Goal: Build 3D reconstruction of video sequences shot by a moving camera, including both static background and moving objects.

Scenario: Multiple objects move rigidly on a ground plane, observed by a moving camera (rotation+translation).

1. Motion Segmentation
   - Extraction and matching of feature points
   - Estimation of inter-frame homographies
   - Identification of motion blobs
   - Removal of parallax pixels

2. Reconstruction of Static Background
   - Homography-based self-calibration
   - Ground plane position: \( \mathbf{N} \cdot \mathbf{P} = d \)
   - 3D point triangulation
   - Bundle Adjustment

3. Reconstruction of Moving Objects
   - Object shape inference
     (Real) moving camera + moving object \( \Rightarrow \) (Virtual) moving camera + static object
   - Ground-plane assumption: every object must lie and move on the ground plane
   - Object scale estimation
     - At least one object point is on or close to the ground plane: \( \mathbf{N} \cdot (\mathbf{sP}) = d \)
   - Object motion estimation
     - Rotation can be solved uniquely: \( \mathbf{R}_i^c = (\mathbf{R}_i^v)^{-1} \mathbf{R}_i^c \)
     - Translation needs more constraints: \( \mathbf{N}(\mathbf{T}_i^c - \mathbf{T}_{i+1}^c) = 0 \)

Summary
- A practical system for building consistent 3D reconstruction of both static background and moving objects
- Object scale and motion estimation based on the ground plane
- Future work: more experimental evaluation; extension to dense reconstruction…