

Shenlong Wang

Suite 720
661 University Ave.
Toronto, Ontario

416-569-1119 (mobile)
slwang@cs.toronto.edu
<http://www.cs.toronto.edu/~slwang/>

My goal is to make robots assist us in our daily lives in the open world. To reach this goal, I have focused on building more reliable and generalizable mobile robots, such as self-driving vehicles. I leverage my knowledge in computer vision, robotics and deep learning to tackle problems such as 3D perception and reconstruction, localization and mapping, motion estimation, simulation, and deep structural learning.

Education

- **University of Toronto** Toronto, Ontario
PhD student in Computer Science Jan. 2014 - present
– Advisor: Raquel Urtasun
- **Northwestern Polytechnical University** Xi'an, China
Master of Science in Pattern Recognition Sep. 2010 - Mar. 2013
- **Northwestern Polytechnical University** Xi'an, China
Bachelor of Science in Computational Mathematics Sep. 2006 - Jun. 2010

Employment

- **Senior Research Scientist II** Mar 2019 - present
Uber Advanced Technologies Group Toronto Toronto
– Manager: Raquel Urtasun
- **Senior Research Scientist I** Mar 2018 - Mar 2019
Uber Advanced Technologies Group Toronto Toronto
– Manager: Raquel Urtasun
- **Research Scientist II** May 2017 - Mar 2018
Uber Advanced Technologies Group Toronto Toronto
– Manager: Raquel Urtasun
- **Research Intern** Jun 2016 - Sept 2016
Snapchat Research Venice
– Host: Jia Li, Linjie Luo and Ning Zhang
- **Research Intern** Aug 2015 - Nov 2015
Microsoft Research Redmond, Interactive 3D Group Redmond
– Host: Pushmeet Kohli, Shahram Izadi and Sean Fanello
- **Research Assistant** Jul 2011 - Aug 2013
The Hong Kong Polytechnic University Hong Kong
– Advisor: Lei Zhang

Publications

* indicates equal contribution

underline indicates intern/resident mentees

1. Kelvin Wong, **Shenlong Wang**, Mengye Ren, Raquel Urtasun, “Identifying Unknown Instances for Autonomous Driving”, *International Conference on Robot Learning (CoRL)*, Osaka, Japan, 2019. (**Spotlight**)

2. Jerry Liu, **Shenlong Wang**, Raquel Urtasun, “Deep Stereo Compression”, *International Conference on Computer Vision (ICCV)*, Seoul, South Korea, 2019. (**Oral**)
3. Shivam Duggal, **Shenlong Wang**, Wei-Chiu Ma, Rui Hu, Raquel Urtasun, “Differentiable Deep PatchMatch for Efficient Stereo Matching”, *International Conference on Computer Vision (ICCV)*, Seoul, South Korea, 2019.
4. Renjie Liao, Yujia Li, Yang Song, **Shenlong Wang**, Charlie Nash, Yujia Li, William L. Hamilton, David Duvenaud, Raquel Urtasun, and Richard Zemel, “Efficient Graph Generation with Graph Recurrent Attention Networks”, *Neural Information Processing Systems (NeurIPS)*, Long Beach, CA, 2019.
5. Wei-Chiu Ma*, Ignacio Tartavull*, Andrei Bârsan*, **Shenlong Wang***, Gellért Mátyus, Min Bai, Shrinidhi Kowshika, Andrei Pokrovsky, Raquel Urtasun, “Exploiting Sparse Semantic HD Maps for Affordable Localization”, *International Conference on Intelligent Robots and Systems (IROS)*, Macau, China, 2019. (**Oral**)
6. Wei-Chiu Ma, **Shenlong Wang**, Rui Hu, Yuwen Xiong, Raquel Urtasun, “Deep Structured Scene Flow”, *International Conference on Computer Vision and Pattern Recognition (CVPR)*, Long Beach, CA, 2019.
7. Xinkai Wei*, Andrei Barsan*, **Shenlong Wang***, Julieta Martinez, Raquel Urtasun, “Learning to Localize through Compressed Binary Maps”, *International Conference on Computer Vision and Pattern Recognition (CVPR)*, Long Beach, CA, 2019.
8. Justin Liang*, Namdar Homayounfar*, Wei-Chiu Ma, **Shenlong Wang**, Raquel Urtasun, “Convolutional Recurrent Network for Road Boundary Extraction”, *International Conference on Computer Vision and Pattern Recognition (CVPR)*, Long Beach, CA, 2019.
9. Andrei Bârsan*, **Shenlong Wang***, Andrei Pokrovsky, Raquel Urtasun, “Learning to Localize with a Lidar Intensity Map”, *Conference on Robot Learning (CORL)*, Zurich, Switzerland, 2018. (**Spotlight**)
10. Min Bai*, Gellert Mattyus*, Namdar Homayounfar, **Shenlong Wang**, Shrinidhi Kowshika Lakshmikanth, Raquel Urtasun, “Deep Multi-Sensor Lane Detection”, *International Conference on Intelligent Robots and Systems (IROS)*, Madrid, Spain, 2018. (**Spotlight**)
11. Ming Liang, Bin Yang, **Shenlong Wang**, Raquel Urtasun, “Deep Continuous Fusion for Multi-Sensor 3D Object Detection”, *European Conference on Computer Vision (ECCV)*, Munich, Germany, 2018.
12. **Shenlong Wang***, Simon Suo*, Wei-Chiu Ma, Andrei Pokrovsky, Raquel Urtasun, “Deep Parametric Continuous Convolutional Neural Networks”, *International Conference on Computer Vision and Pattern Recognition (CVPR)*, Salt Lake City, UT, 2018. (**Spotlight**)
13. Daniel Ron, Kun Duan, Chongyang Ma, Ning Xu, **Shenlong Wang**, Sumant Hanumante and Dhritiman Sagar, “Monocular Depth Estimation via Deep Structured Models with Ordinal Constraints”. *International Conference on 3D Vision (3DV)*, Verona, Italy, 2018.
14. **Shenlong Wang**, Min Bai*, Gellert Mattyus*, Hang Chu*, Wenjie Luo, Bin Yang, Justin Liang, Joel Cheverie, Sanja Fidler, Raquel Urtasun, “TorontoCity: Seeing the World with a Million Eyes”, *International Conference on Computer Vision (ICCV)*, Venice, Italy, 2017. (**Spotlight**)
15. **Shenlong Wang**, Linjie Luo, Ning Zhang, Li-Jia Li, “AutoScaler: Scale-Attention Networks for Visual Correspondence”, *British Conference on Computer Vision (BMVC)*, London, UK, 2017. (**Oral**)
16. Wei-Chiu Ma, **Shenlong Wang**, Marcus A. Brubaker, Sanja Fidler, and Raquel Urtasun, “Find Your Way by Observing the Sun and Other Semantic Cues”, *International Conference on Robotics and Automation (ICRA)*, Singapore, 2017. (**Oral**)
17. **Shenlong Wang**, Sanja Fidler, Raquel Urtasun, “Proximal Deep Structured Models”, *Neural Information Processing Systems (NeurIPS)*, Barcelona, Spain, 2016.

18. Hang Chu, **Shenlong Wang**, Sanja Fidler, and Raquel Urtasun, “HouseCraft: Building Houses from Rental Ads and Street Views”, *European Conference on Computer Vision (ECCV)*, Amsterdam, Netherlands, 2016
19. Sergio Orts Escolano, Christoph Rhemann, Sean Fanello, Wayne Chang, Adarsh Kowdle, Yury Degtyarev, David Kim, Philip Davidson, Sameh Khamis, Mingsong Dou, Vladimir Tankovich, Charles Loop, Qin Cai, Philip Chou, Sarah Mennicken, Julien Valentin, Vivek Pradeep, **Shenlong Wang**, Sing Bing Kang, Pushmeet Kohli, Yuliya Lutchyn, Cem Keskin, Shahram Izadi, “Holoportation: Virtual 3d teleportation in real-time”, *ACM User Interface Software and Technology Symposium (UIST)*, Tokyo, Japan, 2016. (**Oral**)
20. **Shenlong Wang**, Sean Fanello, Christoph Rhemann, Shahram Izadi, and Pushmeet Kohli, “The Global Patch Collider”, *International Conference on Computer Vision and Pattern Recognition (CVPR)*, Las Vegas, NV, 2016. (**Oral**)
21. Gellért Mátyus, **Shenlong Wang**, Sanja Fidler, Raquel Urtasun, “HD Maps: Fine-grained Road Segmentation by Parsing Ground and Aerial Images”, *International Conference on Computer Vision and Pattern Recognition (ICCV)*, Santiago, Chile, 2015.
22. **Shenlong Wang**, Sanja Fidler, Raquel Urtasun, “Lost Shopping! Monocular Localization in Large Indoor Spaces”, *International Conference on Computer Vision (ICCV)*, Santiago, Chile, 2015. (**Oral**)
23. Gellért Mátyus, **Shenlong Wang**, Sanja Fidler, Raquel Urtasun, “Enhancing World Maps by Parsing Aerial Images”, *International Conference on Computer Vision (ICCV)*, Santiago, Chile, 2015.
24. **Shenlong Wang**, Sanja Fidler, Raquel Urtasun, “Holistic 3D Scene Understanding from Single Geo-tagged Image”, *International Conference on Computer Vision and Pattern Recognition (CVPR)*, Boston, MA, 2015. (**Oral**)
25. **Shenlong Wang**, Alex Schwing, Raquel Urtasun, “Efficient Inference for Continuous Markov Random Fields with Polynomial Potentials”, *Neural Information Processing Systems (NeurIPS)*, Montreal, Canada, 2014.
26. **Shenlong Wang**, Lei Zhang, Raquel Urtasun, “Transductive Gaussian Process for Image Denoising ”, *International Conference on Computational Photography (ICCP)*, Santa Clara, CA, 2014. (**Oral**)
27. **Shenlong Wang**, Lei Zhang, “Nonlocal Spectral Prior Model for Low-level Vision”, *Asian Conference on Computer Vision (ACCV)*, Daejeon, Korea, 2012.
28. **Shenlong Wang**, Lei Zhang, Yan Liang, Quan Pan, “Semi-Coupled Dictionary Learning with Applications in Image Super-Resolution and Photo-Sketch Image Synthesis ”, *International Conference on Computer Vision and Pattern Recognition (CVPR)*, Providence, RI, 2012.
29. Meng Yang, Lei Zhang, David Zhang, **Shenlong Wang**, “Relaxed Collaborative Representation for Pattern Classification”, *International Conference on Computer Vision and Pattern Recognition (CVPR)*, Providence, RI, 2012.

Honors and Awards

- **Fellowships and Scholarships**

– Facebook Fellowship (13 worldwide)	2017
– Adobe Fellowship (10 worldwide)	2017
– RBC Innovation Scholarship	2017
– Platform Computing Fellowship	2016
– First-Class Graduate Scholarship, NPU (Top 5%)	2011
– National Scholarship (Top 1%)	2009

- Special-Class Undergraduate Scholarship , NPU (Top 0.5%) 2009
- First-Class Scholarship, NPU (Top 10%) 2007, 2008

- **Awards and Prizes**

- Top Patent Filings All-Time Leaderboard, Rank 4th (company-wide), Uber 2019
- Best Master’s Thesis Award, NPU (Top 0.5%) 2013
- Second-Class Award of Chinese Graduate Mathematical Contest of Modeling 2011
- Provincial Excellent Graduate (Top 1%) 2010
- Meritorious Winner of Mathematical Contest of Modeling 2009

- **Travel and Hardware Grants**

- CVPR Doctoral Consortium Grant 2019
- NIPS Travel Grant 2014, 2016
- NVidia Research Hardware Grant 2014
- UofT SGS Conference Grant 2014

Service

- **Conference Reviewing**

- Neural Information Processing System (NeurIPS)
- International Conference on Computer Vision (ICCV)
- Computer Vision and Patter Recognition (CVPR)
- International Conference on Machine Learning (ICML)
- European Conference on Computer Vision (ECCV)
- International Conference on Learning Representations (ICLR)
- International Conference on Robotics and Automation (ICRA)
- International Conference on Intelligent Robots and Systems (IROS)
- Uncertainty and Artificial Intelligence (UAI)
- Asian Conference on Computer Vision (ACCV)

- **Journal Reviewing**

- IEEE Trans. on Pattern Recognition and Machine Intelligence (PAMI)
- International Journal of Computer Vision (IJCV)
- IEEE Trans. on Image Processing (TIP)
- IEEE Trans. on Geoscience and Remote Sensing (TGRS)
- Computer Vision and Image Understanding (CVIU)
- Pattern Recognition (PR)
- Image and Vision Computing (IVC)
- IEEE Trans. on Circuits and Systems for Video Technology (TCSVT)

- **Outreach Program**

- Mentor, Women in Computer Vision Workshop 2018
- Mentor, University of Toronto Undergraduate AI Group 2016

Teaching Experience

- **Teaching Assistant** Jan 2014 - Present
University of Toronto *Toronto*
 - Introduction to Image Understanding (CSC420): Spring 2017
 - Inference Algorithms and Machine Learning (ECE521): Spring 2017
 - Machine Learning and Data Mining (CSC 411): Fall 2016, Spring 2016, Fall 2014
 - Introduction to Machine Learning (CSC 2515): Fall 2015, Spring 2015
 - Advanced Machine Learning (STA D68): Fall 2015
 - Introduction to Visual Computing (CSC 320): Spring 2014

Talks

- **Invited Talks:**
 - Towards More Robust and Data-Efficient Robotics in the Wild Intel Intelligent System Lab, 2019
 - Towards More Robust and Data-Efficient Robotics in the Wild NVIDIA Research, 2019
 - Deep Geometric Scene Understanding for Self-Driving Cars CREATE Summer School, 2019
 - TorontoCity Endless Summer School, 2017
 - 3D Scene Understanding with Knowledge about the World VALSE Webinar, 2016
 - 3D Scene Understanding with Knowledge about the World York University, 2015
- **Conference Talks:**
 - Deep Parameteric Continuous Conv CVPR, 2018
 - TorontoCity ICCV, 2017
 - The Global Patch Collider CVPR, 2016
 - Lost Shopping! Monocular Localization in Large Indoor Spaces ICCV, 2015
 - Holistic 3D Scene Understanding from a Single Monocular Image CVPR, 2015
- **Seminar Talks:**
 - The Global Patch Collider University of Toronto, 2016
 - Efficient Inference on Continuous MRFs with Polynomial Potentials University of Toronto, 2014
 - Efficient Inference on Continuous MRFs with Polynomial Potentials NCAP Summer School, 2014

Mentorship

- **PhDs:**
 - Sivabalan Manivasagam (CS UofT)
- **Masters:**
 - Andrei Barsan (CS UofT)
 - Simon Suo (CS UofT)
 - Kelvin Wong (CS UofT)
 - Annie Zhang (CS UofT)
 - Joyce Yang (CS UofT)
- **AI Residents:**

- Shivam Duggal
- Jerry Liu

- **Undergrad Interns:**

- Kelvin Wong (CS Waterloo)
- Simon Suo (CS Waterloo)
- Xinkai Wei (CS Waterloo)
- Joyce Yang (CS Waterloo)
- Frieda Rong (CS Waterloo)
- Lila Huang (CS Waterloo)
- Tom Meredith (ME Waterloo)
- Ahmed Sabie (CS Waterloo)
- Josh Jung (CS Waterloo)
- Joe Yang (CS Waterloo)
- Joey Yu (Math Waterloo)
- Can Cui (ME Waterloo)
- Calvin Liu (CS Waterloo)
- Jessica Zhang (CS Waterloo)

Patents

1. Sean Ryan Francesco Fanello, Shahram Izadi, Pushmeet Kohli, Christoph Rhemann, and **Shenlong Wang**. "Computerized Correspondence Estimation Using Distinctively Matched Patches." U.S. Patent 9,886,652.
2. **Shenlong Wang**, Wei-Chiu Ma, Shun Da Suo, Raquel Urtasun, and Ming Liang. "Continuous Convolution and Fusion in Neural Networks." U.S. Patent Application 16/175,161.
3. Min Bai, Gellert Mattyus, Namdar Homayounfar, **Shenlong Wang**, Shrinidhi Lakshmikanth, Raquel Urtasun, Wei-Chiu Ma. "Autonomous Vehicle Lane Boundary Detection Systems and Methods " U.S. Patent Application 16/122,267.
4. Wei-Chiu Ma, **Shenlong Wang**, Namdar Homayounfar, Shrinidhi Lakshmikanth, Raquel Urtasun, "Lightweight Vehicle Localization Systems and Methods" U.S. Patent Application 16/123,289
5. Wei-Chiu Ma, **Shenlong Wang**, Rui Hu, Yuwen Xiong, Raquel Urtasun, "Deep Structured Scene Flow for Autonomous Vehicles", United States Provisional Patent Application No. 62/851,753
6. Min Bai, **Shenlong Wang**, Raquel Urtasun, "System and Method for Identifying Travel Way Features", United States Provisional Application No. 62/768,829
7. Andrei Barsan, **Shenlong Wang**, Julieta Martinez, Xinkai Wei, Joyce Yang, Justin Liang, Raquel Urtasun, "Feature Compression and Localization for Autonomous Devices", United States Provisional Application No. 62/768,849
8. Sivabalan Manivasagam, **Shenlong Wang**, Wei-Chiu Ma, Raquel Urtasun, "System and methods for Generating synthetic Light Detection and Ranging Data via Machine Learninga" United States Provisional Application
9. Julieta Martinez, Andrei Barsan, **Shenlong Wang**, Raquel Urtasun, "Image based Localization System", United States Provisional Application No. 62/768,898

Computer Skills

- **Languages** C/C++, Python, MATLAB, Bash
- **Scientific Packages** Pytorch, Tensorflow, MxNet, NumPy, OpenGL, OpenCV, OpenMP and MPI