Unseen 6D Pose Competition Proposal

EPFL CVLab and ESA Advanced Concept Team

Scientific Objective: Provide a platform to demonstrate the 6D pose estimation algorithms for unseen objects. The competition will take place in a spacecraft context but will remain applicable for non-space domains.

Dataset Characteristics:

- 100+ spacecraft models of varying textures and fidelity
- Earth albedo and direct lighting
- Earth rendered and real earth image backgrounds
- 30,000+ rendered images with annotations
- Two test tracks
  - **Test Track A**: ~5 - 10 unique models
    Non-annotated images with target models included
    Object is unseen but known
  - **Test Track B**: ~5 - 10 unique models
    Non-annotated images with no target models included
    Object is unseen and unknown
    Test Track B render models cannot be publicly available
    Test Track B images should not be released (otherwise participants can recreate the Track B models)

Evaluation Criteria:

Evaluation on the test tracks will be based on relative pose. As test targets are different from the training targets, and a model is not provided, each participant is likely to have a unique canonical frame for their pose estimations. For a fair evaluation, the relative pose to a baseline image will be evaluated. ~5 baseline (non annotated) images will be shared for each target model in Track A and Track B.

Challenges:

Can the competition be formatted in such a way that the test images for Track B are NOT released? Is it possible to do this without having the evaluators implement the participant's code?

Do we have access to 5+ non publicly available spacecraft models? Do we need to create the models ourselves?

CVLab Team Action Items:

1. Construct the dataset
   a. Obtain 100+ spacecraft models (5+ must not be publicly available)
   b. Render images of 100+ models (can this be automated?)
   c. Explore and modify lighting conditions
   d. Explore and modify target locations (current dataset has out of Field of View renders)
2. Finalize Evaluation Criteria
   a. Are training image annotations absolute or relative?
   b. Is ADD (Average Distance of Model Points) appropriate when no model is being shared?
3. Produce a baseline solution
   a. Literature search (template matching may not be serviceable for Test Track B)
   b. Implement the architecture
   c. Train/test on our dataset