# Dr. Changjiang Cai

Staff Research Engineer in 3D Vision – InnoPeak Technology, Inc

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## About

I am serving as a Sr. researcher in 3D computer vision with InnoPeak Technology, Inc., to solve problems in 3D reconstruction and XR(AR/VR/MR) via leveraging my knowledge of Computer Vision and Machine Learning. I obtained my Ph.D. degree of Computer Science from *Stevens Institute of Technology*. My research interests focus on image and video based 3D reconstruction, human mesh recovery and representation learning.

## Education

- **Stevens Institute of Technology** **Hoboken, New Jersey, USA**
  *Doctor of Philosophy in Computer Science, in May 2021*
  Research Interests: Computer Vision and Machine Learning. Specifically, Stereo Vision, Depth Prediction, 3D reconstruction and Human Mesh Recovery.
  **Advisor**: Philippos Mordohai (`https://mordohai.github.io`)
- **Stevens Institute of Technology** **Hoboken, New Jersey, USA**
  *Master of Engineering in Electrical Engineering, in February 2016*
  Concentration: Computer Vision and Machine Learning.
  **Advisor**: Gang Hua (`http://www.ganghua.org`)
- **Xi'an Jiaotong University** **Xi'an, Shaanxi, China**
  *Mechanical Engineering*
  Research Area: Digital Image Processing. **Advisor**: Dehong Yu
- **Northwestern Polytechnical University** **Xi'an, Shaanxi, China**
  *B.E. in Automobile Engineering, in July 2009*
  Thesis: Structural Design and 3D Modeling of an Assistive Robot. **Advisor**: Renping Shao

## Publications

### Published

- Jiachen Liu, Pan Ji, Nitin Bansal, **Changjiang Cai**, Qingan Yan, Xiaolei Huang, Yi Xu. *PlaneMVS: 3D Plane Reconstruction from Multi-View Stere.* In CVPR 2022, New Orleans, LA, June 2022.
- **Changjiang Cai**, Philippos Mordohai. *Do End-to-end Stereo Algorithms Under-utilize Information?* In International Conference on 3D Vision (3DV), 2020.

- **Changjiang Cai**, Matteo Poggi, Stefano Mattoccia, and Philippos Mordohai, *Matching-space Stereo Networks for Cross-domain Generalization.* In International Conference on 3D Vision (3DV), 2020.
- Konstantinos Batsos, **Changjiang Cai**, Philippos Mordohai. *CBMV: A coalesced bidirectional matching volume for disparity estimation.* In CVPR 2018, Salt Lake City, Utah, June 2018.
- **Changjiang Cai**, Haipei Sun, Boxiang Dong, Bo Zhang, Ting Wang, Hui Wang.*Pairwise Ranking Aggregation by Non-interactive Crowdsourcing with Budget Constraints.* The 37th IEEE International Conference on Distributed Computing (ICDCS), June, 2017, Atlanta, GA.
- Haoxiang Li, Mohammed Kutbi, Xin Li, **Changjiang Cai**, Philippos Mordohai, Gang Hua, *An Egocentric Computer Vision based Co-Robot Wheelchair.* IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2016.

### Preprints/Submissions

- Ren Li, **Changjiang Cai**, Georgios Georgakis, Srikrishna Karanam, Terrence Chen, Ziyan Wu. *Towards Robust RGB-D Human Mesh Recovery.* arXiv:1911.07383.

## Projects

- **2022 Project** *Consistent Dense Depth Estimation from Multi-view Stereo or Monocular Videos*
  - Reconstructing geometrically consistent depth for dense pixels in multi-view stereo images or a monocular video via leveraging structure-from-motion to establish geometric constraints among common pixels shared by many views.
- **2021 Project** *GCN based Local Expansion for End-to-end MRF Energy Optimization*
  - Integrating local $\alpha$-expansion to GCN for end-to-end solution of MRF energy optimization (e.g., in stereo matching, semantic segmentation and optical flow estimation).
- **2020 Project** *Self-/Un-supervised Robust Presentation Learning*
  - Self- or un-supervised learning for a robust representation which aims to improve semantic segmentation, optical flow estimation and monocular or stereo depth estimation.
- **2020 Project** *Do End-to-end Stereo Algorithms Under-utilize Information?*
  - Incorporated content-adaptive deep filtering techniques into SOTA networks (including DispNetC, GCNet, PSMNet, and GANet) for improved stereo matching.
- **2019 Project** *Matching-space Stereo Networks for Cross-domain Generalization*
  - Proposed a novel family of architectures with domain-invariant generalization.
- **2019 Project** *Depth-Aware Human Mesh Recovery*
  - Proposed a new method using RGB-D data to estimate a parametric human mesh model
- **2018 Project** CBMV_ ROB Entry in the Robust Vision Challenge, CVPR'18 workshop
  - Submitted the CBMV_ROB entry in the stereo challenge, leveraging CBMV volume as in our previous work and local expansion algorithm for optimization.
- **2017 Project** ***CBMV**: A **C**oalesced **B**idirectional **M**atching **V**olume for Disparity Estimation*
  - Generated a matching volume by coalescing diverse evidence from a bidirectional matching process via random forest classifiers.
- **2016 Project** **Crowdsourcing:** *Budget-conscious Ranking by Non-interactive Crowdsourcing*
  - Designed a crowdsourced ranking algorithm enabling task requester to obtain a good

full ranking result from the crowdsourced pairwise comparison, with a limited budget.

- **2015 Project** **Epitome Transform Coding:** *Towards Joint Compression of Images*
  - Proposed epitome transform coding, an approach to joint compression of a set of images.

## Industry Experience

- **Full-time** **InnoPeak Technology, Inc. Palo Alto, CA**
  *Staff Research Scientist* *Nov 2022 – Present*
- **Full-time** **InnoPeak Technology, Inc. Palo Alto, CA**
  *Sr. Research Scientist* *Jun 2021 – Nov 2022*
- **Part-time intern** **Futurewei Technologies, Inc. Seattle, WA**
  *Research Intern* *Sep 2020 – Dec 2020*
- **Summer intern** **Futurewei Technologies, Inc. Seattle, WA**
  *Research Intern* *May 2020 – Aug 2020*
- **Summer intern** **UII America, Cambridge, MA**
  *Research Intern* *May 2019 – Aug 2019*

## Teaching Experience

- **CS442 - Database Management Systems** **Stevens Institute of Technology**
  *Teaching Assistant* *Aug 2016 – Dec 2016*

## Services

- **Reviewer for the following journals**:
  - IEEE Transactions on Image Processing (TIP)
  - IEEE Transactions on Multimedia (TMM)
  - International Journal of Computer Vision (IJCV)
- **Reviewer for the following conferences:**
  - ACM Multimedia Conference (Since ACMMM 2020)
  - AAAI Conference on Artificial Intelligence (Since AAAI 2022)
  - International Conference on Pattern Recognition (Since ICPR 2022)
  - International Conference on Multimedia Information Processing and Retrieval (MIPR'22)
  - IEEE/CVF Conf. on Computer Vision and Pattern Recognition (Since CVPR 2023)

## Skills

- **Programming Languages:** Python, C/C++, CUDA, Python& C++ Hybrid, MATLAB
- **Deep Learning:** PyTorch, TensorFlow, Keras, Caffe
- **Machine Learning:** Numpy, Scikit-learn, Scipy, Pandas
- **Computer Vision and 3D Geometry:** OpenCV, PyTorch Geometric, TensorFlow Graphics
- **Other Library & APIs:** Matplotlib, Cython, Boost C++

- **Database:** MySQL, PostgreSQL
- **Tools:** Vim, Git, CMake, Bash, Tmux, Visual Studio Code, MeshLab, Office, Latex
- **OS Platforms:** Linux, macOS, Windows

## Languages

- Chinese (native), English (proficient)

## Hobbies

- Playing Basketball, Running and Biking
- Driving and Road Trip