HENGGANG CUI

(651)403-3366 ⋄ cuihenggang@gmail.com ⋄ https://cuihenggang.github.io

INTERESTS

Autonomous driving, deep learning, computer vision, and large-scale machine learning systems.

SKILLS

Languages/Libraries/Tools Python, C/C++, PyTorch, TensorFlow, git, LaTex, JIRA

WORK EXPERIENCE

Motional, Pittsburgh, PA.

Principal Research Scientist, Prediction Team Lead January, 2021 to *now*

- Lead a team of 7 people. Build R&D team, make plan and strategy, and manage risk.
- Our team is responsible for developing machine learning models to predict the behavior of the other road users for the self-driving vehicle.

Uber Advanced Technologies Group, Pittsburgh, PA.

Senior Software Engineer, Tech Lead June, 2017 to January, 2021

- Worked on the production deep learning models for detecting objects on the road and predicting their future trajectories from lidar point clouds, camera images, and radar returns.
- Led projects in the team and mentored junior engineers.
- Works patented and published at *ICRA '21*, *ICRA '20*, *WACV '20*, *IV '20*, *KDD '20*, and *ICRA '19*.

EDUCATION

Carnegie Mellon University, Pittsburgh, PA.

Ph.D., Electrical and Computer Engineering (GPA: 3.93) May, 2017

- Advisor: Greg Ganger
- Research Topic: Distributed large-scale machine learning systems

Tsinghua University, Beijing, China

Bachelor of Science, Electronic Information Science and Technology July 2012

PHD THESIS RESEARCH

Thesis: Exploiting Application Characteristics for Efficient System Support for Large-Scale Machine Learning

- **Committee**: Greg Ganger, Phil Gibbons, Garth Gibson, Eric Xing, and Derek Murray
- **Thesis Subprojects**: As follows:

GeePS: Specialized Parameter Server for Deep Learning on GPUs

Published at EuroSys'16, and open-sourced at https://github.com/cuihenggang/geeps

- Designed GeePS, a distributed parameter server system for distributed deep learning on GPU machines.
- Achieved good scalability from single-machine Caffe (13× more throughput with 16 machines), by overlapping communication with computation.
- Supported DNNs that cannot fit in GPU memory, by swapping data to/from CPU memory in the background.

IterStore: Efficient Parameter Server for Iterative ML

Published at SoCC'14 and open-sourced at https://github.com/cuihenggang/iterstore

- Proposed an efficient parameter server architecture that achieves up to 50× speedup over the baseline.

SELECTED PUBLICATIONS

1 **Henggang Cui***, Hoda Shajari*, Sai Yalamanchi, Nemanja Djuric. "Ellipse Loss for Scene-Compliant Motion Prediction." In *IEEE International Conference on Robotics and Automation (ICRA)*, 2021.

2 **Henggang Cui**, Fang-Chieh Chou, Jake Charland, Carlos Vallespi-Gonzalez, Nemanja Djuric. "Uncertainty-Aware Vehicle Orientation Estimation for Joint Detection-Prediction Models." In *IEEE International Conference on Intelligent Transportation (ITSC)*, 2021.

3 Nemanja Djuric, **Henggang Cui**, Zhaoen Su, Shangxuan Wu, Huahua Wang, Fang-Chieh Chou, Luisa San Martin, Song Feng, Rui Hu, Yang Xu, Alyssa Dayan, Sidney Zhang, Brian C. Becker, Gregory P. Meyer, Carlos Vallespi-Gonzalez, Carl K. Wellington. "MultiXNet: Multiclass Multistage Multimodal Motion Prediction." In *IEEE Intelligent Transportation Systems (IV)*, 2021.

4 Eason Wang*, **Henggang Cui***, Sai Yalamanchi, Mohana Moorthy, Fang-Chieh Chou, Nemanja Djuric. "Predicting Motion of Vulnerable Road Users using High-Definition Maps and Efficient ConvNets." In *SIGKDD Conference on Knowledge Discovery and Data Mining (KDD)*, 2020.

5 Fang-Chieh Chou, Tsung-Han Lin, **Henggang Cui**, Vladan Radosavljevic, Thi Nguyen, Tzu-Kuo Huang, Matthew Niedoba, Jeff Schneider, Nemanja Djuric. "Predicting Motion of Vulnerable Road Users using High-Definition Maps and Efficient ConvNets." In *IEEE Intelligent Transportation Systems (IV)*, 2020.

6 **Henggang Cui**, Thi Nguyen, Fang-Chieh Chou, Tsung-Han Lin, Jeff Schneider, David Bradley, Nemanja Djuric. "Deep Kinematic Models for Kinematically Feasible Vehicle Trajectory Predictions." In *IEEE International Conference on Robotics and Automation (ICRA)*, 2020.

7 Nemanja Djuric, Vladan Radosavljevic, **Henggang Cui**, Thi Nguyen, Fang-Chieh Chou, Tsung-Han Lin, Jeff Schneider. "Uncertainty-aware Short-term Motion Prediction of Traffic Actors for Autonomous Driving." In *IEEE Winter Conference on Applications of Computer Vision (WACV)*, 2020.

8 **Henggang Cui**, Vladan Radosavljevic, Fang-Chieh Chou, Tsung-Han Lin, Thi Nguyen, Tzu-Kuo Huang, Jeff Schneider, Nemanja Djuric. "Multimodal Trajectory Predictions for Autonomous Driving using Deep Convolutional Networks." In *IEEE International Conference on Robotics and Automation (ICRA)*, 2019.

9 **Henggang Cui**, Hao Zhang, Gregory R. Ganger, Phillip B. Gibbons, and Eric P. Xing. "GeePS: Scalable Deep Learning on Distributed GPUs with a GPU-Specialized Parameter Server." In *ACM European Conference on Computer Systems (EuroSys)*, 2016.

10 Aaron Harlap, **Henggang Cui**, Wei Dai, Jinliang Wei, Gregory R. Ganger, Phillip B. Gibbons, Garth A. Gibson, and Eric P. Xing. "Addressing the Straggler Problem for Iterative Convergent Parallel ML." In *ACM Symposium on Cloud Computing (SoCC)*, 2016.

11 **Henggang Cui**, Kimberly Keeton, Indrajit Roy, Krishnamurthy Viswanathan, and Gregory R. Ganger. "Using Data Transformations for Low-latency Time Series Analysis." In *ACM Symposium on Cloud Computing (SoCC)*, 2015.

12 Jinliang Wei, Wei Dai, Aurick Qiao, Qirong Ho, **Henggang Cui**, Gregory R. Ganger, Phillip B. Gibbons, Garth A. Gibson, Eric P. Xing. "Managed Communication and Consistency for Fast Data-Parallel Iterative Analytics." In *ACM Symposium on Cloud Computing (SoCC)*, 2015.

13 **Henggang Cui**, Alexey Tumanov, Jinliang Wei, Lianghong Xu, Wei Dai, Jesse Haber-Kucharsky, Qirong Ho, Gregory R. Ganger, Phillip B. Gibbons, Garth A. Gibson, and Eric P. Xing. "Exploiting Iterative-ness for Parallel ML Computations." In *ACM Symposium on Cloud Computing (SoCC)*, 2014.

14 **Henggang Cui**, James Cipar, Qirong Ho, Jin Kyu Kim, Seunghak Lee, Abhimanu Kumar, Jinliang Wei, Wei Dai, Gregory R. Ganger, Phillip B. Gibbons, Garth A. Gibson, and Eric P. Xing. "Exploiting Bounded Staleness to Speed Up Big Data Analytics." In *USENIX Annual Technical Conference (ATC)*, 2014.

15 Qirong Ho, James Cipar, **Henggang Cui**, Jin Kyu Kim, Seunghak Lee, Phillip B. Gibbons, Garth A. Gibson, Gregory R. Ganger, and Eric P. Xing. "More Effective Distributed ML via a Stale Synchronous Parallel Parameter Server." In *Neural Information Processing Systems (NIPS)*, 2013.

16 Dan Li, **Henggang Cui**, Yan Hu, Yong Xia, and Xin Wang. "Scalable Data Center Multicast using Multi-class Bloom Filter." In *19th IEEE International Conference on Network Protocols (ICNP)*, 2011.

PATENTS

1 Nemanja Djuric, **Henggang Cui**, Thi Duong Nguyen, Fang-Chieh Chou, Tsung-Han Lin, Jeff Schneider, and David McAllister Bradley. "Motion Prediction for Autonomous Devices". *US20200272160A1*.

2 Nemanja Djuric, Vladan Radosavljevic, Thi Duong Nguyen, Tsung-Han Lin, Jeff Schneider, **Henggang Cui**, Fang-Chieh Chou, and Tzu-Kuo Huang. "Object Motion Prediction and Autonomous Vehicle Control". *US20190049970A1*.

3 **Henggang Cui**, Kimberly Keeton, Indrajit Roy, Krishnamurthy Viswanathan, and Haris Volos. "Processing a query using transformed raw data". *US20170322987A1*.