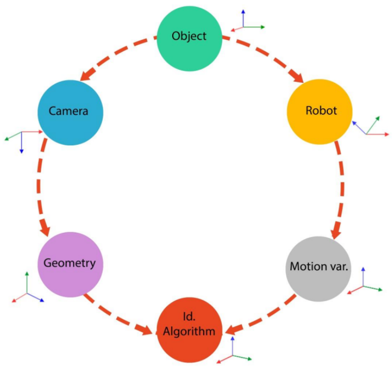
Spatial Object Approximation for Motion Tracking



Project Description

Unknown object tracking is a well-known problem in computer vision for which there exists numerous solutions. However, we would like to challenge the traditional methods in this project. Instead of considering a given object as a whole uniformly-distributed particle, we would like to approximate it with a certain number of points which will be placed within the object. For this, we need to first register the whole object geometry based on data received from a camera. Therefore, we have to rotate the object to make all faces visible to the camera. This is done using a 7 DoF robot arm capable of manipulating the object. Once, all object faces are registered, the points will be distributed within the object. "What are the optimum topological distribution and number of points?" are the challenging questions which have to be resolved in this framework, as well. Besides the information coming from the camera, we are also able to read the states of the robot that is manipulating the object. Fusing the camera and robot sensory data in an observer, we are able to estimate these points motion (position and velocity) in the camera frame. Since we simplify the object geometry information by describing it with some points, this scheme has several advantages and use cases. For instance, obstacle avoidance in robot manipulators might be made more efficient.

Who are you?

The following list summarizes specialties required for this thesis:

Robotics:

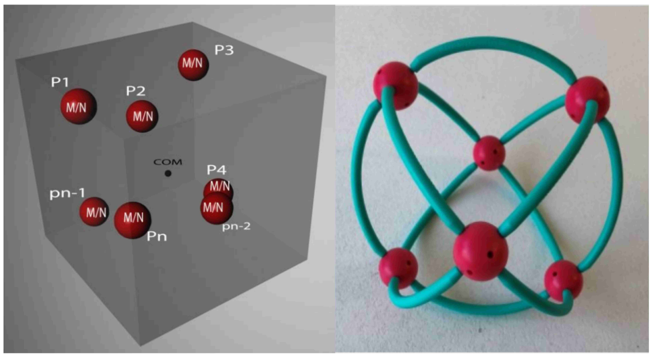
- Theory (Kinematics and differential kinematics, frame transformations)
- Robot programming

Computer vision:

- Object tracking
- Geometry construction

Mathematics and system theory:

- Optimization problem for point distributions
- Observer design for velocity and acceleration estimation



Related publications from our institute:

Sauer, Axel, Elie Aljalbout, and Sami Haddadin. "Tracking Holistic Object Representations." arXiv preprint arXiv:1907.12920 (2019).

Who to contact?
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