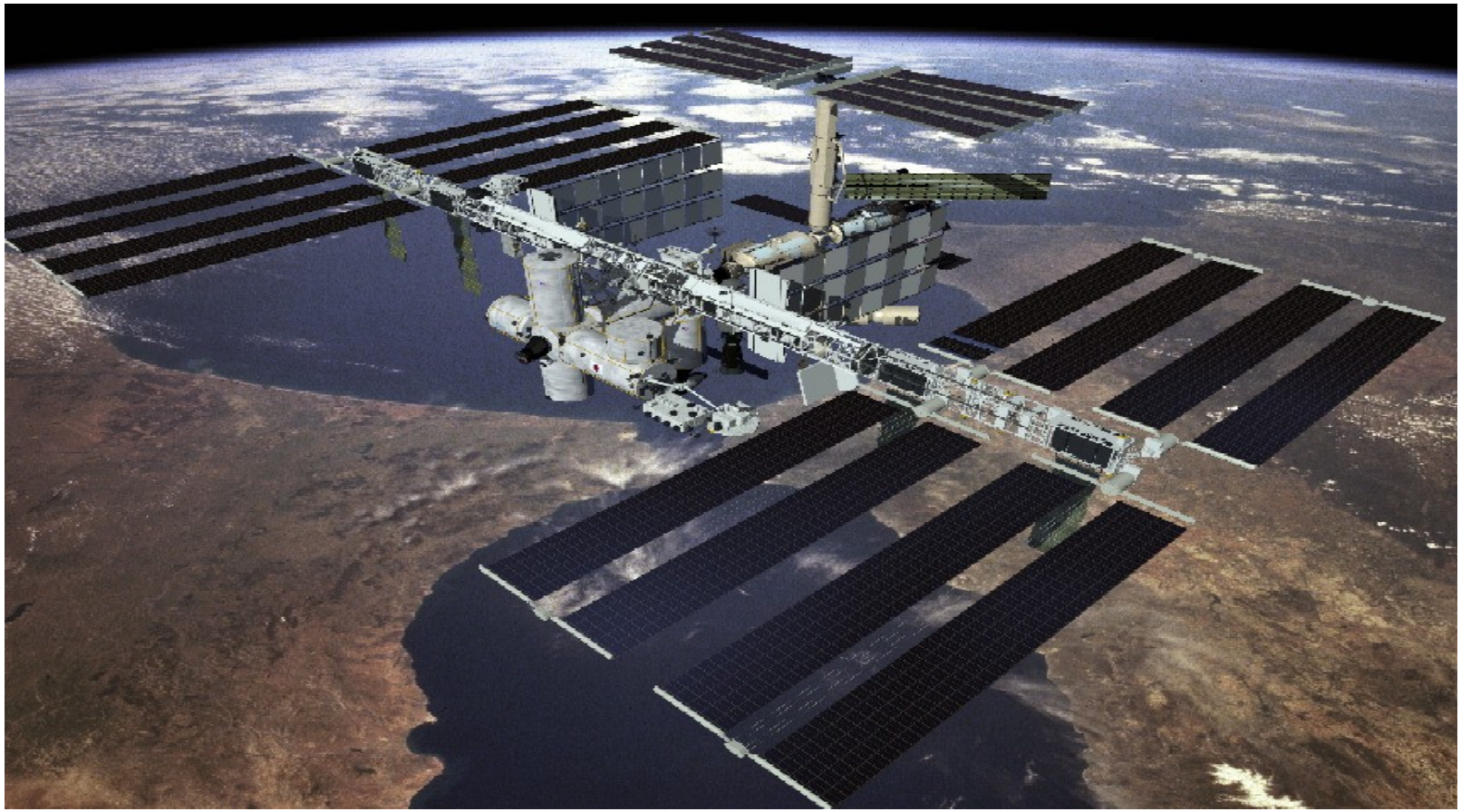
VISICS

KATHOLIEKE UNIVERSITEIT LEUVEN

WEAR++



Augmented reality on the International Space Station

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Maarten Vergauwen

Collaborators

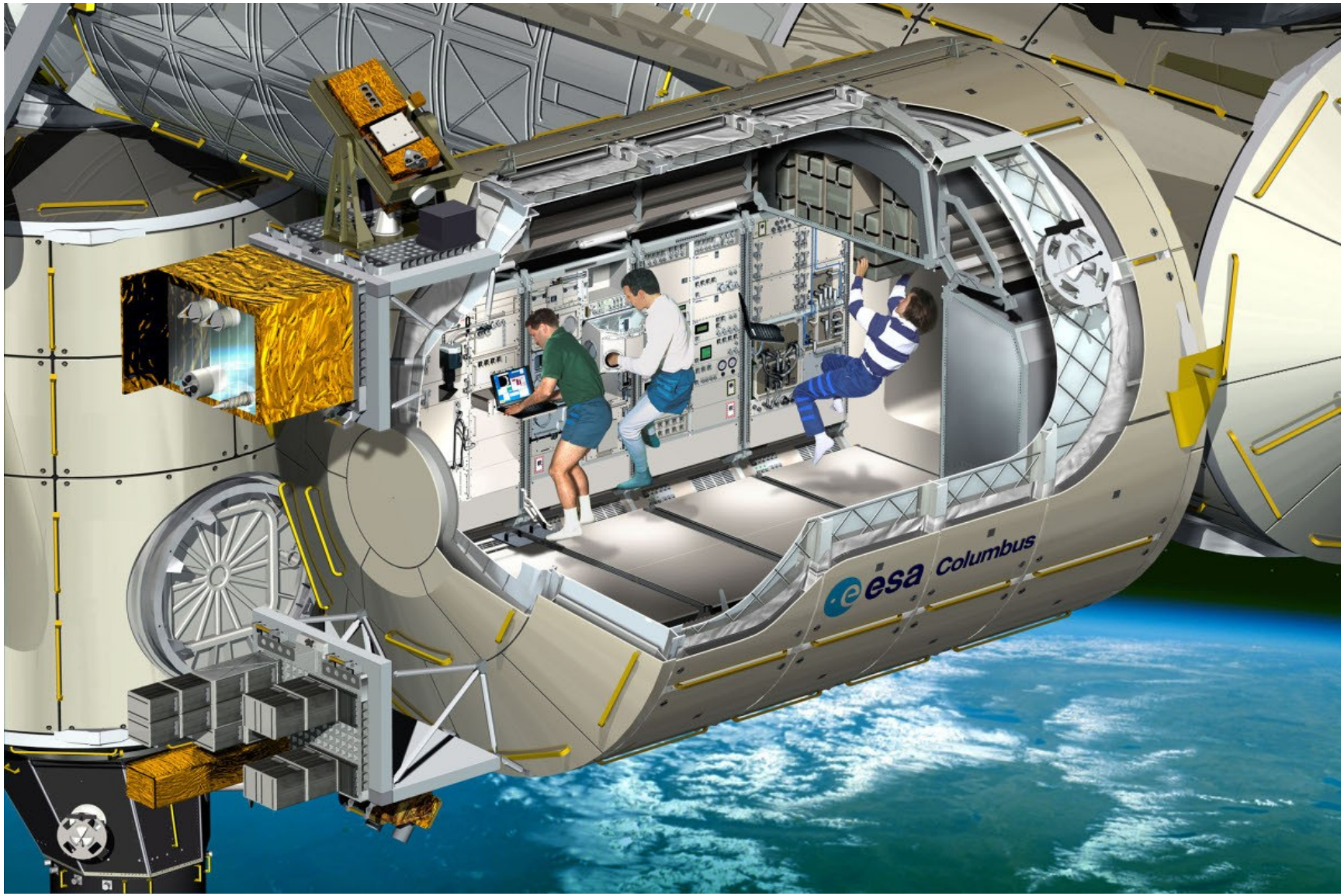




WEAR system

- Head Mounted display
- Camera
- Inertial Measurement Unit

Columbus Lab



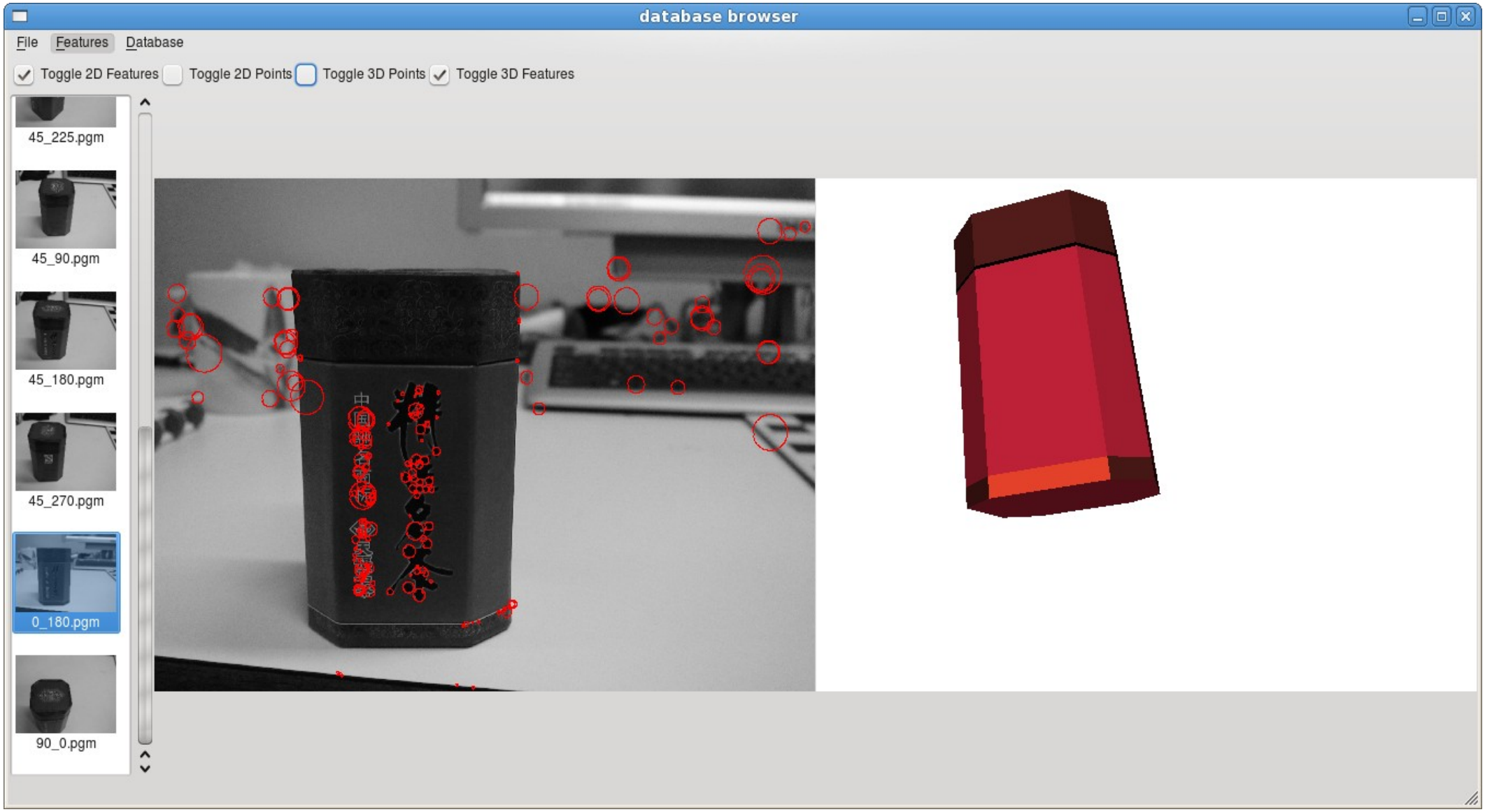
Pose Estimation

- Pose estimation of the camera using visual cues from the environment
  - Initialize pose
  - Update pose

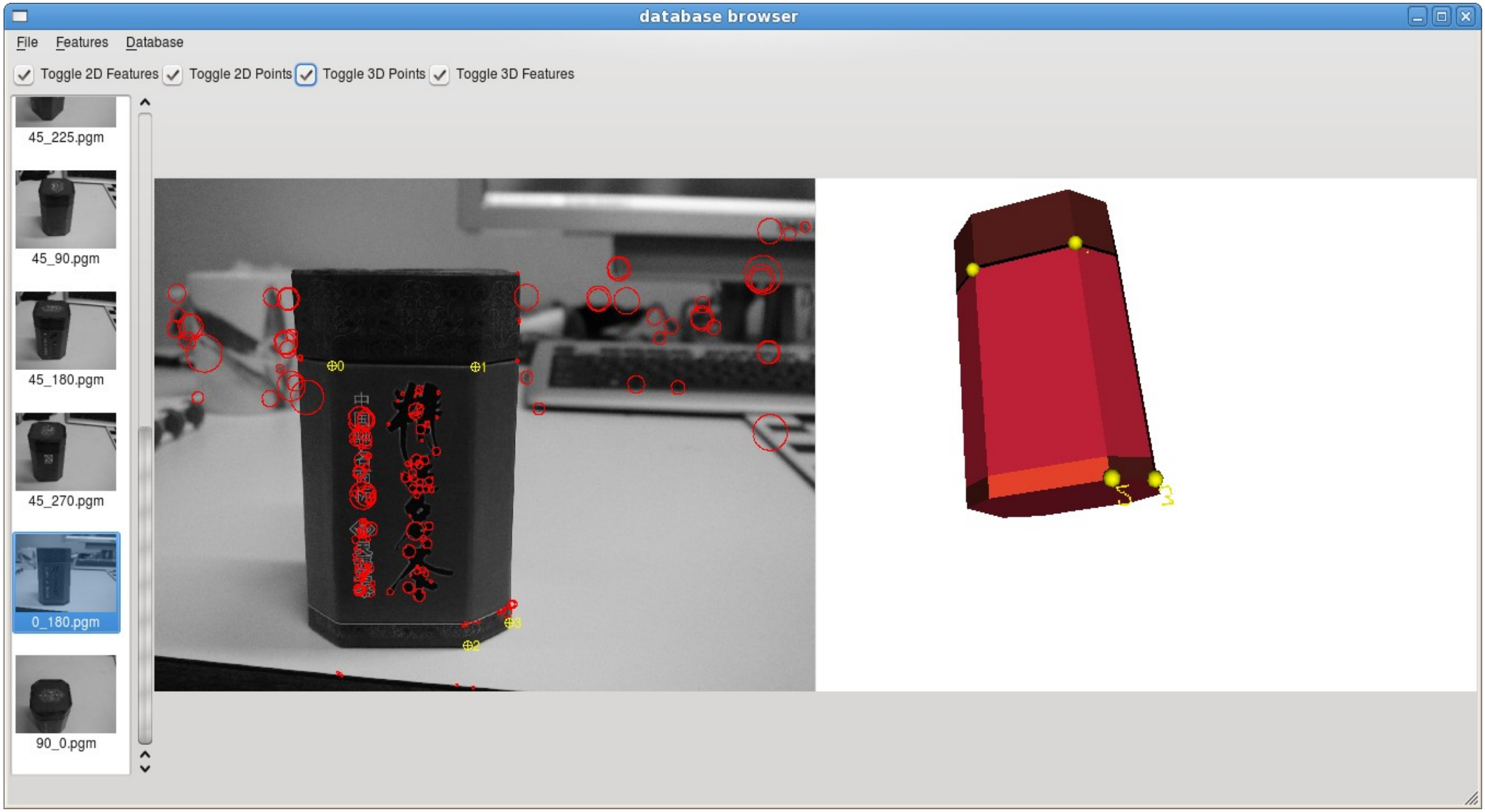
Pose estimation algorithm

- Training stage
  - Extract SURF features from training images
  - Assign 3D coordinate to each feature
- On-line stage
  - Extract SURF from a test image
  - Match descriptors to database
  - Use 3D information to compute the pose

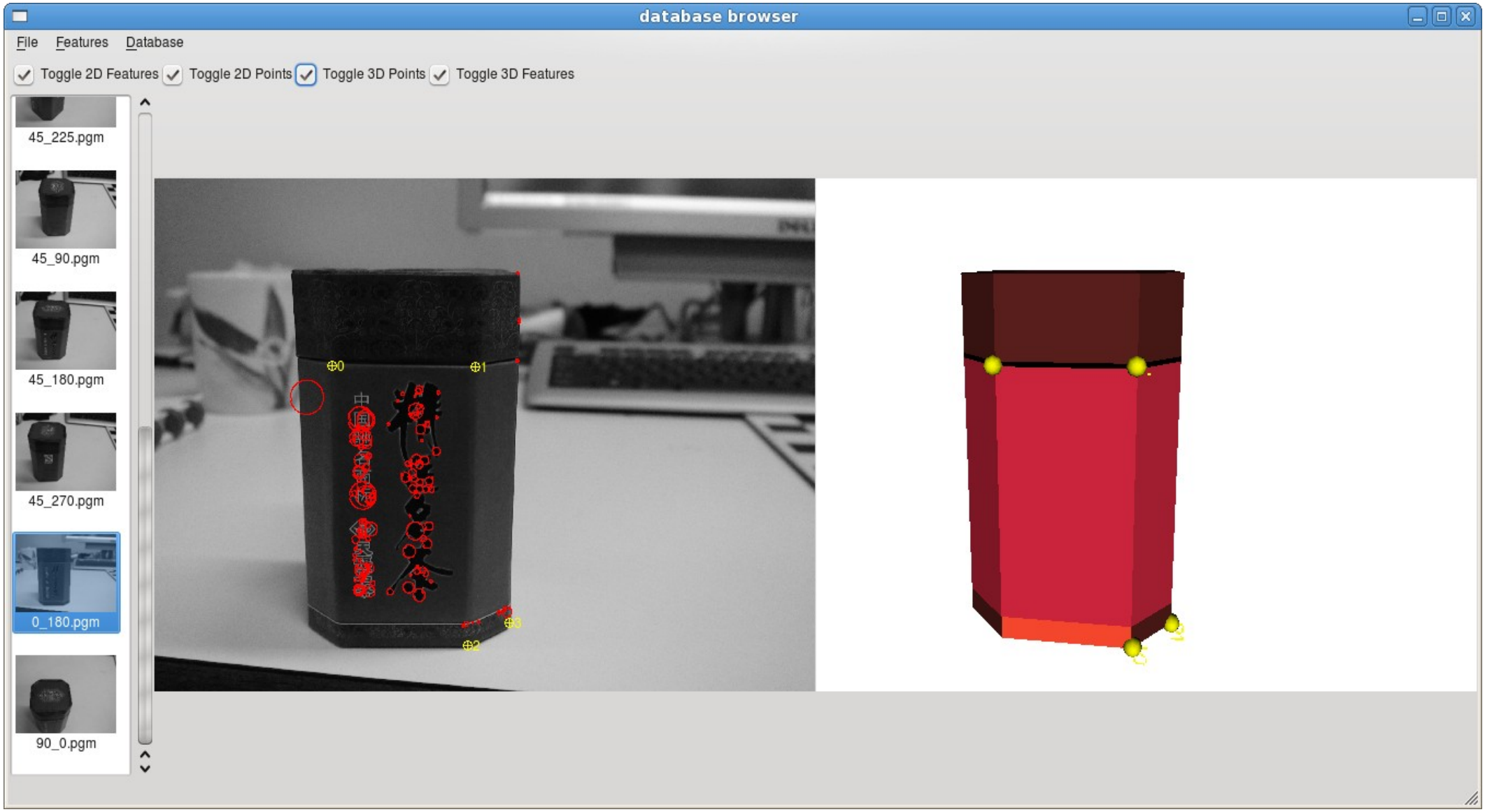
Training GUI



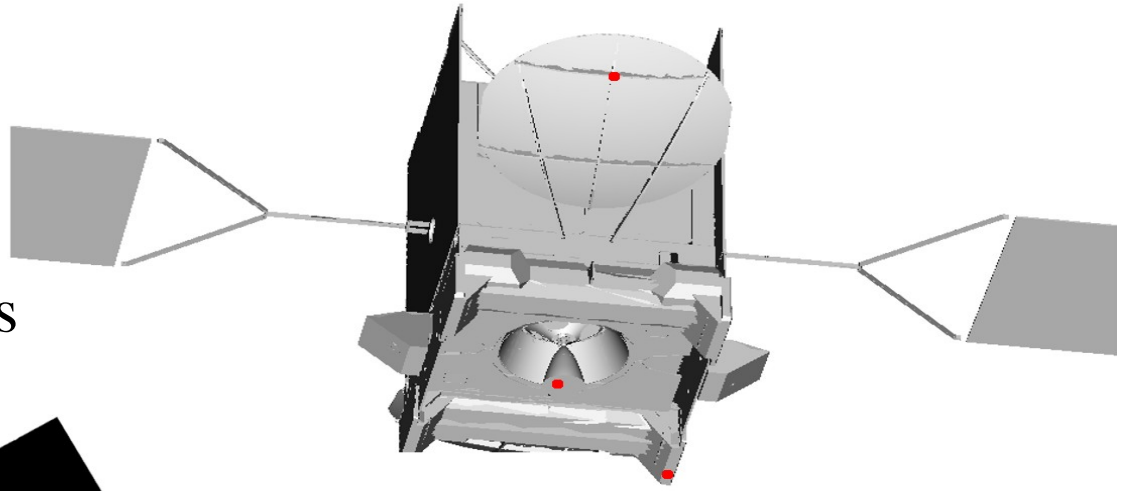
Training GUI



Training GUI

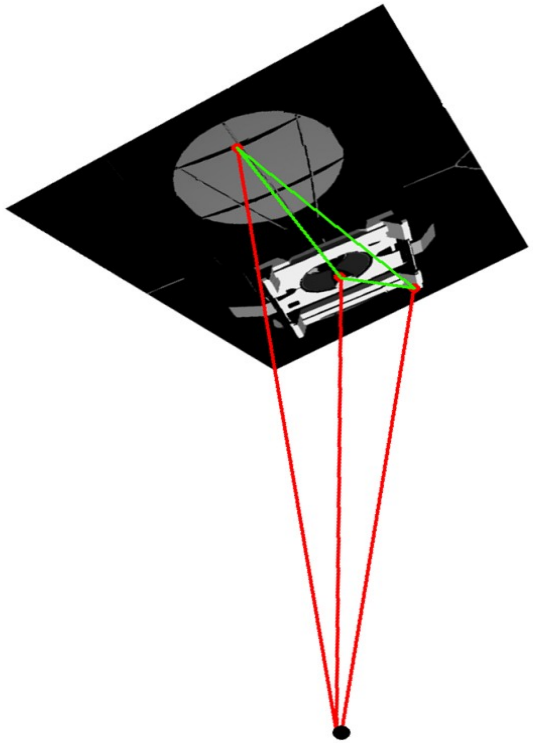


3-point algorithm



Inputs:

- Three 2D – 3D Correspondences
- Calibrated camera



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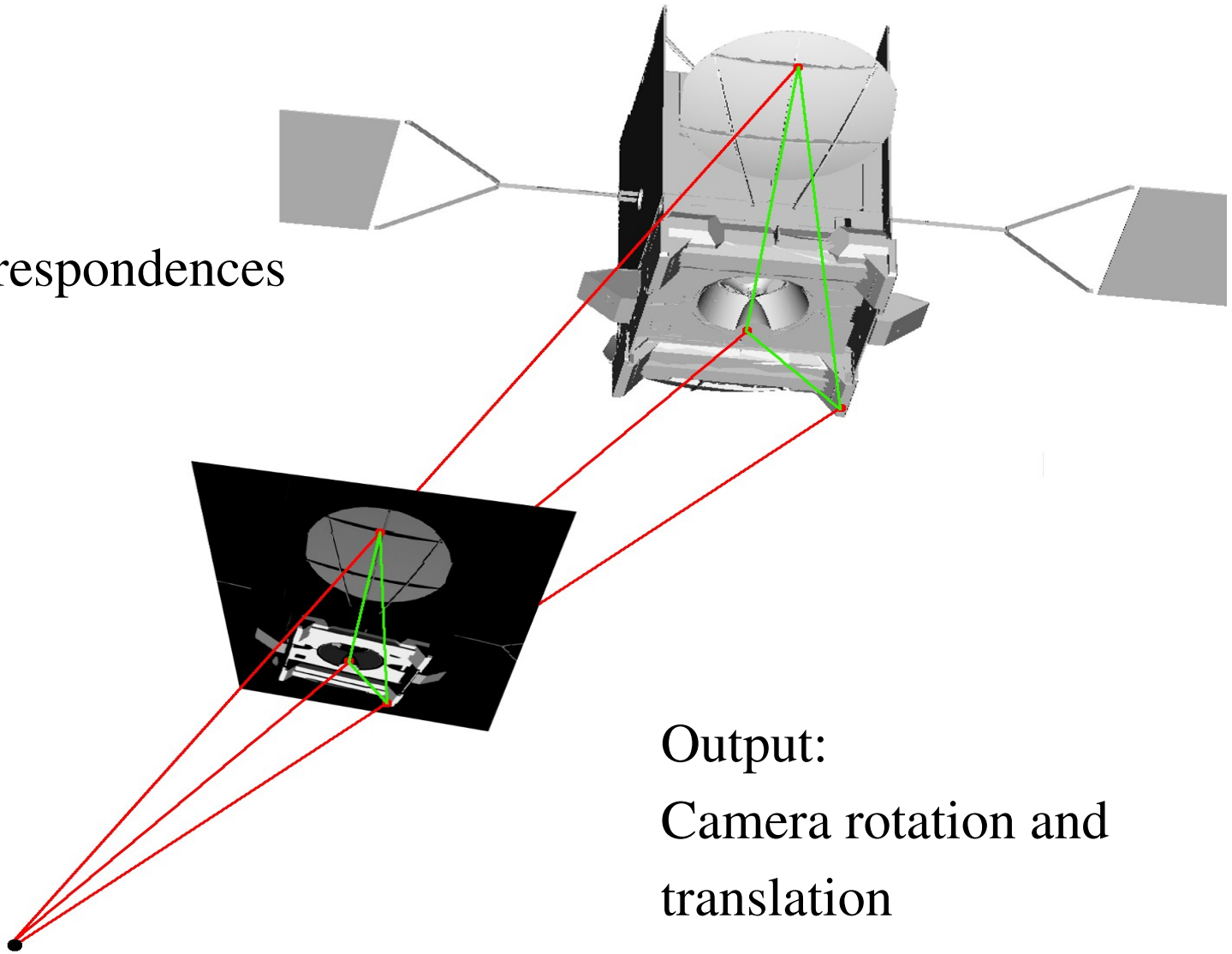


Output:

Camera rotation and translation

Image Retrieval

- Create clusters of visual words (K-means)
- Represent images as histograms of visual words (vector space model)
- Ranking by histogram similarity
- Point-to-point matching with highest ranked images

Pose Computation

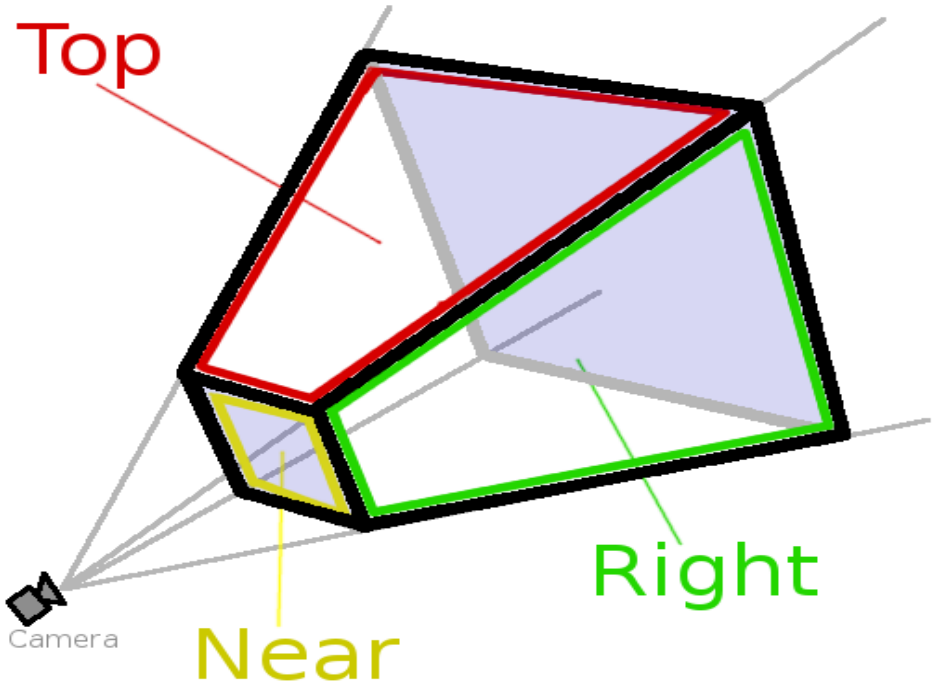
- 3-point algorithm with RANSAC
  - Robust against mismatches
- Non-linear optimisation

Extended Kalman Filter

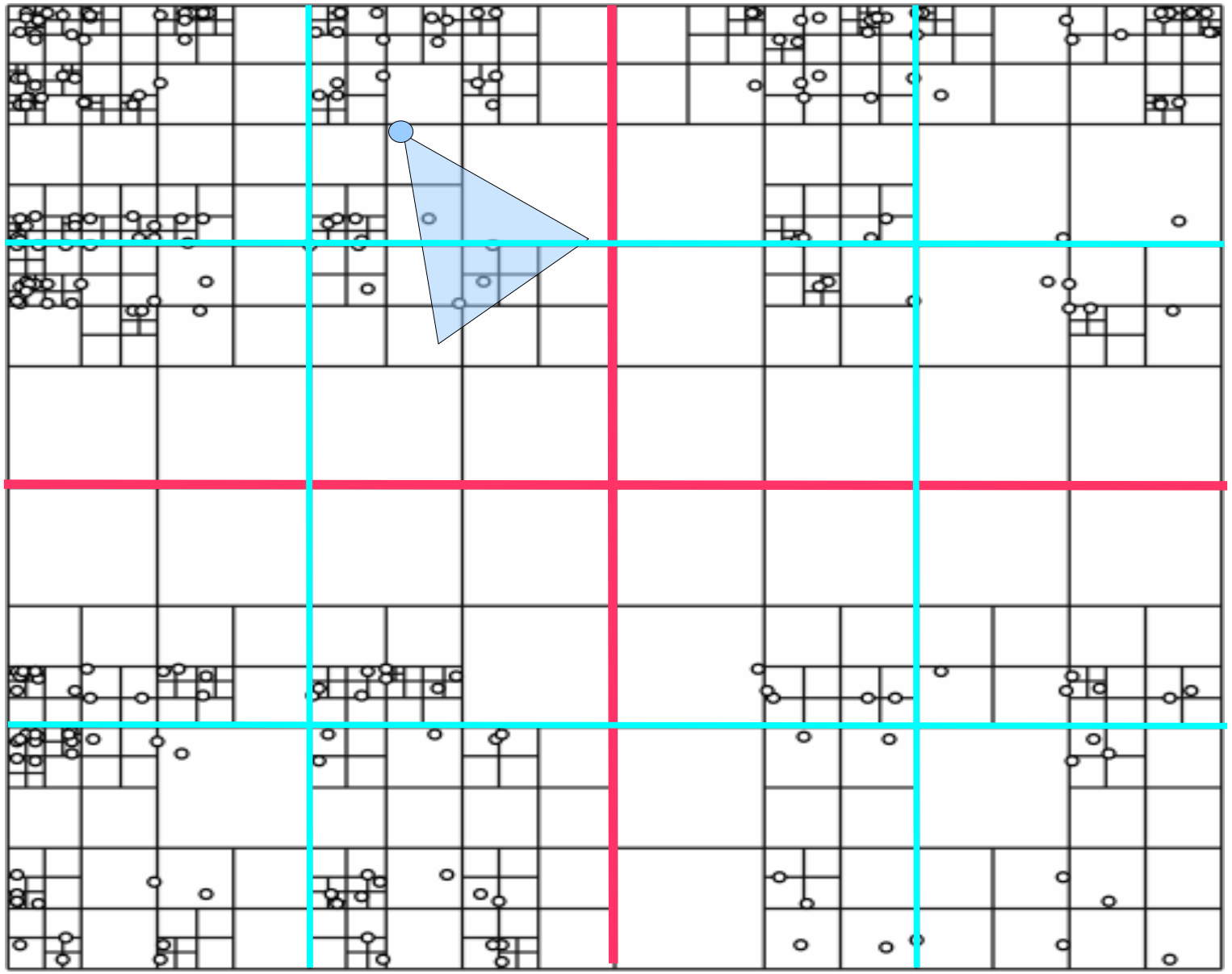
- States:
  - Position
  - Velocity
  - Incremental angular velocity
  - Angular velocity
- Inputs:
  - Pixel error between measured and predicted feature positions

Frustum Culling

- When visual tracking fails...
- Check Points with camera frustum planes
- Octree to further speed up search



Frustum Culling



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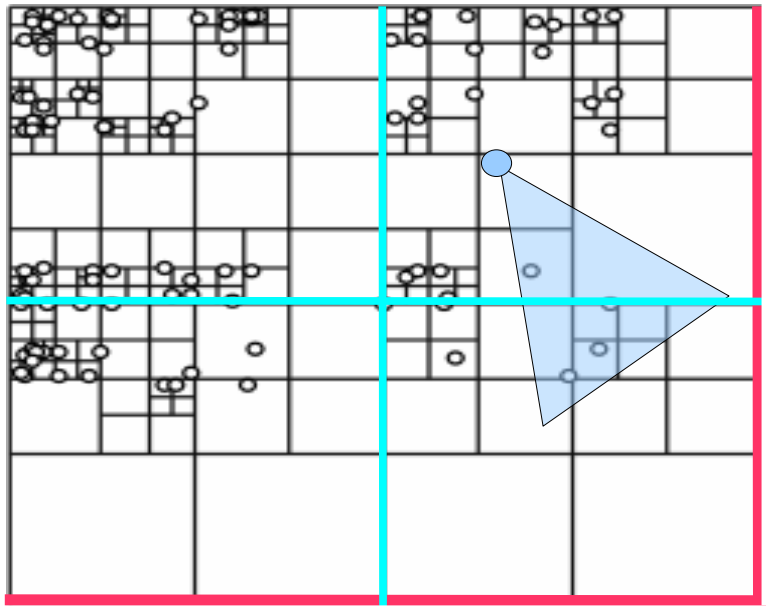

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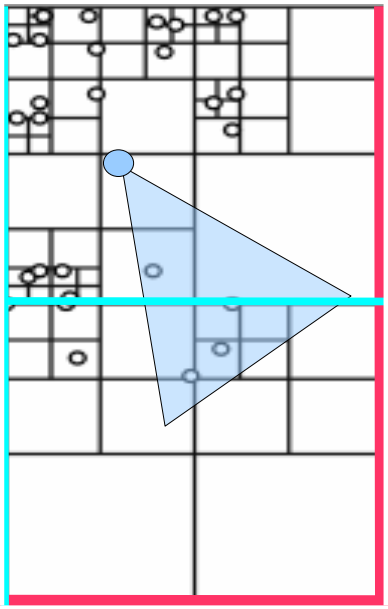

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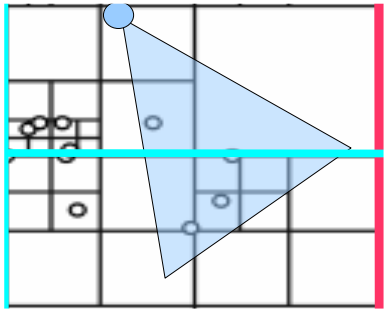

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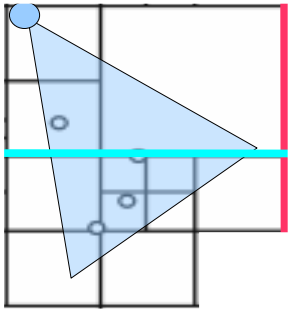
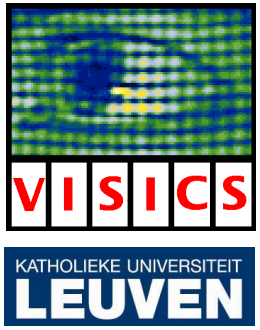
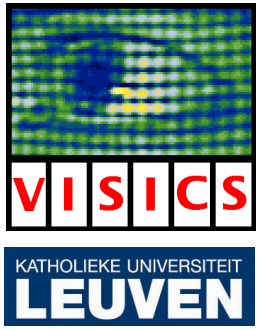




Results



Results

Video clip...