Recent Advances in 3D Computer Vision

pre-meeting

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Lingni Ma

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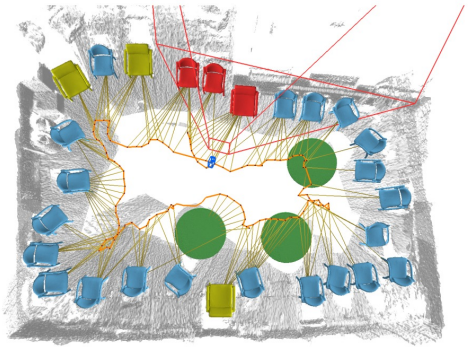
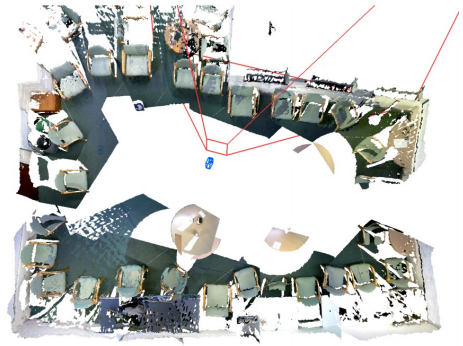




Outline

What will you learn in the seminar?

- Get an overview on fundamental techniques to solve problems in tracking and mapping
- Be able to read and understand scientific publications
- Prepare and give a talk
- Write a scientific report

How do you need to prepare for the seminar?

- Please do not work on your topic completely alone
  $\rightarrow$ meet at least twice with your supervisor
- Schedule:

  - 1 month before the talk: meet supervisor to discuss paper
  - 1 week before the talk: meet supervisor to discuss your slides
  - [optional] shortly after the talk: get feedback of your supervisor
  - 2 weeks after the talk: submit report

How will your presentation be?

- 30 minutes talk, 10 minutes for questions
  $\rightarrow$ make sure to finish on time!
- 1-2 minutes per slide $\rightarrow$ 15-30 slides, do not put too much information!
- Recommended structure:
  - Introduction, problem motivation, outline
  - Approach
  - Experimental results
  - Discussion
  - Summary of scientific contributions

What about the final report?

- Use LaTeX template and send final pdf via email to supervisor
- Length: 6-10 pages
- Language: English

What do we expect from you?

- Regular attendance is required!
- Active participation in the discussions
- Quality of the talk
- Quality of the report

How is the seminar organized?

- Weekly meetings are on Wednesdays from 2pm to 4pm
- Two presentations per week
- 14 participants $\rightarrow$ 7 weeks of presentations
- There might be an introductory meeting before the presentations start
- Starting date will be announced on web page once papers are assigned, probably end of May

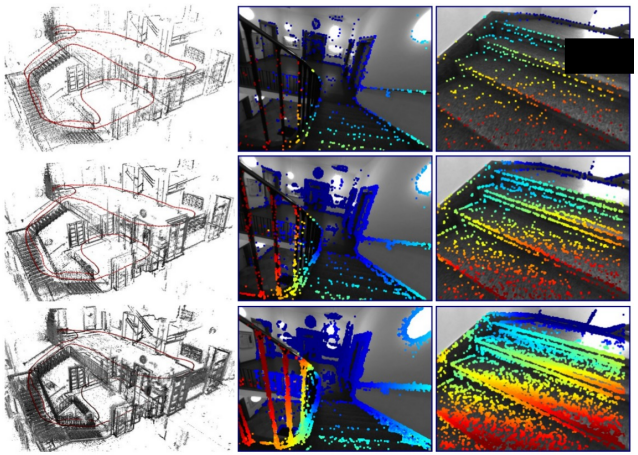
Where do you find the list of papers?

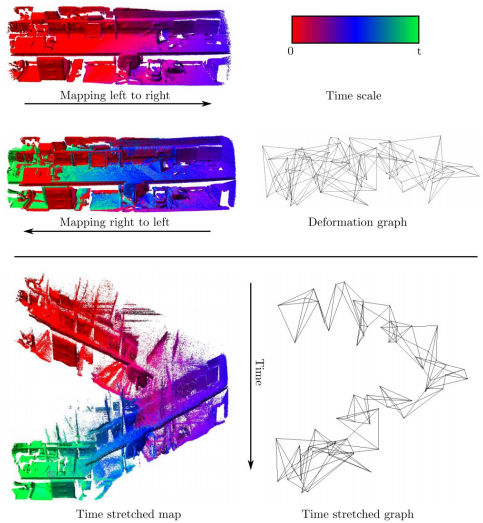
- Go to the seminar web page:
  `https://vision.in.tum.de/teaching/ss2018/seminar_3dcv`
- Follow the link to the material section (will be added after pre-meeting)
- Login with the password `seminar_3dcv_ss18`

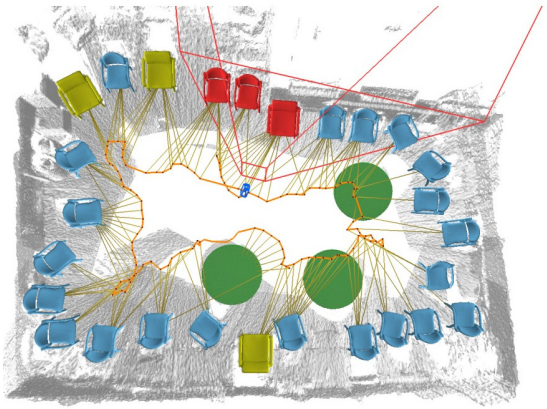
How do we assign papers?

- Register on TUMonline for the seminar *and*
- Send us an email with your 3 preferred papers
- We will match the TUMonline list with the emails we get and select candidates.
- You will get an email with our decision both in case of acceptance and in case of rejection.

Paper of Interests

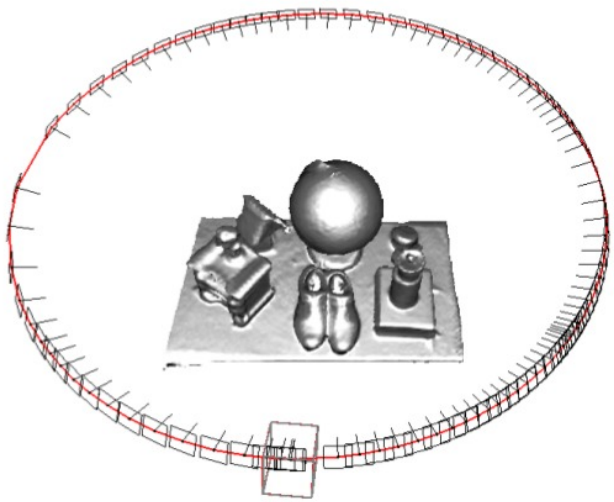


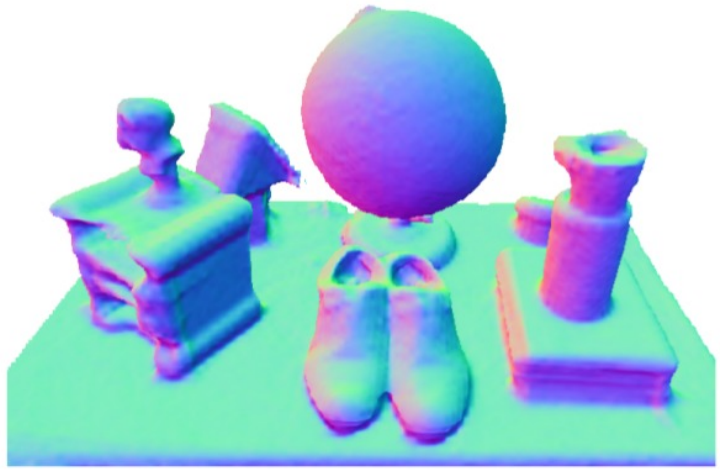




KinectFusion: Real-Time Dense Surface Mapping and Tracking

R. Newcombe, S. Izadi, O. Hilliges, D. Molyneaux
D. Kim, A. Davison, P. Kohli, J. Shotton
S. Hodges and A. Fitzgibbon



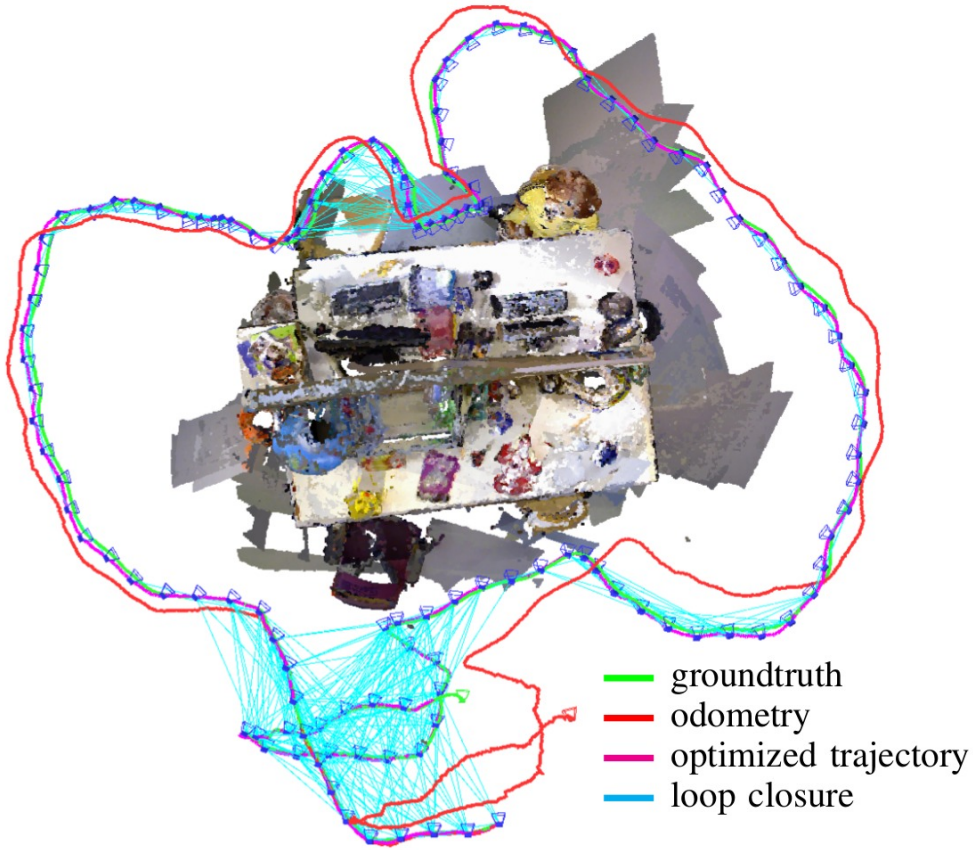


BundleFusion: Real-time Globally Consistent 3D Reconstruction using On-the-fly Surface Re-integration

A. Dai, M. Nießner, M. Zollhöfer, S. Izadi and C. Theobalt

Dense Visual SLAM for RGB-D Cameras

C. Kerl, J. Sturm and D. Cremers

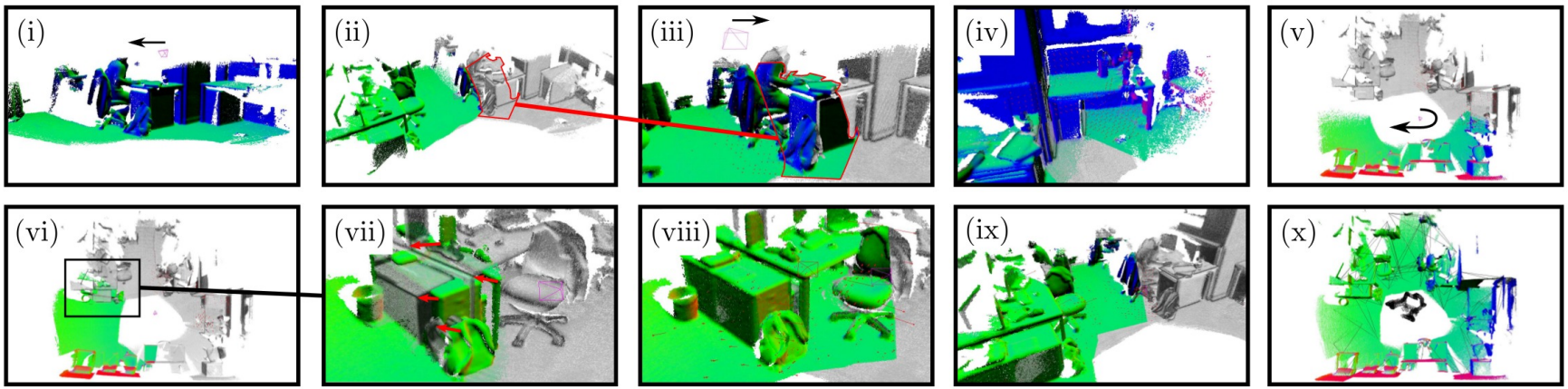


Real-Time Camera Tracking and 3D Reconstruction Using Signed Distance Functions

E. Bylow, J. Sturm, C. Kerl, F. Kahl and D. Cremers

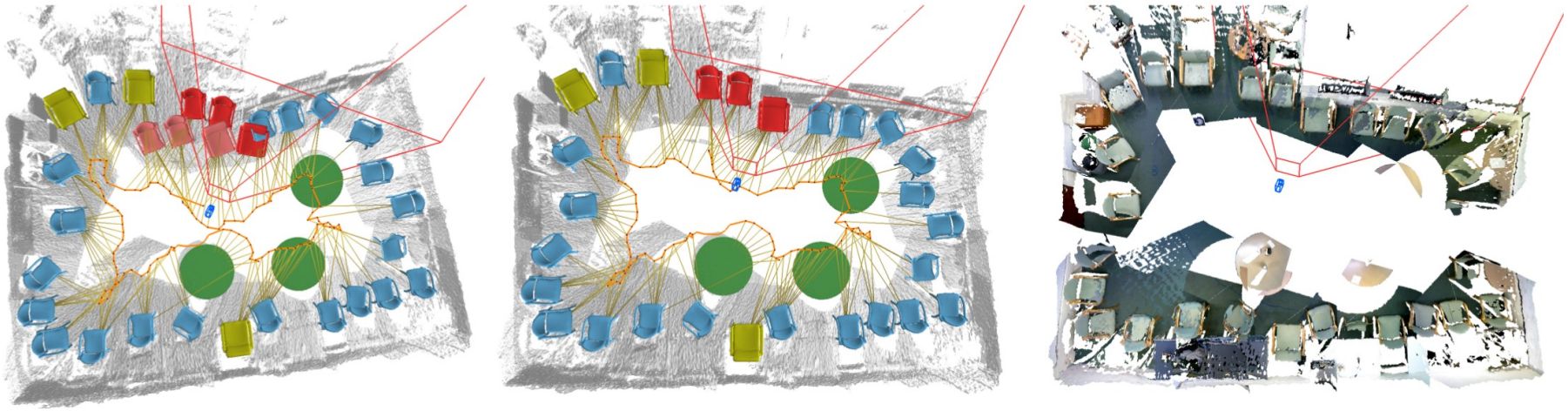
ElasticFusion: Real-Time Dense SLAM and Light Source Estimation

T. Whelan, R. F. Salas-Moreno, B. Glocker
A. Davison and S. Leutenegger



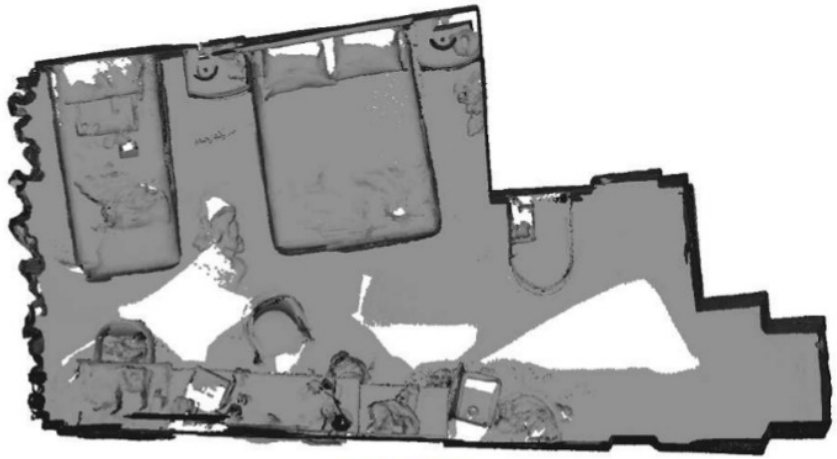
SLAM++: Simultaneous Localisation and Mapping at the Level of Objects

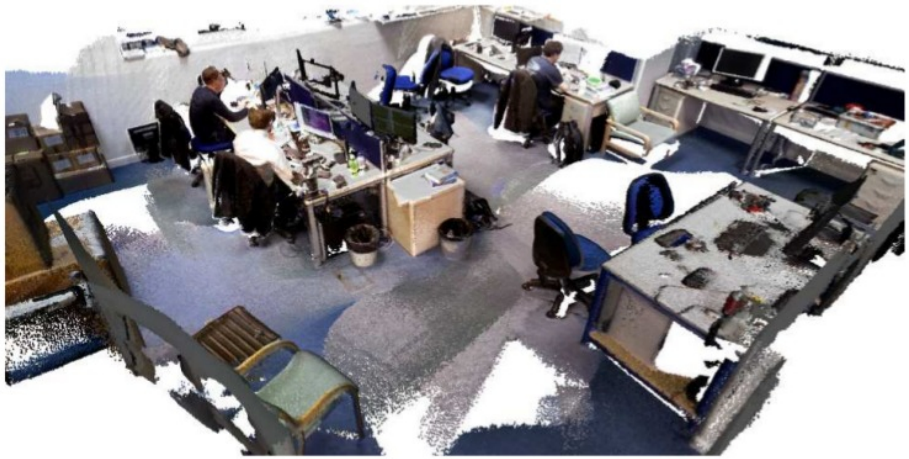
R. F. Salas-Moreno, R. Newcombe, H. Strasdat, P. Kelly and A. Davison



RGB-D SLAM

video demo





Dense Reconstruction

Real-time 3D Reconstruction at Scale using Voxel Hashing

M. Nießner, M. Zollhöfer, S. Izadi and M. Stamminger

Color Map Optimization for 3D Reconstruction with Consumer Depth Cameras

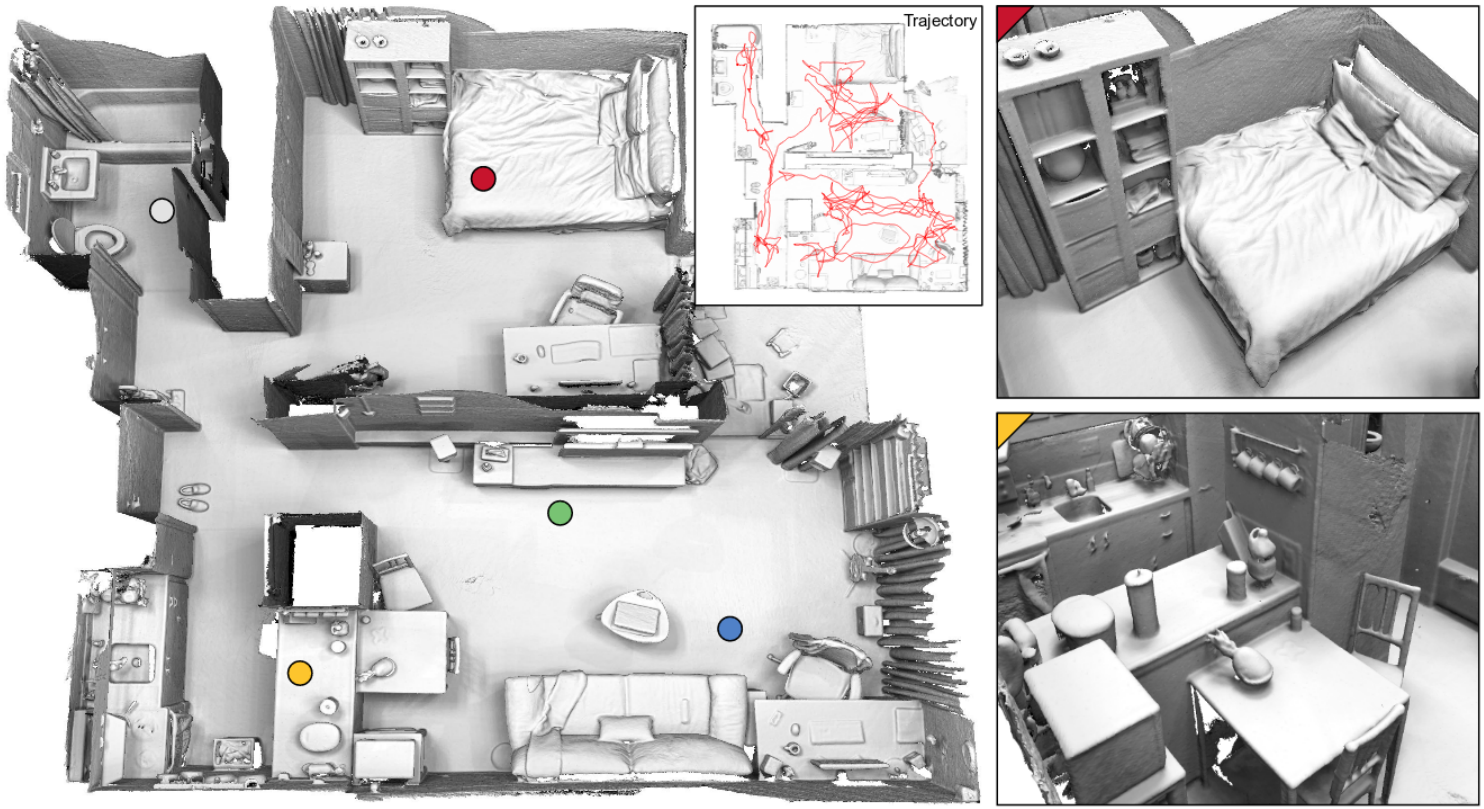
Q.-Y. Zhou and V. Koltun

Input

Optimized reconstruction

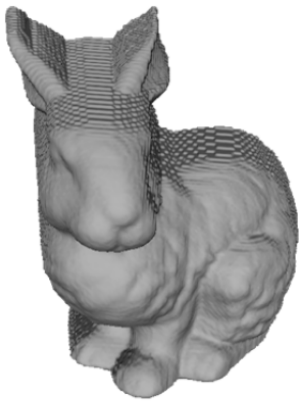
Robust Reconstruction of Indoor Scenes

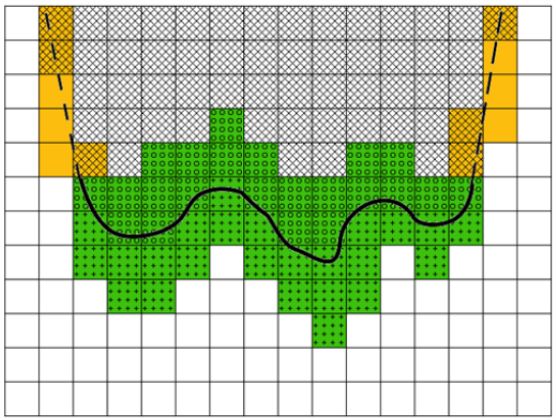
S. Choi, Q.-Y. Zhou and V. Koltun

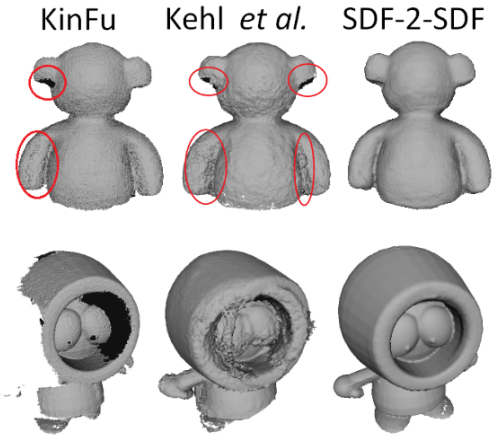


SDF-2-SDF: Highly Accurate 3D Object Reconstruction

M. Slavcheva, W. Kehl, N. Navab and S. Ilic

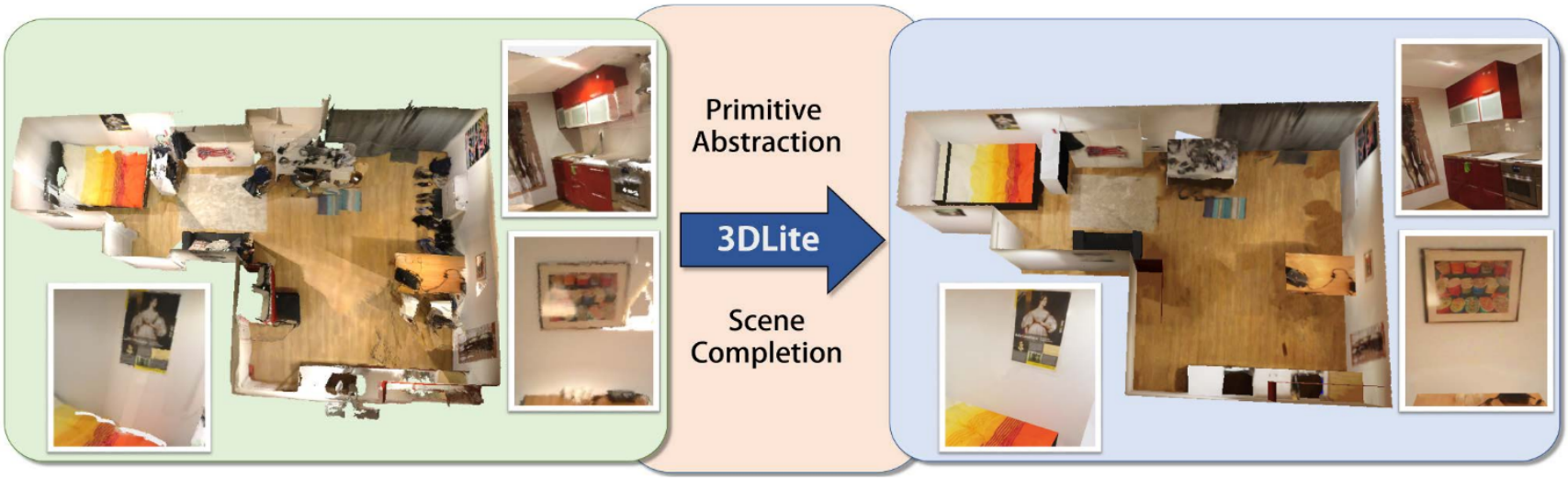






3DLite: Towards Commodity 3D Scanning for Content Creation

J. Huang, A. Dai, L. Guibas and M. Nießner



Dynamic Mapping

VolumeDeform: Real-time Volumetric Non-rigid Reconstruction

M. Innmann, M. Zollhöfer, M. Nießner
C. Theobalt and M. Stamminger

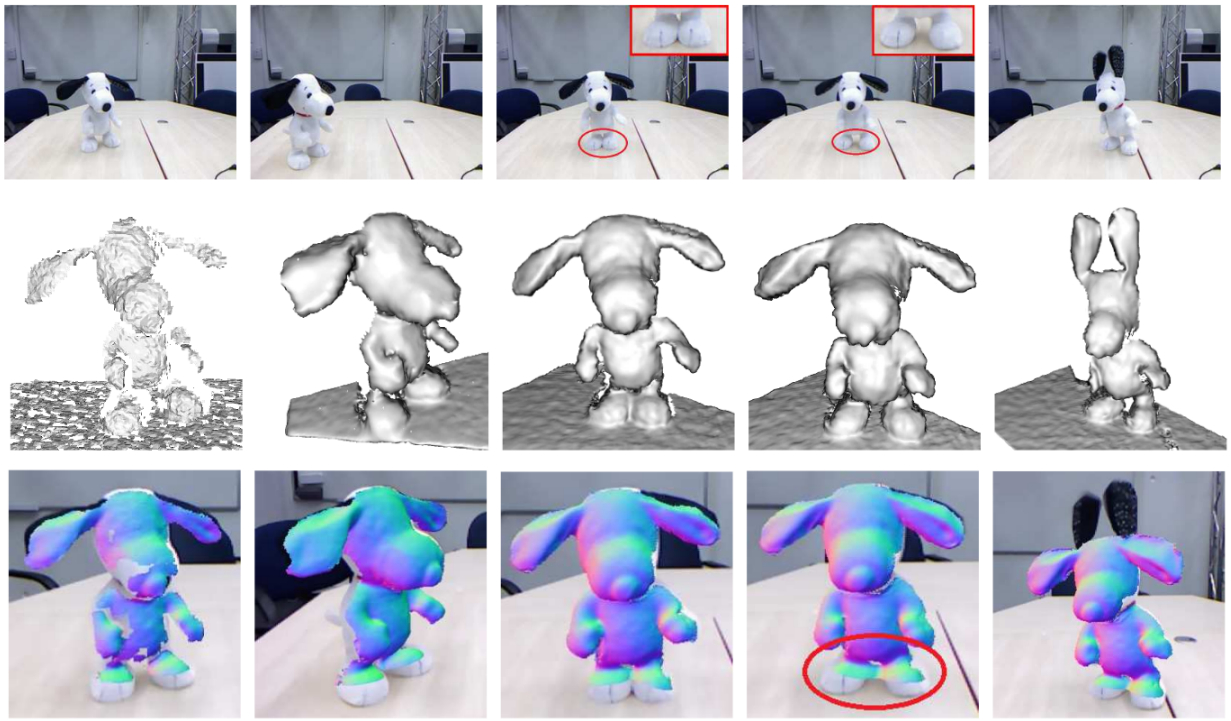
DynamicFusion: Reconstruction and Tracking of Non-rigid Scenes in Real-Time

R. Newcombe, D. Fox and S. Seitz

(d) Canonical Model (e) Canonical model warped into its live frame (f) Model Normals

KillingFusion: Non-rigid 3D Reconstruction without Correspondences

M. Slavcheva, M. Baust, D. Cremers and S. Ilic

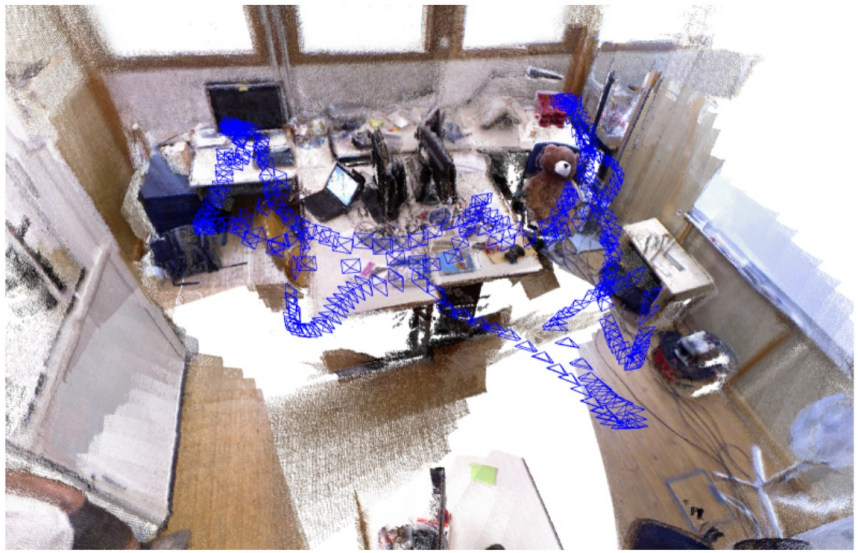


Fusion4D: Real-time Performance Capture of Challenging Scenes

M. Dou, S. Khamis, Y. Degtyarev, P. Davidson
S. Fanello, A. Kowdle, S. Escolano, C. Rhemann
D. Kim, J. Taylor, P. Kohli, V. Tankovich and S. Izadi

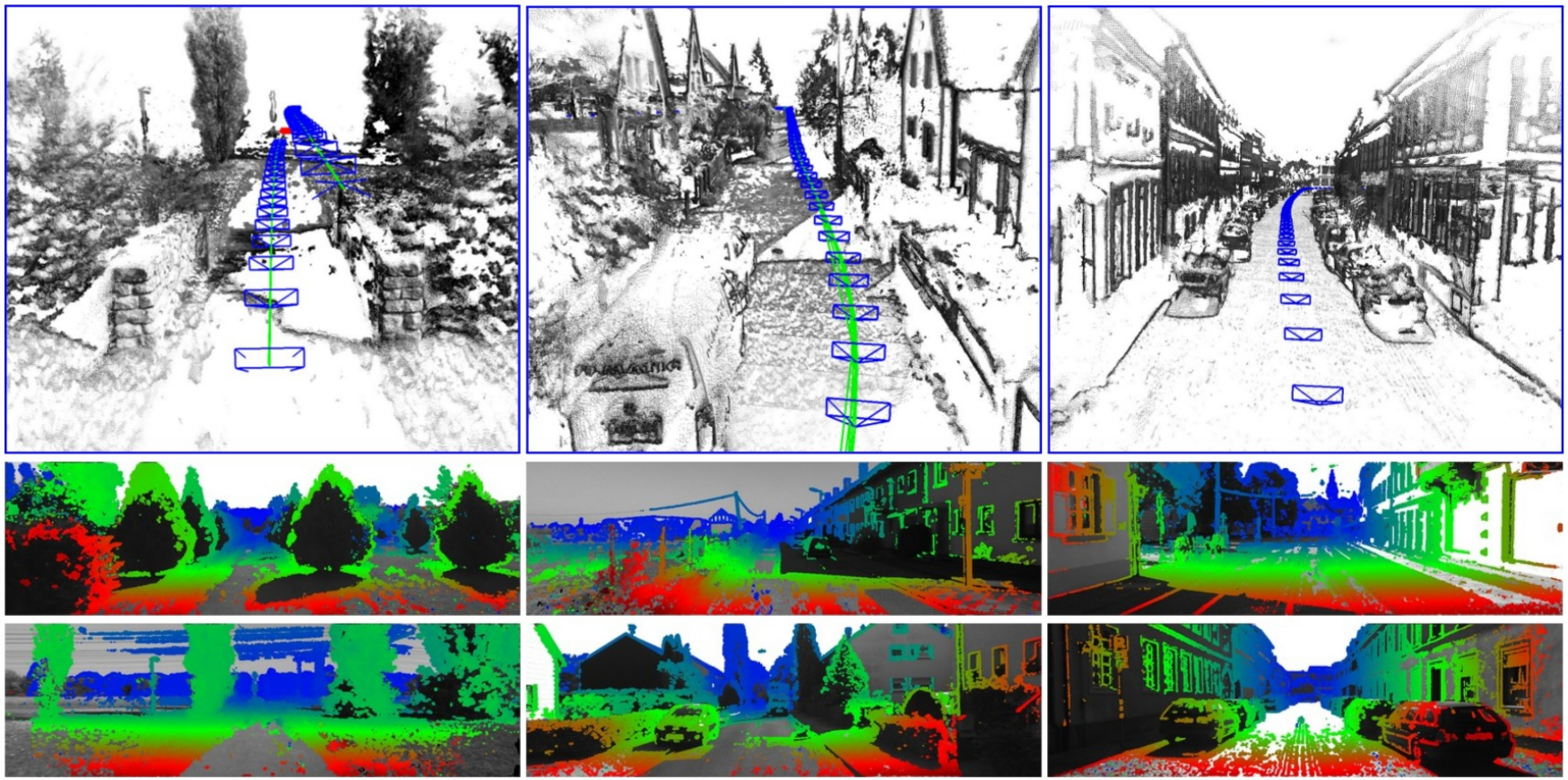
ORB-SLAM: a Versatile and Accurate Monocular SLAM System

R. Mur-Artal, J. Montiel, and J. Tardós



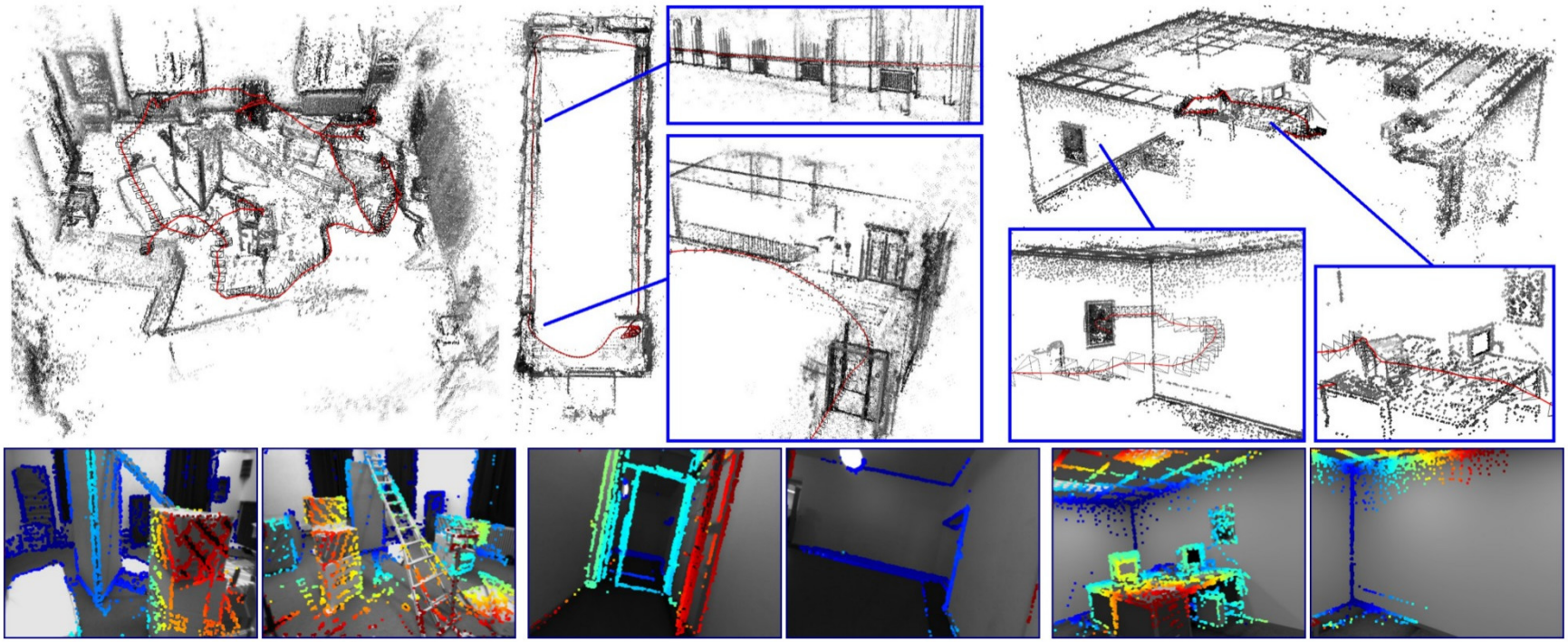
Large-Scale Direct SLAM with Stereo Cameras

J. Engel, J. Stueckler and D. Cremers



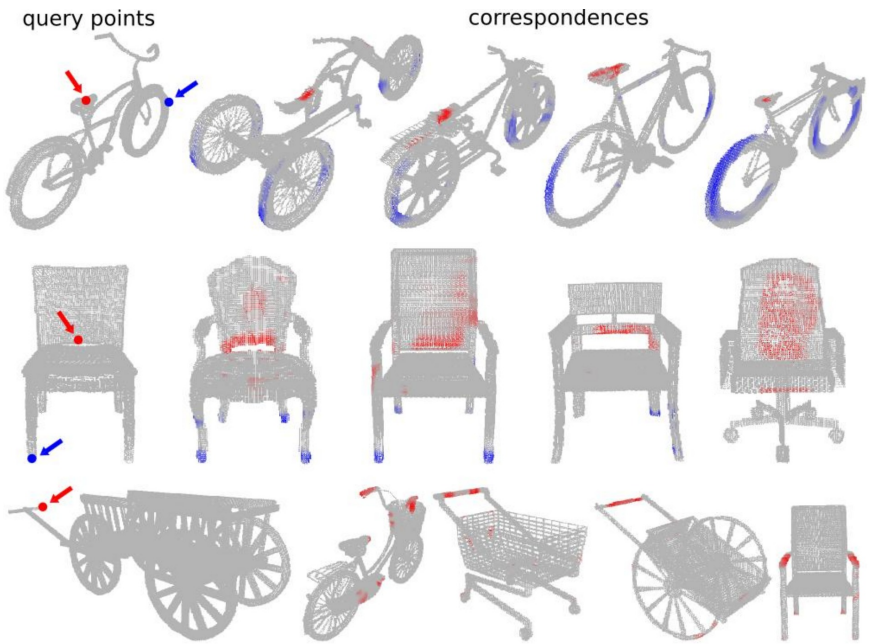
Direct Sparse Odometry

J. Engel, V. Koltun and D. Cremers



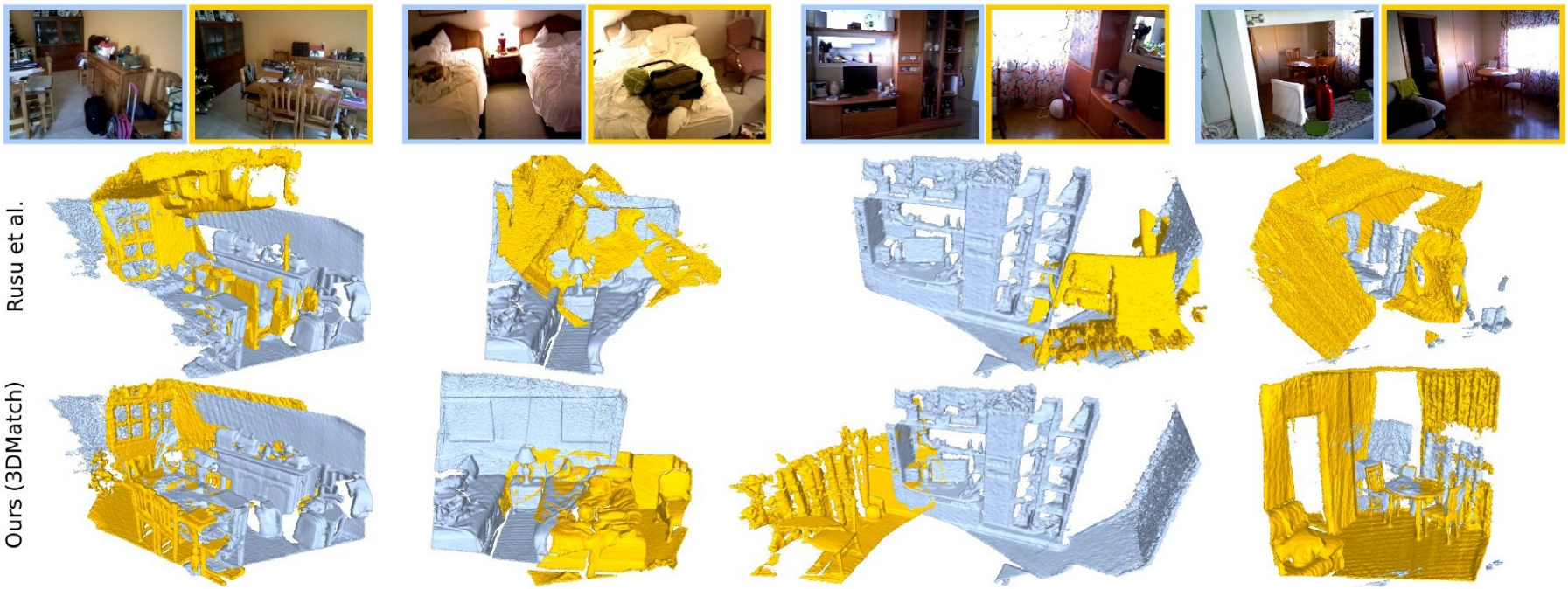
3DMatch: Learning Local Geometric Descriptors from RGB-D Reconstructions

A. Zeng, S. Song, M. Nießner, M. Fisher, J. Xiao and T. Funkhouser



3D feature, correspondences

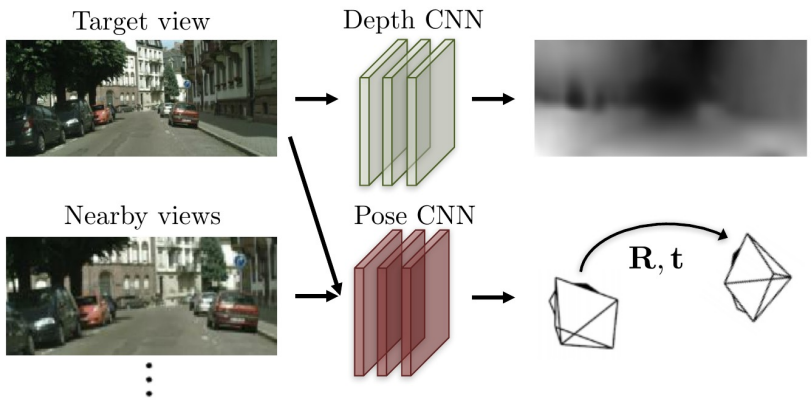
- keypoint matching
- correspondences over 3D meshes
- geometric registration



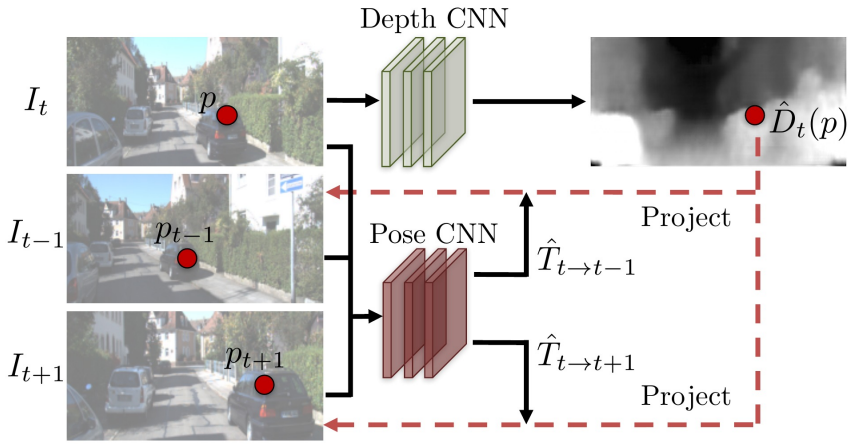
Unsupervised Learning of Depth and Ego-Motion from Video

T. Zhou, M. Brown, N. Snavely and D. G. Lowe

(a) Training: unlabeled video clips.



(b) Testing: single-view depth and multi-view pose estimation.

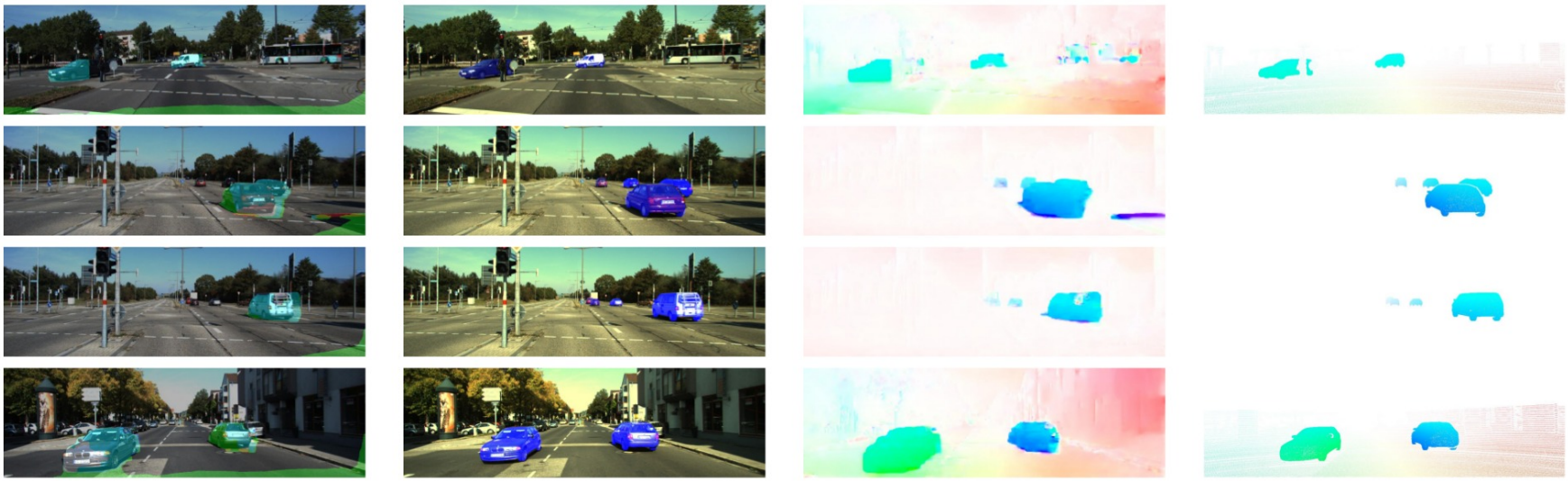


depth and motion

- CNN
- unsupervised learning
- adapt canonical algorithms with deep learning

SfM-Net: Learning of Structure and Motion from Video

S. Vijayanarasimhan, S. Ricco and C. Schmid,
R. Sukthankar and K. Fragkiadaki



Questions ?

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