

## Introduction to Augmented Reality

### Exercise 10 (P,H) Pose estimation

As the mathematical background necessary for pose estimation is well beyond the scope of this exercise, a function `estimateSquarePose` is provided on the web. This function takes a list of 4 two-dimensional points and a marker size in meters and returns a  $4 \times 4$  matrix containing the complete transformation between camera and marker.

*Note:* the markers on the provided sheet should have a size of 4.5 cm.

Print the resulting matrix on the console. In order to verify your results, look especially at the last column of the matrix to verify that the translation is correct. You can not easily interpret the rotation information from the matrix. If you want to interpret the rotation values, convert the matrix to euler angles.

Now play around with your system. Does the movement of the marker in front of the camera correspond to the results of your marker tracker?

*Hint:* If the printed values do not match to your movement, try to find suitable adjustment parameters for the corner points. As mentioned in the API, the origin is assumed to be at the camera's center of projection. So, where might be the best location for the origin of the image?

Again play with your system. You now will see, that rotations over 90 degrees let your data jump. Find a solution for this issue.

*Hint:* Where you check for the minimal value of the ID, store the number of 90 degree rotations and shift the corner points accordingly before you give them to `estimateSquarePose`.