

# Cai Gao

## CONTACT INFORMATION

Phone: [716-907-5822](tel:716-907-5822) Email: [caigao@buffalo.edu](mailto:caigao@buffalo.edu) & [cai.gao@hotmail.com](mailto:cai.gao@hotmail.com)  
Department of Industrial & Systems Engineering, University at Buffalo, SUNY

## SUMMARY

Engineer with a strong background in mathematical modeling and optimization analysis.

## EDUCATION

- Ph.D., **University at Buffalo** Buffalo, NY  
*Industrial Engineering - Operations Research; GPA: 3.88/4.0* 9/2015 - Present
- M. S., **Southwest University** Chongqing, China  
*Computer Science; GPA: 3.70/4.0* 9/2012 - 7/2015
- B. S., **Southwest University** Chongqing, China  
*Textile Engineering; GPA: 3.33/4.0* 9/2008 - 7/2012

## PROGRAMMING & SOFTWARE

C/C++, Python, Matlab, R, Gurobi, Cplex, GAMS, IPOPT, Gravity

## RESEARCH INTERESTS

Mathematical Programming, Machine Learning, Network Optimization, Metaheuristic

## RESEARCH EXPERIENCE

- **Los Alamos National Laboratory** Los Alamos, NM  
*Graduate Research Assistant; Mentor: Dr. Hassan Hijazi* 6/2019 - 12/2019
  - **HyperShperes Classifier:** This model exploits using constraints (hyperspheres) to define feasible regions for objects and build mathematical models for classification
- **University at Buffalo** Buffalo, NY  
*Research Assistant; Advisor: Dr. Jose L. Walteros* 9/2015 - present
  - **Drone Routing Problem:** Develop both mixed-integer programming models and heuristics for drones routing problems of applications for Intelligence, Surveillance, and Reconnaissance activities
  - **Close-enough TSP with Convex Neighborhoods:** propose both local and global criteria on optimal solutions; tackle this problem in full generosity by proposing a mixed-integer nonlinear programming model, which is solved by generalized Benders decomposition for model performance enhancement
- **Southwest University** Chongqing, China  
*Research Assistant; Advisor: Dr. Yong Deng* 9/2012 - 7/2015
  - **Physarum Solver:** A package of algorithms, inspired by a slime mould *physarum polycephalum*, designed and extended for network optimization problems; this project was supported by *Fundamental Research Funds for the Central Universities, China* (Principal Investigator)

## PUBLICATIONS

- Gao, C., Zhang, X., Yue, Z., & Wei, D. J. (2020). An Accelerated Physarum Solver for Network Optimization. *IEEE Transaction on Cybernetics*. 50 (2), 765-776.
- Gao, C., Yan, C., Adamatzky, A., & Deng, Y. (2014). A Bio-inspired Algorithm for Route Selection in Wireless Sensor Networks. *IEEE Communications Letters*. 18 (11), 2019-2022.
- Yan, C., Gao, C., Yu, J., Deng, Y., & Nan, K. (2014). The Optimal Path Tour Problem. *International Journal of Unconventional Computing*. 10 (5-6), 429-454.
- Zhang, X., Gao, C., Deng, Y., & Zhang, Z. L. (2016). Slime Mould Inspired Applications on Graph-Optimization Problems. *Advances in Physarum Machines*, Springer International Publishing. 519-562.

## PAPERS IN PREPARATION

- Gao, C., Walteros, J. L., & Murray, C. (2019). A Mixed-integer Programming Model for Solving Risk/Reward Asset Routing Problem ( $R^2$ ARP): Optimal Route Planning for Airborne Sensors. plan to submit to *European Journal of Operational Research*.

- **Gao, C.,** Wei, N. J. & Walteros, J. L., Generalized Benders Decomposition for Solving Close-enough Traveling Salesman Problem with Convex Neighborhoods. plan to submit to *INFORMS Journal on Computing*.
  - **Gao, C.** & Walteros, J. L. An Efficient Heuristic for UAV Routing with Profits in Hostile Environment, *polish writing*.
  - **Gao, C.** & Hijazi, H. An Interpretable Shape Recognition Learning Model. *working on numerical experiment*.
- PRESENTATIONS AND TALKS**
- Gao, C. & Walteros, J. L. (2018). A Variable 2-opt Method for UAV Routing with Profits in Hostile Environment. *INFORMS Annual Meeting*, Pheonix, AZ.
  - Gao, C. & Walteros, J. L. (2017). An Exact Method for Risk&Reward Asset Routing Problem. *INFORMS Annual Meeting*, Houston, TX.
  - Gao, C. & Walteros, J. L. (2016). The Risk/Reward Asset Routing Problem (R<sup>2</sup>ARP): Optimal Route Planning for Airborne Sensors. *INFORMS Annual Meeting*, Nashville, TN.
  - Gao, C. & Deng, Y. (2013). Workshop on 9<sup>th</sup> Conference of Complex Network, Beijing, China.
  - Gao, C. & Deng, Y. (2013). Workshop on 2013 Chinese Ph.D. Academic Forum - Research Progress in Complexity, Hangzhou, China.
- RELEVANT COURSEWORK**
- **OR:** Linear Programming, Discrete Optimization, Stochastic Methods, Applied Stochastic Processes, Network Optimization, Urban Operations Research, Stochastic Inventory Theory
  - **CS:** Algorithm Analysis and Design 1&2, Social Network Behavior Analysis
  - **Math:** Real Analysis, Multi-variables Calculus, Game Theory
  - **Self-study:** Machine Learning, Deep Learning, Nonlinear Optimization, Abstract Algebra
- AWARDS**
- Student Awards – University at Buffalo, US
    - Presidential Fellowship 2015–2019
    - Dean’s Fellowship 2015
  - Student Awards – Southwest University, China
    - National Scholarship of Graduate 2013 & 2014
    - 2<sup>nd</sup> Prize of 9th National Mathematic Contest in Modeling(for Graduates) 2013
    - National Encouragement Scholarship 2009
- TEACHING EXPERIENCE**
- Teaching Assistant, University at Buffalo, Buffalo, NY*
- EAS 305 – Applied Probability & Statistics Inference, *Fall, 2015*
  - IE 408/508 – Quality Assurance *Spring, 2016*
  - IE 320 – Economic Engineering *Spring, 2017*
  - IE 408/508 – Quality Assurance *Spring, 2019*