

Wei Guo

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EXPERTISE SUMMARY

- Hands-on experience using deep learning on image segmentation under widely varying illumination conditions in manufacturing systems
- Research experience applying *topological data analysis* (TDA) methods to computer vision and dynamic network problems
- Extensive experience dealing with both structured and unstructured data on large datasets, and applying machine learning techniques to business problems

COMPUTER SKILLS

Programming Languages: Python, C/C++, R, SQL, Matlab, Fortran, AMPL
Software & Tools: Keras, PyTorch, CVX, SNOPT

EDUCATION

University of Washington, Seattle, WA

Ph.D., Industrial and Systems Engineering

Mar '20

Dissertation: Feature Extraction Using Topological Data Analysis for Machine Learning and Network Science Applications

University of Minnesota, Twin Cities, Minneapolis, MN

M.S., Industrial and Systems Engineering

Apr '14

M.S., Aerospace Engineering and Mechanics

Dec '10

Harbin Institute of Technology, Harbin, China

M.S., Control Science and Engineering

Jul '08

B.S., Control Science and Engineering

Jul '06

RELEVANT PROJECT

Deep Learning for Automated In-Process Inspection of Composite Layup (US Patent Application) [\[Featured on BARC website\]](#) [\[Github\]](#)

Supervisors: Dr. Agnes Blom-Schieber (Boeing) and Prof. Ashis G. Banerjee Apr '18 - Dec '19

- Won **best presentation award** (presented by Dr. Agnes Blom-Schieber) in data analytics track at *2019 Boeing Tech Excellence Conference* as main contributor
- Developed semantic segmentation-based methods for visual inspections of tow boundaries that form the edges of the individual composite plies
- Trained a two-stage modified U-Net model to learn binary pixel-level segmentation
- Extracted tow boundaries based on the differences between predicted pixel class probabilities
- Improved tow end detection accuracy from 88% using current software to ~99%

PROFESSIONAL EXPERIENCE

University of Washington, Seattle, WA

Research Assistant, Boeing Advanced Research Center (BARC)

Jan '16 - Dec '19

• **Community Detection in Large-Scale Dynamic Networks Using TDA** [\[Github\]](#)

- Developed a unified framework for detecting communities and tracking major structural changes during network evolution based on a newly proposed *community tree* representation
- Designed and implemented algorithms to build and update community trees efficiently

• **Sparse Realization of TDA for Multi-Way Classification** [\[Github\]](#)

- Presented a new method, a.k.a. *Sparse-TDA*, that incorporates sparse sampling to extract discriminative features in the presence of noisy and redundant information
- Demonstrated its advantage over a state-of-the-art kernel TDA method (comparable accuracy / up to 98% training time reduction) and L_1 -regularized feature selection methods (2%-8% accuracy increase / up to 73% training time reduction) on 3D meshes of synthetic and real human postures and textured images

- **Application of TDA in Manufacturing for Feature Selection**

- Applied *TDA Mapper algorithm* on benchmark data sets for chemical yield prediction and semiconductor fault detection
 - Yielded topological networks to facilitate a better understanding of casual relationships between process variables and outputs through direct visualization
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HONORS &
AWARDS

- **NSF Doctoral Consortium Travel Award**, IEEE CASE & ISAM, 2016
 - **Long March Fellowship** from the First Academy of China Aerospace Science & Industry Corp. (CASIC), 2003
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COURSEWORK

- **Deep Learning:** Deep Learning ([Coursera specialization certificate](#))
 - **Statistics:** Statistical Inference, Stochastic Modeling of Scientific Data, Nonparametric Regression and Classification, Statistical Computing, Stochastic Programming & Game Theory
 - **Operations Research:** Linear Optimization Models in Engineering, Convex Optimization, Stochastic Processes in Engineering, Engineering Simulation, Decision Analysis
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PUBLICATIONS

- **W. Guo**, R. Chen, Y.-C. Chen, and A. G. Banerjee. Efficient Community Detection in Large-Scale Dynamic Networks Using Topological Data Analysis. Working paper.
 - E. U. Samani, **W. Guo**, and A. G. Banerjee. Deep Learning-Based Semantic Segmentation of Microscale Objects. In *Proceedings of International Conference on Manipulation, Automation and Robotics at Small Scales (MARSS)*, Helsinki, Finland, 2019.
 - **W. Guo**, K. Manohar, S. L. Brunton, and A. G. Banerjee. Sparse-TDA: Sparse Realization of Topological Data Analysis for Multi-Way Classification. *IEEE Transactions on Knowledge and Data Engineering*, 30(7): 1403-1408, 2018.
 - R. Chen, Y.-C. Chen, **W. Guo**, and A. G. Banerjee. A Note on Community Trees in Networks. In *Workshop on Synergies in Geometric Data Analysis at Neural Information Processing Systems (NIPS)*, *arXiv preprint arXiv:1710.03924*, 2017.
 - **W. Guo** and A. G. Banerjee. Identification of Key Features Using Topological Data Analysis for Accurate Prediction of Manufacturing System Outputs. *Journal of Manufacturing Systems*, 43(2): 225-234, 2017.
 - **W. Guo** and A. G. Banerjee. Toward Automated Prediction of Manufacturing Productivity Based on Feature Selection Using Topological Data Analysis. In *Proceedings of IEEE International Symposium on Assembly and Manufacturing (ISAM)*, Ft. Worth, TX, 2016.
 - **W. Guo**, Y. J. Zhao, and B. Capozzi. Optimal Unmanned Aerial Vehicle Flights for Seeability and Endurance in Winds. *Journal of Aircraft*, 48(1): 305-314, 2011.
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