CURRICULUM VITAE

Guangyang Zeng

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EDUCATION

- **Ph.D.**, (Sep. 2017 – Jun. 2022)
  College of Control Science and Engineering, Zhejiang University, Hangzhou, P.R.China
  Advisor: Peng Cheng.
  Co-advisor: Jiming Chen, Junfeng Wu.
  Thesis: Distributed Detection and Accurate Localization in Sensor Networks
- **B.Eng.**, (Sep. 2013 – Jun. 2017)
  College of Control Science and Engineering, Zhejiang University, Hangzhou, P.R.China
  Outstanding Graduate

RESEARCH INTERESTS

Statistical inference; State estimation; Wireless sensor networks.

AWARDS AND HONORS

- Third Prize of the 16th "Challenge Cup" Extracurricular Academic and Technological Works Competition of College Students in Zhejiang Province, Zhejiang Province, China 2019
- Outstanding Graduate, Zhejiang University, China 2017
- Second Prize of Mathematical Modeling Competition of Zhejiang University, Zhejiang University, China 2016
- Third-class Scholarship for Outstanding Students, Zhejiang University, China 2014, 2015
- First Prize of Physics Innovation Competition for College Students in Zhejiang Province, Zhejiang Province, China 2014

PROJECTS

- Cross-Media Intelligent Monitoring for "Low-Slow-Small" Aircraft, The Fundamental Research Funds for the Central Universities, No. 2018FZA5008, Jan. 2018–Dec. 2018 (participant).
- Small UAV Intrusion Detection Based on Swarm Intelligence Perception, National Natural Science Foundation of China, No. 61772467, Jan. 2018–Dec. 2021 (participant).

PAPERS

[1] **Guangyang Zeng**, Junfeng Wu, Xiufang Shi, and Zhiguo Shi, "A Novel Decision Fusion Scheme with Feedback in Neyman-Pearson Detection Systems", ***The 56th Annual Allerton Conference on Communication, Control, and Computing***, Urbana-Champaign, USA, Oct. 2018, pp. 647–653.

[2] **Guangyang Zeng**, Xiaoqiang Ren, and Junfeng Wu, "Low-complexity Distributed Detection with One-bit Memory Under Neyman-Pearson Criterion", ***IEEE Transactions on Control of Network Systems***, vol. 9, no. 1, pp. 2–13, Mar. 2022.

[3] **Guangyang Zeng**, Biqiang Mu, Jieqiang Wei, Wing Shing Wong, and Junfeng Wu, "Localizability with Range-Difference Measurements: Numerical Computation and Error Bound Analysis", ***IEEE/ACM Transactions on Networking***, DOI: 10.1109/TNET.2022.3162930, to appear.

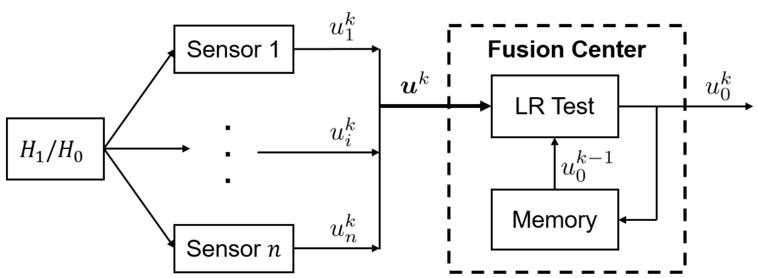
[4] **Guangyang Zeng**, Biqiang Mu, Jiming Chen, Zhiguo Shi, and Junfeng Wu, "Global and Asymptotically Efficient Localization from Range Measurements", ***IEEE Transactions on Signal Processing***, DOI: 10.1109/TSP.2022.3198167, to appear.

PATENTS

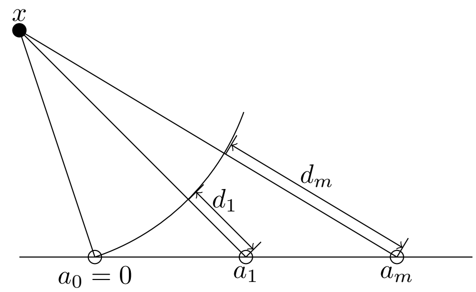
[1] Junfeng Wu, Jiming Chen, Jieqiang Wei, and **Guangyang Zeng**, "Localizing a Target Device Based on Measurements from a Measurement Device Array", US patent, patent number: 11353541.

RESEARCH DESCRIPTION

- **Low-complexity Distributed Detection with a One-bit Memory**
  We consider a multi-stage distributed detection scenario, where n sensors and a fusion center (FC) are deployed to accomplish a binary hypothesis test. At each time stage, local sensors generate binary messages, assumed to be spatially and temporally independent given the hypothesis, and then upload them to the FC for global detection decision making. We suppose a one-bit memory is available at the FC to store its decision history and focus on developing iterative fusion schemes. We first visit the detection problem of performing the Neyman-Pearson (N-P) test at each stage and give an optimal algorithm, called the oracle algorithm, to solve it. Structural properties and limitation of the fusion performance in the asymptotic regime are explored for the oracle algorithm. We notice the computational inefficiency of the oracle fusion and propose a low-complexity alternative, for which the likelihood ratio (LR) test threshold is tuned in connection to the fusion decision history compressed in the one-bit memory. The low-complexity algorithm greatly brings down the computational complexity at each stage from $O(4^n)$ (worst case) to $O(n)$. We show that the proposed algorithm is capable of converging exponentially to the same detection probability as that of the oracle one. Moreover, the rate of convergence is shown to be asymptotically identical to that of the oracle algorithm. Finally, numerical simulations and real-world experiments demonstrate the effectiveness and efficiency of our distributed algorithm.



- **Global TDOA Localization**
  This work studies the localization problem using noisy range-difference measurements, or equivalently time difference of arrival (TDOA) measurements. There is a reference sensor, and for each other sensor, the TDOA measurement is obtained with respect to the reference one. By minimizing the sum of squared errors, a nonconvex constrained least squares (CLS) problem is formulated. In this work, we focus on devising an algorithm to seek the global minimizer of the CLS problem, hoping that the numerical solution meets some precision requirement in terms of relative error. Based on the Lagrange multiplier method, we first branch the feasible Lagrange multiplier set into several subsets and develop a workflow in terms of if-then-else control structure to seek the global minimizer by searching for the optimal Lagrange multiplier. The execution order is carefully organized so that it is in line with the general principle of putting the flow that one normally understands to be executed first. We then dive into detailed searching methods in different cases and conduct computational error analysis, giving the error bound on the Lagrange multiplier, when we search for it, to meet the precision requirement on an approximate solution. Based on the above achievements, a programmable global minimizer seeking algorithm is proposed for the CLS problem. Simulations and experimental tests on a public dataset demonstrate the effectiveness of the proposed algorithm.



- **Asymptotically Efficient TOA Localization**
  We consider the range-based localization problem, which involves estimating an object's position by using m sensors, hoping that as the number m of sensors increases, the estimate converges to the true position with the minimum variance. We show that under some conditions on the sensor deployment and measurement noises, the least-squares (LS) estimator is strongly consistent and asymptotically normal. However, the LS problem is nonsmooth and nonconvex, and therefore hard to solve. We then devise realizable estimators that possess the same asymptotic properties as the LS one. These estimators are based on a two-step estimation architecture, which says that any $\sqrt{m}$-consistent estimate followed by a one-step Gauss-Newton iteration can yield a solution that possesses the same asymptotic property as the LS one. The keypoint of the two-step scheme is to construct a $\sqrt{m}$-consistent estimate in the first step. In terms of whether the variance of measurement noises is known or not, we propose the Bias-Eli estimator (which involves solving a generalized trust region subproblem) and the Noise-Est estimator (which is obtained by solving a convex problem), respectively. Both of them are proved to be $\sqrt{m}$-consistent. Moreover, we show that by discarding the constraints in the above two optimization problems, the resulting closed-form estimators (called Bias-Eli-Lin and Noise-Est-Lin) are also $\sqrt{m}$-consistent. Plenty of simulations verify the correctness of our theoretical claims, showing that the proposed two-step estimators can asymptotically achieve the Cramer-Rao lower bound.