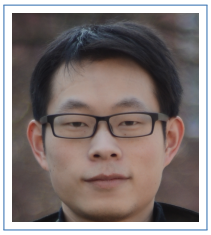
Rui Yu

Curriculum Vitae

✉ *r.yu@cs.ucl.ac.uk*
www0.cs.ucl.ac.uk/staff/R.Yu



Work

2019.2-Now **Computer Vision Engineer**, *Apple*.

2017-2019.1 **Computer Vision Engineer**, *DJI*.

Education

2013-2017 **PhD in Computer Vision**, *University College London*.
Supervisor: Lourdes Agapito and Chris Russell

2012-2013 **PhD in Computer Vision**, *Queen Mary, University of London*.
Supervisor: Lourdes Agapito and Chris Russell

2009-2012 **MEng in Computer Vision**, *Northwestern Polytechnical University*.
Supervisor: Yanning Zhang and Tao Yang

2005-2009 **BEng in Computer Science**, *Northwestern Polytechnical University*.

PhD Thesis

Title *Learning dense 3D models from video*

Supervisors Professor Lourdes Agapito & Chris Russell

Description This PhD project aims to provide optimization methods for detailed life-like 3D reconstructions of non-rigid objects from video taken with a single camera.

Master Thesis

Title *Vision-based autonomous landing of an unmanned aerial vehicle*

Supervisors Professor Yanning Zhang & Tao Yang

Description This thesis aims to develope a real-time vision-based autonomous landing system for an unmanned aerial vehicle.

Selected Publications

IJCV submission *Qi Liu Yin*[†], ***Rui Yu***[†], *Andrew Fitzgibbon, Chris Russell, Lourdes Agapito([†]joint first authorship)*. Better Together: Joint Reasoning for Non-rigid 3D Reconstruction with Specularities and Shading. Invited for IJCV Special Issue submission.

BMVC16(Oral) ***Rui Yu***, *Chris Russell, Lourdes Agapito.* Solving Jigsaw Puzzles with Linear Programming.

BMVC16 (Best Poster) Qi Liu Yin, ***Rui Yu***, *Andrew Fitzgibbon, Chris Russell, Lourdes Agapito.* Better Together: Joint Reasoning for Non-rigid 3D Reconstruction with Specularities and Shading.

ICCV15 ***Rui Yu***, *Chris Russell, Neill D. F. Campbell, Lourdes Agapito.* Direct, Dense, and Deformable: Template-Based Non-Rigid 3D Reconstruction from RGB Video.

ECCV14(Oral) *Chris Russell*[†], ***Rui Yu***[†], *Lourdes Agapito([†]joint first authorship).* Video Pop-up: Monocular 3D Reconstruction of Dynamic Scenes.

ECCV14 *Tao Yang, Yanning Zhang, Jingyi Yu, Jing Li, Xiaomin Tong,* ***Rui Yu***, *Lingyan Ran.* All-in-Focus Synthetic Aperture Imaging.

IVC14 *Tao Yang, Yanning Zhang,* ***Rui Yu***, *Xiaoqiang Zhang, Ting Chen, Lingyan Ran, Zhengxi Song, Wenguang Ma.* Simultaneous active camera array focus plane estimation and occluded moving object imaging.

TCSVT13 *Tao Yang, Yanning Zhang, Xiaomin Tong, Xiaoqiang Zhang,* ***Rui Yu***. A new hybrid synthetic aperture imaging model for tracking and seeing people through occlusion.

CVPR11 *Tao Yang, Yanning Zhang, Xiaomin Tong, Xiaoqiang Zhang,* ***Rui Yu***. Continuously tracking and see-through occlusion based on a new hybrid synthetic aperture imaging model.

Awards

2013-2017 UCL PhD Studentship

2012-2013 QMUL PhD Studentship

2012 Outstanding Master Dissertation Award of NWPU

2009-2011 Award of First Rank Grant of NWPU

2005-2009 Award of 'Yingcai' Scholarship of NWPU

2005-2006 Award of National Scholarship

Project Experiences

Jigsaw Puzzle **Summary:** we propose a novel Linear Program (LP) based formulation for solving jigsaw puzzles. We formulate jigsaw solving as a set of successive global convex relaxations of the standard NP-hard formulation, that can describe both jigsaws with pieces of unknown position and puzzles of unknown position and orientation.
Advantages: (1) a reduced sensitivity to local minima compared to greedy approaches, since our successive approximations are global and convex. (2) an increased robustness to the presence of mismatches in the pairwise matches due to the use of a weighted L1 penalty.
Keywords: jigsaw puzzles, linear programming, convex optimization

Direct, Dense 3D Tracking

Summary: we tackle the problem of capturing the dense, detailed 3D geometry of generic, complex non-rigid meshes using a single RGB-only commodity video camera and a direct approach. Research results were published on ICCV 2015.
Advantages: minimizes a robust photometric cost that simultaneously estimates the temporal correspondences and 3D deformations.
Keywords: direct, dense, template-based deformable 3D tracking, monocular non-rigid 3D reconstruction from RGB video
Implementation: C++, Ceres Solver, OpenCV, OpenGL, wxWidgets, Boost
Code: https://github.com/cvfish/PangaeaTracking

Video Pop-up

Summary: consider a video sequence captured by a single camera observing a complex dynamic scene containing an unknown mixture of multiple moving and possibly deforming objects, we propose an unsupervised approach to the challenging problem of simultaneously segmenting the scene into its constituent objects and reconstructing a 3D model of the scene. Research results were published on ECCV 2014 as an oral presentation.
Advantages: able to deal with real-world dynamic scenes and handle seamlessly different types of motion: rigid, articulated and non-rigid.
Keywords: motion segmentation, piecewise rigid reconstruction, graph-cut, non-rigid 3D reconstruction from RGB video
Implementation: Matlab, C++, Ceres Solver

Multi-view reconstruction

Summary: we developed a real-time 3D reconstruction system based on multiple cameras, including Multi-Camera Parallel Image Capture and Foreground Segmentation Module, Real Time 3D Reconstruction Module, Real Time Rendering Module, etc. With this system we can perform real time 3D reconstruction on a single PC.
Advantages: without using any GPU we are able to perform 8-camera reconstruction in real-time.
Keywords: real-time system, shape from silhouette, multi-view reconstruction
Implementation: C++, Visual Studio, MFC, Ogre, OpenCV, OpenGL

Multi-camera multi-people detection, imaging and tracking

Summary: we developed a real-time multi-camera multi-people detection, synthetic aperture imaging and tracking system. A novel hybrid synthetic aperture imaging model was proposed to solve occlusion challenges. A network camera based hybrid synthetic aperture imaging system has been set up, and experimental results with qualitative and quantitative analysis demonstrate that the method can reliably locate and see people in challenge scene. Research results were published on CVPR 2011.
Advantages: (1) This algorithm is the first time to solve occluded people imaging and tracking problem in a joint multiple camera synthetic aperture imaging domain. (2) A multiple model framework is designed to achieve seamless interaction among the detection, imaging and tracking modules. (3) In the object detection module, a multiple constraints based approach is presented for people localization and ghost objects removal in a 3D foreground silhouette synthetic aperture imaging volume. (4) In the synthetic imaging module, a novel occluder removal based synthetic imaging approach is proposed to continuously obtain object clear image even under severe occlusion. (5) In the object tracking module, a camera array is used for robust people tracking in color synthetic aperture images.
Keywords: real-time system, detection and tracking, multi-camera, multi-people, camera-array, synthetic aperture imaging
Implementation: C++, Visual Studio, MFC, OpenCV, OpenGL

Vision-based autonomous UAV Landing

Summary: we developed a real-time vision-based UAV autonomous landing system. Different from traditional vision-based UAV landing guidance system, our system uses visible remote super brightness flashlight instead of infra-red light. Effective localization result can be as far as 400m even in a strong lighting environment. Accuracy of our localization result was demonstrated by the safe landing of our UAV without using Differential GPS. With this technology we participated AVIC Cup-International UAV Innovation Grand Prix.
Advantages: the effective detection distance of the system is about 400m and the system has been successfully used in real-world UAV landing experiments.
Keywords: real-time system, detection and tracking, vision-based UAV autonomous landing system
Implementation: C++, Visual Studio, MFC, OpenCV, OpenGL

Experiences Summary

Background

Research interests in optimization, computer vision machine learning and deep learning, etc. Hands on experiences in techniques such as SLAM, linear programming, non-linear least squares, graph-cuts, 3D deep learning.

Research

9+ years computer vision research experience, with a special focus on geometric computer vision, including structure from motion, shape from silhouette, camera-array synthetic aperture imaging, multi-view reconstruction, monocular reconstruction of dynamic scenes, 6DoF camera tracking and 3D shape tracking.

Engineering	9+ years computer vision system development experience, including real-time multi-view reconstruction system, real-time autonomous UAV landing system, real-time multi-camera multi-people detection, imaging and tracking system. Lots of software and library experiences, e.g. PyTorch, Visual Studio, emacs, MFC, OpenCV, OpenGL, ROS, Ceres Solver, Ogre and Boost etc.
Publications	Top conference publications in computer vision, including CVPR, ICCV and ECCV.
Activities	Attendance of top computer vision conferences and workshops, including ICCV, ECCV and SLAM workshops.

Code

DeMoN	`https://github.com/cvfish/pytorch_demon`
VideoPopup	`https://github.com/cvfish/VideoPopup`
DenseTracking	`https://github.com/cvfish/PangaeaTracking`

Talks

Online Talk	Deep Learning Meets Geometry. *slide*
BMVC Oral	Solving Jigsaw Puzzles with Linear Programming. *slide*
ECCV Oral	Video Pop-up: Monocular 3D Reconstruction of Dynamic Scenes. *slide*

Full Publications

GoogleScholar	For all my publications, please refer to *my google scholar page*.