Visibility Reasoning Method

\[
S(t) = \arg\max_i P_j P_i \quad \text{Visibility prior}
\]

\[
S(t) = \text{argmax} \quad \text{Visibility likelihood}
\]

Photometric consistency

Motion consistency

Geometric consistency

Dynamic 3D Reconstruction

Input: Videos from 480 views

Output: Long, dense, and accurate trajectory stream

Challenge

Time-varying visibility reasoning: which cameras are observing which point at each time instance?

Expected visibility set

Accurate 3D patch shape and texture of the 3D patch are required

Tend to have narrow visibility set

No 3D patch shape and texture of the 3D patch are required

Wide and accurate visibility set

Geometric consistency

Vision prior

Photometric consistency

Motion consistency

Visibility accuracy (%)

Input:

Videos from 480 views

Output:

Long, dense, and accurate trajectory stream

A core challenge in large-scale dynamic 3D reconstruction is visibility estimation—estimating which cameras observe which points at each instant in time. In this paper, we present a method to reason about the time-varying visibility of a 3D moving point captured by a large number of cameras. Our algorithm takes, as input, camera poses and image sequences, and outputs the time-varying set of the cameras in which a target point is visible. We formulate visibility estimation as a maximum a posteriori (MAP) estimate using photometric consistency, motion consistency, and geometric consistency, in conjunction with a proximal camera network prior. We demonstrate that our estimated visibility increases reconstruction performance in accuracy and density.

MAP Visibility Estimation for Large-Scale Dynamic 3D Reconstruction

Hanbyul Joo, Hyun Soo Park, and Yaser Sheikh
Carnegie Mellon University

Abstract

Visibility Reasoning Method

Quantitative Result

Qualitative Result