Rigid Body Motion from Videos

Naman Rastogi   Pratik Kalshetti
163050056   163050048

Problem Statement

The goal is to acquire pairwise relevant parameters of object collisions simply based on input video and reconstruct a physically valid motion.

Challenges

- Video data lacks depth information

- Computing absolute quatities (e.g., mass) is not possible without access to reference measurements

- Given the nonlinear structure of the underlying physics, the reconstruction of a desirable sequence requires extensive prior experience

- Initializing orientations in presence of illumination variation in videos

Key Ideas

- Regularize the problem of reconstructing collisions of object pairs from videos using laws of rigid body physics

- Demonstrate how to reconstruct plaussible collision sequences in 3D, by observing objects in motion away from the collision instant

- The method outputs physical parameters that would otherwise be very difficult to acquire, which can further be used for authoring new collision sequences
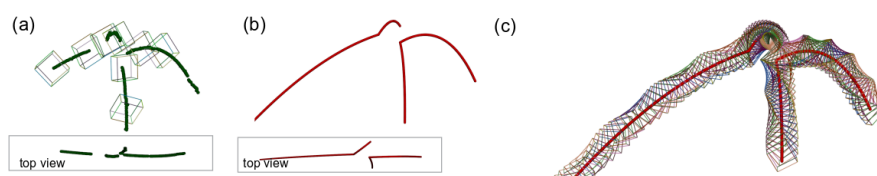
Results

Figure 1: a) the result of initialization: labeled centroid and approximate depth values (green dots) together with the initialized orientations (green cuboids); b) 3D parabolas resulting from full optimization (red curves), and c) motion over time (colored cuboids).

Implementation Approach

1. Acquire video of two objects colliding under gravity only

2. Background subtraction of objects (using OpenCV)

3. Use ransac for initializing positions

4. Initialize orientations using OpenDR (user input if necessary)

5. Formulate the optimization function in CERES and get the parameters

6. Reconstruct collision sequence using the above estimated parameters