

# XUDONG(NICK) ZHANG

PhD Candidate

🏠 4252 Union St. New York, NY 11355

☎ 646-668-8402

✉ [xzhang5@gradcenter.cuny.edu](mailto:xzhang5@gradcenter.cuny.edu)

🌐 [LinkedIn](#)

🐙 [GitHub](#)

🏠 [Webpage](#)

## Areas of Research Interests

- Large-scale and High-performance Machine/Deep Learning, NLP, Computer Vision.
- Object Tracking, Image Segmentation and Reconstruction.
- Modeling (ODE, PED, and Stochastics) and Simulation.
- Parallel Computing.

## Education

Ph.D. | May 2021 (expected) | City University of New York, New York, USA.

Major: Computer Science (GPA: 3.91)

M. PHIL | 2018 | City University of New York, New York, USA.

Major: Computer Science (GPA: 3.9)

M. PHIL | 2014 | City University of New York, New York, USA.

Major: Mechatronics Engineering (Biosensor design and fabrication) (GPA: 3.74)

B. ENG | 2008 | Jilin University, Changchun, China.

Major: Mechatronics Engineering, Minor: Business Administration (GPA: 3.6 (Major), 3.2 (Minor))

## Skills

- **Programming platforms:** Python, C++, MATLAB, Java.
- **Packages and platforms:** PyTorch, Scikit-learn, Hadoop, Spark, Pandas, NumPy, OpenCV, Matplotlib.
- **Machine/Deep Learning:** LightGBM, XGBoost, AdaBoost, Logistic Regression, Decision Trees, Random Forest, SVM (Support Vector Machines), Linear Regression, Clustering, Gaussian Mixture Models (GMM), Deep Learning (CNN, RNN).
- **Reinforcement Learning:** Q-Learning, Deep Q Network (DQN), Policy Gradient.
- **High-performance and parallel packages:** OpenMPI, MPICH, Numba.
- **Operation System:** Linux (Ubuntu), Mac OS, Windows.

## Work Experience

### BMT Biosystems

#### Data Scientist Intern

Branford, CT, USA

05/2018 – 08/2018

- **Machine Learning in Data Imputation**

Analyzed the data imputation of tremendous amount of medical data by using maximum likelihood estimation. The imputed data improved the classification accuracy **by 32.31%**.

- **Feature Engineering in Medical Data**

Identified and extracted the critical features of medical data by applying the machine learning classifiers. The extracted features improved the (random forest) model stability and prediction accuracy **from 86.22% to 92.13%**.

### Dept. of Computer Science, City University of New York

#### Research Assistant, PhD Candidate

New York, NY, USA

09/2016 – Present

- **Machine & Deep Learning in Multi-Object Tracking**

Proposed a ReID-based tracking model ([HTracker](#)) based on deep convolutional neural network and particle filters to improve the tracking speed **from 22 fps to 36.7 fps (state-of-the-art)** on public dataset MOT16, MOT17 [challenges](#).

- **Machine Learning and Data Imputation on Large-Scale Datasets**

Solved the missing data problems for 20-year large-scale health records of NYC by using the maximum likelihood estimation. This imputation improved the disease prediction accuracy **from 89.43% to 96.21%** on an SVM machine learning model.

- **Feature Engineering and Machine Learning**  
Extracted and refined the features from 2012-2016 National Crime Victimization dataset by using feature engineering techniques, which improved the prediction accuracy **from 69.37% to 82.76%** on a random forest classifier.
- **Persistent Homology in Image Segmentation and Reconstruction**  
Segmented and reconstructed the fine tissue (**0.5-2mm**) from 3D CT images by using topology and Discrete Morse theory, which provided more accurate segmentation than deep convolutional neural network on **a small amount of image data**.
- **A Stochastic Approximation-Based Clustering Model**  
Proposed a simultaneous perturbation stochastic approximation (SPSA)-based GMM model for data clustering problems. The proposed model achieved **6 times faster than** the traditional gradient descent-based model in data clustering tasks.
- **A Novel Heuristic in A\* Searching Algorithm**  
Proposed a novel Betti-number-based heuristic function for A\* searching algorithm in topological localization problems to improve the searching time and memory consumption by **reducing the number of expanded nodes by 5.8 times** in A\*.
- **High-performance Computing in Searching Global Optima**  
Propose a parallelized simulated annealing (SA) model for searching the global optima to improve the efficiency of filter algorithm by **102 times** for parallel particle filters on [CUNY high-performance clusters](#) (128 CPUs).

**Dept. of Mechanical Engineering, City University of New York**  
**Research Assistant, PhD Candidate**

**New York, NY, USA**  
**09/2011 – 12/2014**

- **ODE/PDE Modeling**  
Developed **mathematical Ordinary/Partial Differential Equation models** to analyze the potential field and current distribution in impedance sensing and further optimized the sensor design.
- **Bio-sensor Design and Fabrication**  
Designed and fabricated **200 um** microfluidic chips and biosensors, including impedance, quartz crystal microbalance (QCM), and nitric oxide (NO) biosensors for cell activity analysis.
- **Experimental Platform Design and Build**  
Wrote **C++** code and Labview program for data acquisition from biosensors. Built experimental platform for cyclically stretching cells and signal acquisition, including coding, printed circuit board (PCB) and circuit design for step motors.

**Dept. of Mechanical Engineering, Jilin University**  
**Research Assistant**

**Changchun, Jilin, CHINA**  
**09/2004 – 12/2008**

- **RBF Neural Networks in Data Analysis**  
Identified the critical features from the dataset related to the quality of electric spot welding (ESW) and used **RBF (Radial Basis Function) neural networks** to analyze and predict the quality of welding.

**Dept. of Computer Science, City University of New York**  
**Adjunct Lecturer**

**New York, NY, USA**  
**09/2017 – 05/2020**

- Taught C++, Java, Computer Networks, and Algorithmic Problem Solving.

## Honors & Awards

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- **Best Paper Award**, Symposium on Theory of Modeling and Simulation 2018, Baltimore, Maryland, USA.
- Graduate Center 5-year fellowship, City University of New York, NY, USA.
- Doctoral Student Research Grant, City University of New York, NY, USA.

## Selected Publications

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1. **Xudong Zhang** and Feng Gu. "Boosting the speed of real-Time multi-object tracking by using weight-reduced neural networks". International Joint Conference on Neural Networks (IJCNN 2021) (submitted)
2. **Xudong Zhang**, Jiehao Xiao, Yifei Gong, Ning Yu, Wei Zhang, Sunghoon Jang, and Feng Gu. "Handling the missing data problem in electronic health records for cancer prediction. In Proceedings of the Modeling and Simulation in Medicine (MSM 2020).
3. Hu, Xiaochen, **Xudong Zhang**, and Nicholas P. Lovrich. "Forecasting identity theft victims: Analyzing characteristics and preventive actions through machine learning approaches." Victims & Offenders (2020): 1-30.
4. Hu, Xiaochen, **Xudong Zhang**, and Nicholas Lovrich. "Public perceptions of police behavior during traffic stops: logistic regression and machine learning approaches compared." Journal of Computational Social Science (2020): 1-26.

5. Xudong Zhang, Pengxiang Wu, Changhe Yuan, Yusu Wang, Dimitris Metaxas, and Chao Chen. "Heuristic search for homology localization problem and its application in cardiac trabeculae reconstruction." International Joint Conferences on Artificial Intelligence (IJCAI 2019). (Oral Presentation, Acceptance Rate 17.9%)
6. Xudong Zhang, and Feng Gu. "Adaptive particle sampling and resampling in parallel/distributed particle filters." In Proceedings of the High-Performance Computing 2019.
7. Xudong Zhang, Jiehao Xiao, and Feng Gu. "Applying a support vector machine to electronic health records for cancer classification." In Proceedings of the Modeling and Simulation in Medicine (MSM 2019).
8. Xudong Zhang, Mohamed, A., Nguyen, L, and Gu, F. Performance analysis of parallel/distributed particle filters, Theory of Modeling and Simulation' 18 (TMS 2018) (Best Paper Award, Oral Presentation, acceptance rate 2.5%).
9. Xudong Zhang, Lixin Huang, Evan Ferguson-Hull, Feng Gu. "Adaptive particle routing in parallel/distributed particle filters". High Performance Computing Symposium (HPC 2017).
12. Xudong Zhang, Liang Zhao, Wei Zhong, and Feng Gu, "Performance Analysis of Resampling Algorithms of Parallel/Distributed Particle Filters," in IEEE Access, vol. 9, pp. 4711-4725, 2021. (Impact factor: 3.745)
13. Xudong Zhang, Liang Zhao, Wei Zhong, and Feng Gu. A generic hybrid resampling algorithm in parallel/distributed particle filters and corresponding convergence analysis. Journal of Parallel and Distributed Computing (2020). (Impact factor: 2.296)
14. Xudong Zhang, Anis Nurashikin Nordin, William Wang, Fang Li, Sunghoon Jang, Ioana Voiculescu. The influence of the electrode dimension on the detection sensitivity of electric cell–substrate impedance sensing (ECIS) and its mathematical modeling. Sensors and Actuators B 247, pp.780-790. (Impact factor: 7.1)
15. Xudong Zhang, Wen Jing, Xu Guocheng. Qualitative estimation of resistance spot welding for stainless steel based on backpropagation neural network, China Welding. Vol.18, No.3, September, 2009, Pages 32–35.