LEARNING OBJECT APPEARANCE FROM OCCLUSIONS USING STRUCTURE AND MOTION RECOVERY

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Contribution

New Approach for Automatic Video Segmentation

- Incorporation of 3D Scene Information
- Foreground Identification using Occlusions
- No Tracking of Foreground Objects required

Applications: Virtual Effect Creation

Application:
Integration of Virtual Objects

Application:
Background Blur Effect

Structure and Motion Recovery

Feature Tracking [1]:

- Consecutive Correspondences: KLT-Tracker
- Non-Consecutive Correspondences: SIFT Matching

Definition of Foreground:

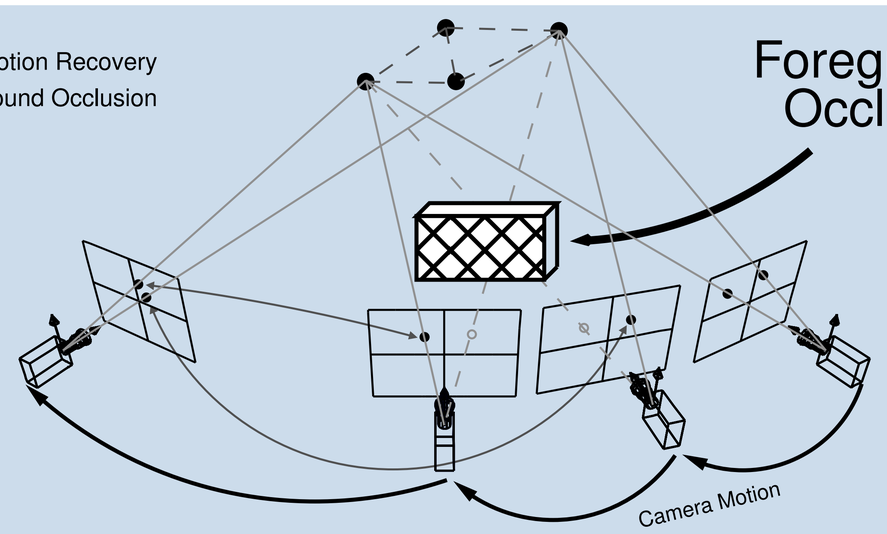
- Image Regions which temporarily occlude Background

Key Idea for Extraction of Foreground Samples:

- Image Features disappear and reappear

  $\Rightarrow$ Feature Tracks with a Non-Consecutive Correspondence induce Information about Foreground and Background

Structure And Motion Recovery
with Foreground Occlusion



Object Appearance

Assumption:

- Object Appearance does not change in the Sequence

Representation of Foreground and Background:

- Foreground: Collect Reprojections of Occluded 3D Points
- Background: Feature Positions of Visible 3D Points
- Use Gaussian Mixture Model (GMM) [2]

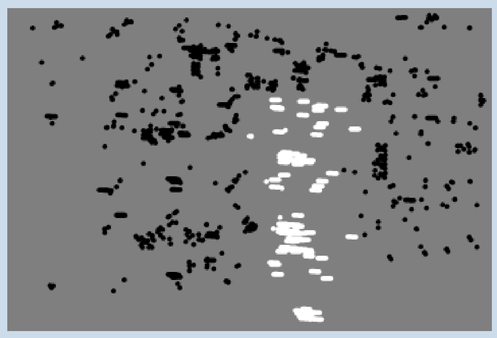
Foreground Segmentation

Minimize Energy E on 3D grid [3]:

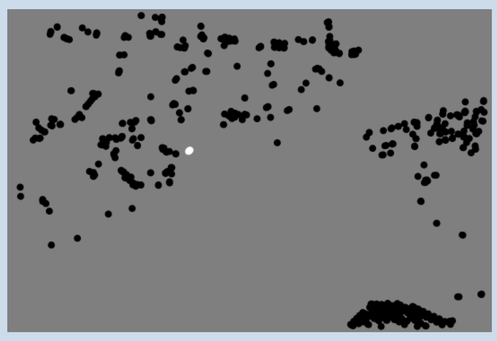
- $$E(x) = \underbrace{\sum_{i \in \mathcal{V}} \varphi_i(x_i)}_{\text{Regional Costs}} + \underbrace{\sum_{(i,j) \in \mathcal{E}} \varphi_{i,j}(x_i, x_j)}_{\text{Boundary Costs}}$$

- Image Sequence represented as Graph
- Compute Minimum Cut $\Rightarrow$ Video Segmentation

Examples

Person [4]
(720x480)
Integrated ACCV Logo

Hand [4]
(720x480)
Blurred Background

[1] K. Cordes, B. Scheuermann, B. Rosenhahn, J. Ostermann: ”Occlusion Handling for the Integration of Virtual Objects into Video”, VISAPP 2012
[2] C. Rother, V. Kolmogorov, A. Blake: ”Grabcut: Interactive Foreground Extraction Using Iterated Graph Cuts”, SIGGRAPH 2004
[3] Y. Boykov, M. P. Jolly: ”Interactive Graph Cuts for Optimal Boundary & Region Segmentation of Objects in n-d Images”, ICCV 2001
[4] P. Sand, S. Teller: ”Particle Video: Long-Range Motion Estimation Using Point Trajectories”, CVPR 2006

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