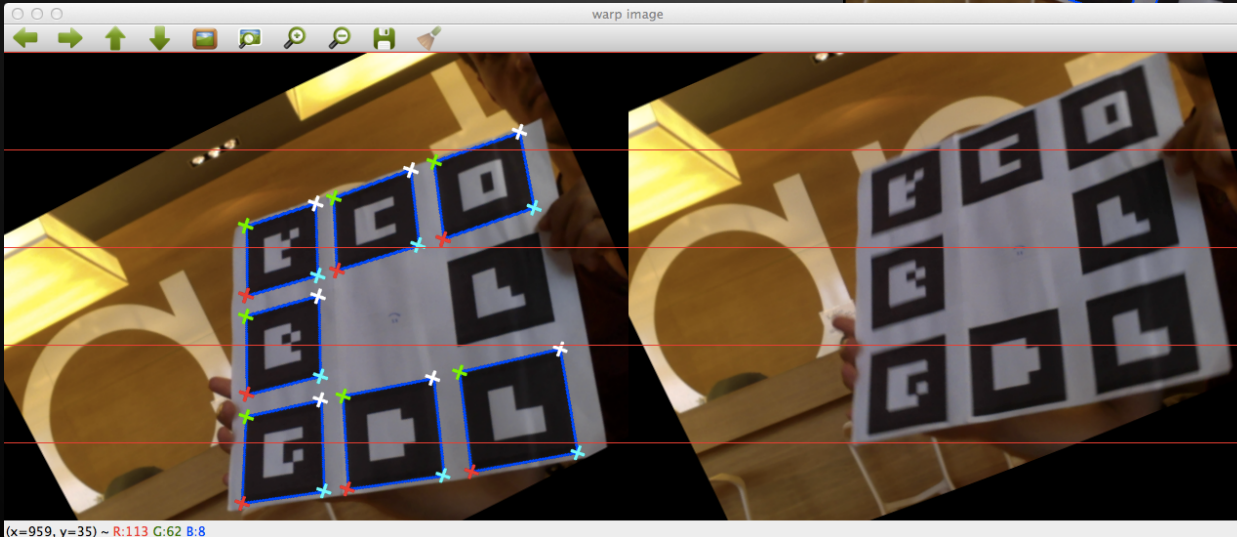
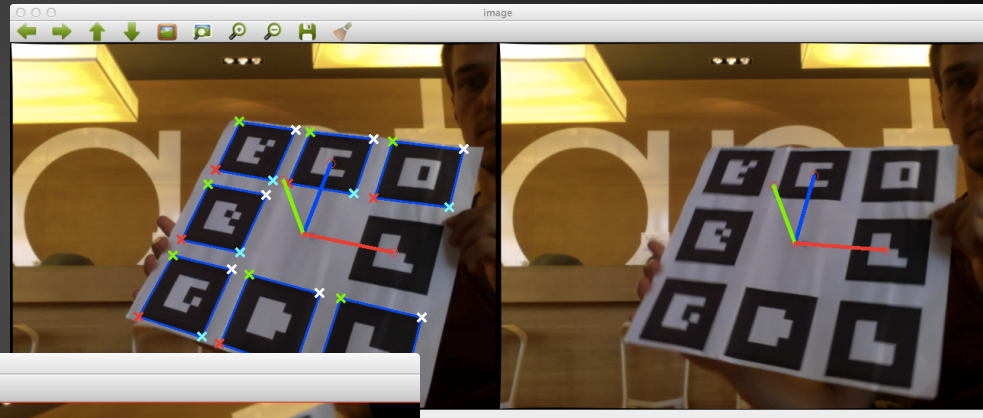


- manual generation of one reference image and corresponding 3D model ✓
- manual generation of multiple references and one 3D model ✓
- automatic generation of a 3D model and arbitrary number of reference images



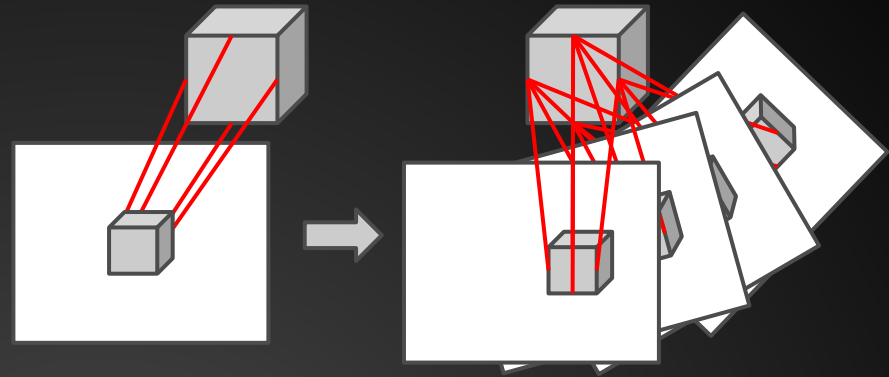
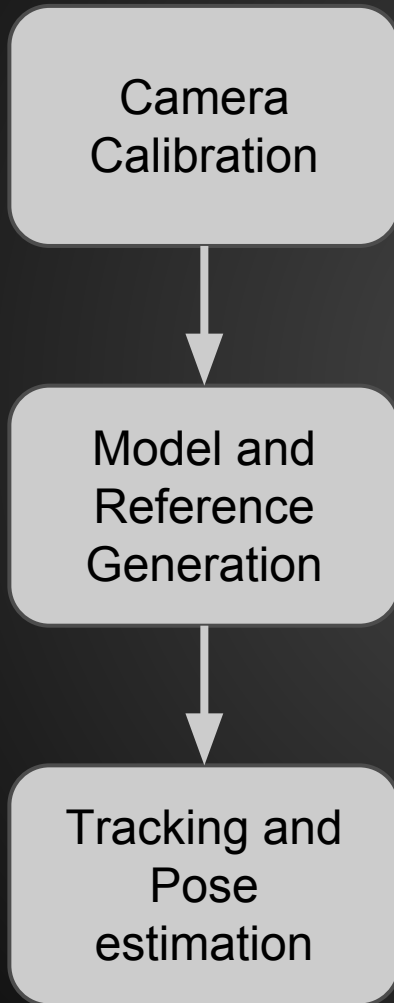
Automatic Model Generation

- using marker board for pose estimation
- rectification for epipolar line depth estimation
- depth estimation via triangulation



(x=959, y=35) - R:113 G:62 B:8

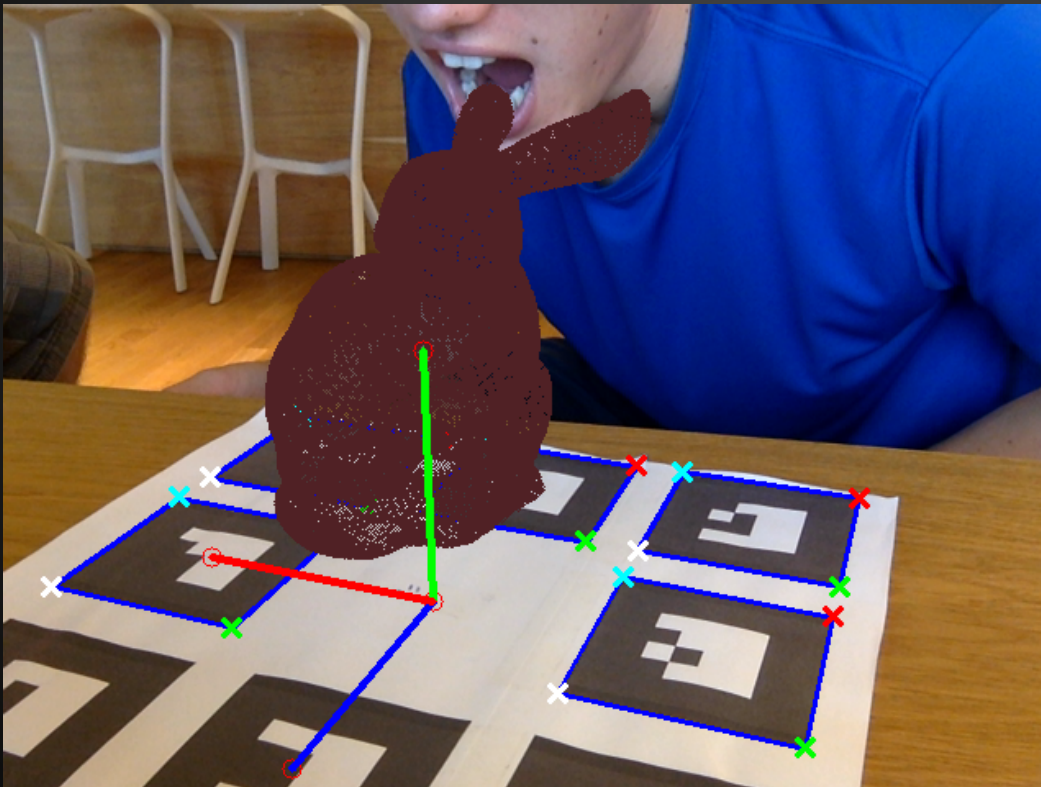
Achievements



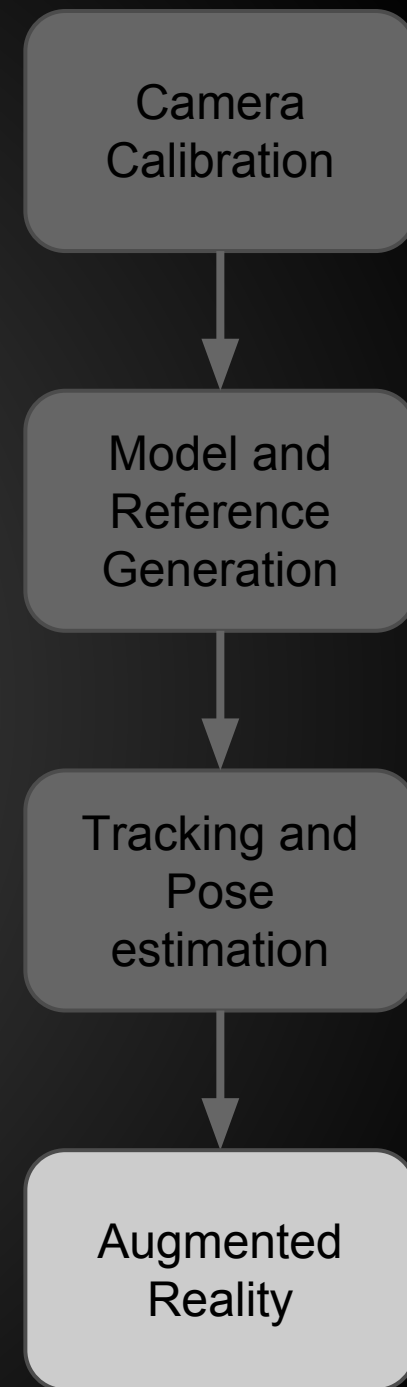
- feature detection on reference and sample ✓
- feature matching ✓
- pose estimation via 2D-3D correspondences (ePnP) ✓
- extension by multiple reference images ✓

Achievements

- AR is a possible use of the estimated pose
- explored different approaches to display and use AR



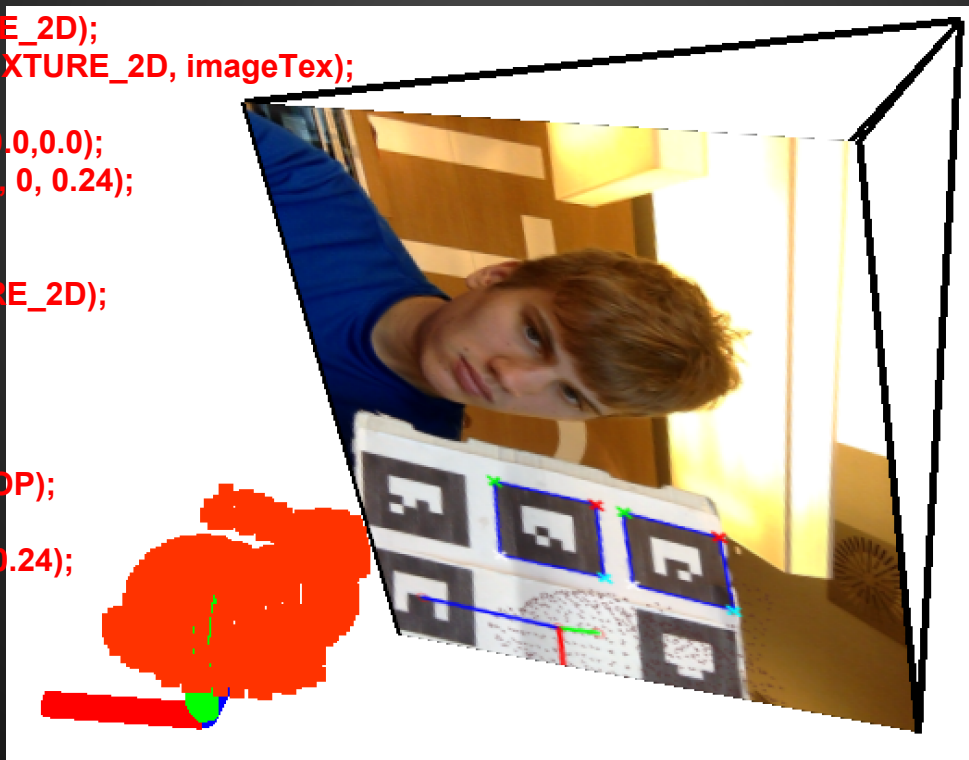
```
cv::projectPoints(pts, rVec, tra, camera, dist, pts2);
```



Achievements

- AR is a possible use of the estimated pose
- explored different approaches to display and use AR

```
glEnable(GL_TEXTURE_2D);  
glBindTexture( GL_TEXTURE_2D, imageTex);  
glBegin(GL_QUADS);  
    glTexCoord2d(0.0,0.0);  
    glVertex3f(-0.32, 0, 0.24);  
    ...  
glEnd();  
glDisable(GL_TEXTURE_2D);  
  
glColor3f(0,0,0);  
glLineWidth(4);  
glBegin(GL_LINE_LOOP);  
    glVertex3f(0,-0.8,0);  
    glVertex3f(-0.32, 0, 0.24);  
    ...  
glEnd();
```



Camera
Calibration

Model and
Reference
Generation

Tracking and
Pose
estimation

Augmented
Reality

[movie]