

Siheng Chen

CONTACT INFORMATION

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RESEARCH INTERESTS

- Machine learning: semi-supervised learning, active sampling
- Signal processing: multiresolution analysis, sparse coding
- Graph mining: graph embedding, ranking
- Applied data science: Social network analysis, 3D point cloud processing, urban computing, bio-image analysis

EDUCATION

- Ph.D in Electrical and Computer Engineering 2012 - 2016
GPA: 4.0, Carnegie Mellon University Pittsburgh, PA, USA
Advisor: Prof. Jelena Kovačević
- Master of Science in Machine Learning 2014 - 2016
GPA: 4.0, Carnegie Mellon University Pittsburgh, PA, USA
Advisor: Prof. Christos Faloutsos
- Master of Science in Electrical and Computer Engineering 2011 - 2012
GPA: 4.0, Carnegie Mellon University Pittsburgh, PA, USA
- Bachelor of Science in Electronic Engineering 2007 - 2011
GPA: 92 (Rank: 1/108), Beijing Institute of Technology Beijing, China

WORKING EXPERIENCE

- Postdoctoral Researcher at Carnegie Mellon University Jan 2017 - Present
- Research intern at Mitsubishi Electric Research Laboratories (MERL) May 2016 - Aug 2016

PUBLICATIONS

Preprint

1. Sufeng Niu*, **S. Chen***, Hanyu Guo, Colin Targonski, J. Kovačević, and Melissa Smith, Generalized Value Iteration Networks: Life Beyond Lattices, *NIPS 2017*, submitted.
2. **S. Chen**, D. Tian, C. Feng, A. Vetro and J. Kovačević, “Fast resampling of 3D point clouds via graphs” *IEEE Trans. Signal Proc.*, submitted.
3. **S. Chen**, Sufeng Niu, Leman Akoglu, J. Kovačević, and Christos Faloutsos, Fast, warped graph embedding: Unifying framework and one-click algorithm, to submit.
4. **S. Chen**, Y. Yang, J. M. F. Moura, and J. Kovačević, “Localization, decomposition and dictionary Learning of piecewise-constant signals on graphs” *IEEE Trans. Signal Proc.*, to submit.
5. **S. Chen**, T. Ji, R. Varma, A. Singh, and J. Kovačević, “Signal representations on graphs: tools and applications” *IEEE Trans. Signal Proc.*, to submit.

Journal

1. G. Lederman, **S. Chen**, J. H. Garrett, J. Kovačević, H. Y. Noh, and J. Bielak A data fusion approach for track monitoring from multiple in-service trains, *Mechanical Systems and Signal Processing*, 2017. Accepted.
2. G. Lederman, **S. Chen**, J. H. Garrett, J. Kovačević, H. Y. Noh and J. Bielak, Track monitoring from the dynamic response of a passing train: a sparse approach, *Mechanical Systems and Signal Processing*, 2017. Accepted.
3. G. Lederman, **S. Chen**, J. H. Garrett, J. Kovačević, H. Y. Noh and J. Bielak, Rail-monitoring from the dynamic response of an operational train, *Mechanical Systems and Signal Processing*, 2017. Accepted.
4. **S. Chen**, Y. Yang, S. Zong, A. Singh, and J. Kovačević, "Detecting localized binary attributes on graphs" *IEEE Trans. Signal Proc.*, vol. 65, no. 10, May, 2017.
5. **S. Chen**, R. Varma, A. Singh, and J. Kovačević, "Signal recovery on graphs: Fundamental limits of sampling strategies" *IEEE Trans. Signal and Information Proc. over Networks, Special Issue on Inference and Learning over Networks*, vol. 2, no. 4, Dec. 2016.
6. **S. Chen**, R. Varma, A. Sandryhaila, and J. Kovačević, "Discrete signal processing on graphs: Sampling theory," *IEEE Trans. Signal Proc.*, vol. 63, no. 24, Aug. 2015, pp. 6510 - 6523.
7. **S. Chen**, A. Sandryhaila, J. M. F. Moura and J. Kovačević, "Signal recovery on graphs: Variation minimization," *IEEE Trans. Signal Proc.*, vol. 63, no. 17, Jun. 2015, pp. 4609-4624.
8. **S. Chen**, F. Cerda, P. Rizzo, J. Bielak, J. H. Garrett and J. Kovačević, "Semi-supervised multiresolution classification using adaptive graph filtering with application to indirect bridge structural health monitoring," *IEEE Trans. Signal Proc.*, vol. 62, no. 11, Jun. 2014, pp. 2879-2893.
9. F. Cerda, **S. Chen**, J. Bielak, J. H. Garrett, P. Rizzo, and J. Kovačević, "Indirect structural health monitoring of a simplified laboratory-scale bridge mode," *International Journal Smart Structure and Systems, Special Issue: Challenge on bridge health monitoring utilizing vehicle-induced vibrations*, vol. 13, no. 5, May. 2014, pp. 849-868.

Conference

1. **S. Chen**, Dong Tian, Chen Feng, and J. Kovačević, "Contour-based resampling of 3D point clouds," *In Proc. IEEE Int. Conf. Acoust., Speech Signal Process.*, New Orleans, USA, March 2017.
2. Yaoqing Yang, **S. Chen**, Mohammad Maddah-Ali, Pulkit Grover, Soumya Kar, and J. Kovačević, "Fast path localization on graphs via multiscale Viterbi decoding," *In Proc. IEEE Int. Conf. Acoust., Speech Signal Process.*, New Orleans, USA, March 2017.
3. **S. Chen**, Yaoqing Yang, Aarti Singh, and J. Kovačević, "Signal Detection on Graphs: Bernoulli Noise Model," *Proc. IEEE Glob. Conf. Signal Information Process.*, Washington, DC, Dec. 2016.
4. **S. Chen**, Yaoqing Yang, Christos Faloutsos, and J. Kovačević, "Monitoring Manhattan's traffic at 5 intersections?" KDD 2016, The 5th International Workshop on Urban Computing, San Francisco, Aug, 2016.
5. **S. Chen**, R. Varma, A. Singh and J. Kovačević, A statistical perspective of sampling scores for linear regression, *In Proc. IEEE Int. Symposium on Information Theory.*, Barcelona, Spain, July 2016.
6. **S. Chen**, R. Varma, A. Singh and J. Kovačević, "Representations of piecewise smooth signals on graphs, *In Proc. IEEE Int. Conf. Acoust., Speech Signal Process.*, Shanghai, China, March 2016. (Invited talk)
7. R. Varma, **S. Chen** and J. Kovačević, "Spectrum-blind signal recovery on graphs", *IEEE International Workshop on Computational Advances in Multi-Sensor Adaptive Processing 2015*, Cancun, Mexico, Dec, 2015. (Invited talk)

8. T. Ji, **S. Chen**, R. Varma and J. Kovačević, “Efficient route planning of autonomous vehicles based on graph signal recovery”, *53rd Annual Allerton Conference on Communication, Control, and Computing 2015*, Allerton, IL, Oct, 2015. (Invited talk)
9. **S. Chen**, R. Varma, A. Singh and J. Kovačević, “Signal recovery on graphs: Random versus experimentally designed sampling”, *Sampling Theory and Applications 11th International Conference*, Washington, D.C., May, 2015. (Invited talk)
10. **S. Chen**, A. Sandryhaila, and J. Kovačević, “Sampling theory for graph signals,” *In Proc. IEEE Int. Conf. Acoust., Speech Signal Process.*, Brisbane, Queensland, May 2015.
11. **S. Chen**, A. Sandryhaila, and J. Kovačević, “Distributed algorithm for graph signal inpainting,” *In Proc. IEEE Int. Conf. Acoust., Speech Signal Process.*, Brisbane, Queensland, May 2015.
12. S. Bittner, **S. Chen**, and J. Kovačević, “Fast algorithm for neural network reconstruction”, *In Proc. IEEE Int. Symposium on Biomedical Imaging.*, Brooklyn, April, 2015.
13. **S. Chen**, A. Sandryhaila, J. M. F. Moura, and J. Kovačević, “Signal denoising on graphs via graph filtering,” *Proc. IEEE Glob. Conf. Signal Information Process.*, Atlanta, GA, Dec. 2014.
14. **S. Chen**, A. Sandryhaila, G. Lederman, Z. Wang, J. M. F. Moura, P. Rizzo, J. Bielak, J. H. Garrett, and J. Kovačević, “Signal inpainting on graphs via total variation minimization,” *In Proc. IEEE Int. Conf. Acoust., Speech Signal Process.*, Florence, Italy, May 2014.
15. G. Lederman, Z. Wang, J. Bielak, H. Noh, J. H. Garrett, **S. Chen**, J. Kovačević, F. Cerda, and P. Rizzo, “Damage quantification and localization algorithms for indirect SHM of bridges,” *Proc. Int. Conf. Bridge Maint., Safety Manag.*, Shanghai, China, July 2014.
16. **S. Chen**, A. Sandryhaila, J.M.F. Moura and J. Kovačević, “Adaptive graph filtering: multiresolution classification on graphs” *Proc. IEEE Glob. Conf. Signal Information Process.*, Austin, TX, Dec. 2013.
17. Z. Wang, **S. Chen**, G.Lederman, F. Cerda, J. Bielak, J. H. Garrett, P. Rizzo and J. Kovačević, “Comparison of sparse representation and Fourier discriminant methods: Damage location classification in indirect lab-scale bridge structural health monitoring” *Proc. Structures Congr.*, Pittsburgh, PA, May 2013.
18. **S. Chen**, F. Cerda, J. Guo, J. B. Harley, Q. Shi, P. Rizzo, J. Bielak, J. H. Garrett and J. Kovačević, “Multiresolution classification with semi-supervised learning for indirect bridge structure health monitoring.” *Proc. IEEE Int. Conf. Acoust., Speech, and Signal Proc.*, Vancouver, Canada, May 2013.
19. F. Cerda, J. H. Garrett, J. Bielak, P. Rizzo, J. A. Barrera, Z. Zhang, **S. Chen**, M. McCann, and J. Kovačević, “Indirect structural health monitoring in bridges: scale experiments,” *Proc. Int. Conf. Bridge Maintenance, Safety and Management*, Lago di Como, Italy, Jul. 2012.

RESEARCH PROJECTS

Data science with graphs

ongoing

- developed a theoretical framework to analyze data that are indexed by general graphs with the applications to community detection, data compression and data recovery
- generalized concepts and tools from classical signal processing to the graph domain, including sampling theory on graphs, graph wavelets and graph dictionary learning
- cooperated with Prof. José. M. F. Moura (ECE at CMU) and Prof Aarti Singh (MLD at CMU)

Graph mining

ongoing

- proposed a generative model for social circle on graphs and a metric to evaluate the likelihood of being social circles
- proposed a graph embedding to improve user profiling and link prediction
- cooperated with Prof. Christos Faloutsos (MLD at CMU) and Prof. Leman Akoglu (Heinz at CMU)

Deep learning with graphs ongoing

- proposed a novel end-to-end neural network planning module, generalized value iteration network (GVIN), which allows an agent to self-learn and plan the optimal paths in unseen irregular spatial graphs, such as real-world street networks
- proposed three novel graph convolution operators to enable GVIN to learn and plan on irregular spatial graphs

Structural health monitoring ongoing

- proposed signal processing and machine learning techniques to determine information about the state of the bridge
- explored an indirect measurement approach for bridge structural health monitoring that collects sensed information from the dynamic responses of many vehicles travelling over a bridge
- cooperated with Prof. Jacobo Bielak (CEE at CMU), Prof. Haeyoung Noh (CEE at CMU) and Dean James H. Garrett (CEE at CMU)

3D point cloud processing Summer intern, 2016

- proposed a resampling strategy of large-scale 3D point clouds with potential applications to progressive compression and efficient registration
- proposed a multiresolution representation for 3D point clouds with potential applications to progressive compression
- cooperated with Dr. Dong Tian (MERL), Dr. Chen Feng (MERL) and Dr. Anthony Vetro (MERL)

Tissue classification in histopathology images 2011-2012

- proposed an automated system for detecting specific tissues in histopathology images
- proposed a spectral clustering-based algorithm for segmenting histopathology images

PRESS COVERAGE

- CMU ECE Headlines: The student and the symposium
- CMU ECE Headlines: Doctoral student Siheng Chen gives talk at Tsinghua University

Invited TALK

- Tutorial talk at Graph Signal Processing Workshop, May, 2017
- Rice University, Digital Signal Processing Group, May, 2017
- Carnegie Mellon University, ECE Energy & Information Seminar, April, 2017
- Peking University, School of Electronic and Computer Engineering, January, 2017
- University of Electronic Science and Technology of China, Department of Electronic Engineering, April, 2016
- Beijing Institute of Technology, Department of Electronic Engineering, March, 2016
- University of Southern California, Signal Transformation, Analysis and Compression Group, January, 2016
- Tsinghua University, Department of Electronic Engineering, May, 2014

TEACHING EXPERIENCE

- 18202 (Undergrad): Mathematical Foundations of Electrical Engineering (instructor: Prof. J. M. F. Moura)
- 18790: Wavelets and Multiresolution Techniques (instructor: Prof. Jelena. Kovačević)
- 18799J: Special topics in signal processing: compressive sensing and sparse optimization (instructor: Prof. A. C. Sankaranarayanan)

STUDENTS MENTORED

- Yanxi Chen (Undergrad in Tshinghua China): Seed set expansion, Summer intern 2017
- Xiao Ma (Undergrad in Beijing Jiaotong, China): Urban computing, Summer intern 2016
- Yuru Wu (Undergrad in Tshinghua, China): Graph mining, Summer intern 2016
- Chao Pan (Undergrad in Tshinghua, China): Tensor decomposition, Summer intern 2016
- Shi Zong (Master in ECE at CMU) Community detection, Summer 2015 - May 2016
- Tianxi Ji (Master in ECE at CMU): Route planning for autonomous vehicles, March 2015 - May 2016
- Chao Li (Master in Software Engineering at CMU): Ranking system, May 2015 - May 2016
- Chen Liang (Undergrad in Tshinghua, China): Graph mining, Summer intern 2015
- Akshay Varun (Undergrad in PESIT, India): Active learning for clustering, Summer intern 2015
- Sean Bittner (Undergrad in ECE at CMU): Neuron signal processing, Summer intern 2014
- Niv Zehngut (Undergrad in ECE at CMU): Wavelets on graphs, Spring 2014
- Yu Zhou (Master in BME): Tissue classification in histology images, Fall 2012 - Spring 2014

SERVICE

Journal Reviews

- IEEE Transactions on Signal Processing
- IEEE Transactions on Signal and Information Processing over Networks
- IEEE Transactions on Image Processing
- IEEE Transactions on Information Theory
- IEEE Transactions on Industrial Electronics
- IEEE Transactions on Cybernetics
- IEEE Signal Processing Letter
- Signal Processing (ELSEVIER)
- Electronics Letters

Conference Reviews

- IEEE International Conference on Acoustics, Speech and Signal Processing
- IEEE International Conference on Image Processing
- IEEE International Symposium on Biomedical Imaging
- IEEE International Workshop on Computational Advances in Multi-Sensor Adaptive Processing
- European Signal Processing Conference

HONORS AND AWARDS

- IEEE ISIT Travel Grant 2016
- IEEE ICASSP National Science Foundation (NSF) Travel Grant 2014, 2016
- Outstanding Graduates in the city of Beijing 2011
- Outstanding Students, Beijing Institute of Technology 2008, 2009, 2010
- China Aerospace Science and Technology Corporation Scholarship 2011
- National Scholarship 2009, 2010
- Meritorious Winner in Mathematical Contest in Modeling 2010