

Fan Yang

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EDUCATION

Doctor of Philosophy, Mechanical Engineering, GPA: 3.88/4.0
Minor area: Applied Mathematics and Statistics
Stony Brook University, Stony Brook, NY 2015-2020
Advisor: Nilanjan Chakraborty
Thesis: *Algorithms for Chance-constrained Multi-robot Task Allocation*
Master of Science, Mechanical Engineering, GPA: 3.96/4.0
Stony Brook University, Stony Brook, NY 2014-2015

EXPERTISE

Programming Languages: C++, Python, Matlab.
Packages & Libraries: OpenCV, g2o, Ceres solver, Sophus, Pytorch, Eigen, PCL, Google Test, Docker.
ROS: RosBag, pcl conversions, Navigation-Stack, Slam_gmapping, m-explore, cv_bridge, Gazebo, RViz.
Hardware: Jetson Xavier NX, KUKA KMP 600-S, Pioneer mobile robot, Turtlebot3, Baxter Robot.
Domain Knowledge: Computer vision, multi-view geometry, Kalman Filter, state estimation, nonlinear optimization, MAP/MLE, deep learning, reinforcement learning.

EXPERIENCE

KUKA Robotics / Midea Corporate Research Center: November 2021 – August 2025
Robotics Navigation Engineer

- VISUAL-INERTIAL SLAM SYSTEM FOR KUKA AUTONOMOUS MOBILE ROBOTS
 - Responsible for the offline optimization module that detects loop closing, optimizes map points and keyframes pose by bundle adjustment, merges maps, and removes outliers and redundant features.
 - Calibrate the camera sensors. Test localization on Jetson Xavier NX platform with RealSense T265 Camera. Collect the ROSBag camera dataset for offline algorithm tuning and evaluation.
 - Collaborate with KUKA AMR team to facilitate system testing and product deployment.
- MAP UPDATING SYSTEM FOR DYNAMIC ENVIRONMENT
 - Collaborate with the KUKA AMR team to identify and analyze localization failures in the dynamic warehouse environment. Propose ideas and solutions. Design map updating pipeline.
 - Responsible for developing the factor-graph-based online mapping module for the dynamic warehouse environment with moving objects and changing inventory.
 - Design and implement multiple map merge schemes that detect changes, update the map, and avoid ghosting due to redundant and false updating.
 - Develop tools to visualize scan match, pose graph structure, and statistics in the occupancy grid map.
- MAP EXTENDING SYSTEM FOR WAREHOUSE WITH LARGE AREA
 - Propose and develop the map extending pipeline for the large warehouse space (100,000 m²).
 - Design and implement the loop closure for pose graph optimization, and relocalization.
 - Define data format for pose graph structure and sensor readings storage and loading using g2o library.
- HIGH PRECISION GROUND TEXTURE MAPPING AND LOCALIZATION
 - Design the ground texture mapping system for the degenerate scenarios, e.g., open area and corridor.
 - Build and solve pose graph optimization using g2o optimization library, which includes factors like odom, feature matching and QR code observations.
 - Collaborate with KUKA AMR team to implement the image processing module responsible for feature extraction, compression, matching, and GPU acceleration.

Personal Developer:

January, 2020 – Present

The selected projects below are open-source. The full portfolio is at <https://yangfan.github.io/projects/>.

- 3D LIDAR-INERTIAL ODOMETRY BASED ON KALMAN FILTER
 - Implement point cloud registration algorithms from scratch including NDT, incremental NDT and ICP.
 - Develop state estimation based on (Iterative) Error State Kalman Filter fusing lidar and IMU data.
 - Preprocess lidar and IMU data: data conversion (ROS msg to PCL point cloud), synchronization, and point cloud undistortion by IMU motion compensation.
- 3D LIDAR-INERTIAL ODOMETRY BASED ON IMU PREINTEGRATION AND POSE GRAPH OPTIMIZATION
 - Implement IMU preintegration class which computes the preintegrated measurement, covariance and Jacobians of residuals and bias update.
 - Build and solve pose graph optimization with preintegrated IMU, bias, prior, NDT alignment factors.
 - Smooth the state estimation by marginalizing the Hessian matrix of optimization variables.
- 3D POINT-CLOUD MAPPING PIPELINE
 - Develop frontend for processing sensor data (GNSS, IMU, Lidar) and creating keyframes and pose graph.
 - Preprocess data: GNSS data conversion (ROS msg, UTM, SE3), synchronization, and cloud undistortion.
 - Develop backend for loop closure detection, global optimization with sensor fusion, and map partition.
- REAL-TIME LIDAR-INERTIAL LOCALIZATION
 - Develop Kalman Filter based point cloud fusion localization system reliable in GPS denied environments.
 - Design multi-thread workflow for acceleration: main thread responsible for state estimation vis ESKF; map management thread for dynamic map loading and visualization which saves memory usage.
- 2D MAPPING SYSTEM FOR AGV/AMR
 - Implement registration algorithms including ICP, ICL and likelihood field using Ceres and g2o libraries.
 - Implement data structures from scratch: kd-tree, distance map, likelihood field, occupancy grid map.
 - Develop a real-time multi-resolution loop closure detection method to reduce accumulated error and a submap-based global optimization module for map correction with lower memory usage.

Research Assistant:

June 2017 – August 2020

A brief summary of my research is provided here: <https://yangfan.github.io/research/>.

- Study extensively the risk-averse and optimization algorithms for multi-robot decision making.
- Formulate path planning and task allocation problems of multi-robot coordination system under uncertain environment using chance-constraint model.
- Propose and implement risk-averse and distributionally robust optimization algorithms for multi-robot decision making.
- Publish research papers to top robotics conferences like ICRA and IROS. The topic includes task allocation, path planning, routing and perimeter patrolling for multi-robot system under uncertain environment with limited resource.
- Reviewer of ICRA, IROS, RA-L, CASE submissions. Mentor for undergraduate and master students.

PUBLICATIONS

Patent

- [1] **Fan Yang**, Xiaoliang Jiao, Wei Xi, Ming Chen, KUKA Robotics. Map updating method and apparatus, and autonomous moving apparatus and storage medium. WO2025050384A1, WIPO. CN121311737A, CNIPA. Under review by USPTO.

Paper/Abstract

- [1] **Fan Yang** and Nilanjan Chakraborty. Chance Constrained Simultaneous Path Planning and Task Assignment with Bottleneck Objective. In *2021 IEEE International Conference on Robotics and Automation (ICRA)*, Xi'an, China, May 2021.
- [2] **Fan Yang** and Nilanjan Chakraborty. Algorithm for multi-robot chance-constrained generalized assignment problem with stochastic resource consumption. In *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pages 4329-4336, Las Vegas, USA, October 2020.

- [3] **Fan Yang** and Nilanjan Chakraborty. Chance constrained simultaneous path planning and task assignment for multiple robots with stochastic path costs. In *2020 IEEE International Conference on Robotics and Automation (ICRA)*, pages 6661-6667, Paris, France, May 2020.
- [4] **Fan Yang** and Nilanjan Chakraborty. Algorithm for optimal chance constrained knapsack problem with applications to multi-robot teaming. In *2018 IEEE International Conference on Robotics and Automation (ICRA)*, pages 1043-1049, Brisbane, Australia, May 2018.
- [5] **Fan Yang** and Nilanjan Chakraborty. Algorithm for multi-robot chance-constrained linear assignment. In *2017 IEEE International Conference on Robotics and Automation (ICRA)*, pages 801-808, Singapore, May 2017.
- [6] **Fan Yang** and Nilanjan Chakraborty. Multirobot simultaneous path planning and task assignment on graphs with stochastic costs. In *2019 International Symposium on Multi-Robot and Multi-Agent Systems (MRS)*, New Brunswick, NJ, USA, August 2019.
- [7] **Fan Yang** and Nilanjan Chakraborty. Multi-robot team formation under uncertain environment. In *Northeast Robotics Colloquium (NERC)*, New Brunswick, NJ, USA, October 2018.
- [8] **Fan Yang** and Nilanjan Chakraborty. Algorithm for optimal chance constrained knapsack with applications to multi-robot teaming. In *27th Fall Workshop on Computational Geometry (FWCG)*, Stony Brook, NY, USA, November 2017.