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Education

Doctor of Philosophy in Aeronautics and Astronautics (Autonomous Systems and Control) [2021 – 2025]
Stanford University, Stanford, CA
Advisor: Mykel J. Kochenderfer
Thesis: ''Planning with Contextual Semantics in Unstructured Environments''

Master of Science in Robotics, System, and Control [2018 – 2020]
ETH Zürich, Zürich, Switzerland
Advisor: Ali Agha (JPL), Juan Nieto, Roland Siegwart
Thesis: ''Active Information Acquisition for Resource-constrained Navigation''

Bachelor of Science in Electrical Engineering [2013 – 2017]
Bandung Institute of Technology, Bandung, Indonesia
Advisor: Bambang Riyanto Trilaksono | Valedictorian
Thesis: Guidance System Design and Implementation for Autonomous Underwater Glider

Research

Stanford Intelligent Systems Laboratory (SISL), *Stanford University* [2021 – Present]

Semantic Reasoning for Object Goal Navigation (In collaboration with Field AI) [1]: Proposed a framework that uses prior spatial configuration and relational semantic knowledge for semantic-guided navigation. Developed a method to build a relational semantic network using common-sense knowledge contained in an LLM. Designed a probabilistic planning algorithm for object-goal navigation with relational semantic knowledge. Validated the framework through simulation and real-world demonstrations with a legged robot.

Local Object Search in Geo-Semantic Belief Space (In collaboration with Field AI) [2]: Developed a framework called SB2G (Semantic Belief Behavior Graph) to enable robots to perform autonomous inspection tasks using semantic information. Designed an active semantic search behavior to guide the robot in locating objects for inspection while reducing semantic information uncertainty. Evaluated the object search performance against the robot behavior manually operated by a human.

Global Planning for Signal Source Seeking (In collaboration with NASA JPL): Formulated active signal source seeking problem using a partially observable Markov decision process (POMDP). Designing a belief update algorithm to predict future information gain of signal measurement. Combining semantic prediction of building structures to plan efficient signal source search.

Locomotion Adaptation using Semantic Belief Graph (In collaboration with NASA JPL) [3]: Proposed a geo-semantic-based representation of a robot's probabilistic roadmap for robot navigation. Designed a new motion planning architecture that uses semantic information to control the robot to a goal location while selecting the best gait locomotion controller based on the perceived terrain type.

Multi-robot task allocation (In collaboration with NASA JPL) [4]: Formulated a multi-robot task allocation framework for an exploration mission of a robot team with heterogeneous capabilities. Evaluated the framework on a real-world scenario in the context of the DARPA Subterranean Challenge. Evaluated a design trade-off on building a multi-robot team with different capabilities.

JPL Mobility and Robotic Systems (Section 347), *NASA Jet Propulsion Laboratory* [2019 – 2021]

Autonomous Legged Robot Navigation [11]: Designed and integrated NeBula autonomy capability [7] on a Boston Dynamics Spot legged robot and evaluated system behavior arised from the interaction between NeBula framework and Boston Dynamics locomotion controller.

Distributed Multi-Robot Data sharing [9]: Developed a distributed multi-robot data sharing using ROS 2. Deployed the solution in the DARPA Subterranean Challenge and enabled reliable data sharing of critical data between robots and the human supervisor in the base station.

Belief-aware Autonomy System Integration [7]: Maintained and integrated various autonomy modules to enable multi-robot operations with different mobility types. Evaluated and improved interaction between modules by accounting for the uncertainty introduced across the system.

Global Fiducial Calibration [5]: Designed an accurate and time-effective algorithm and procedure for global localization using fiducial landmarks and a total station. Deployed the solution for multi-robot calibration in the DARPA Subterranean Challenge.

Martian Subsurface Exploration Mission Design [6,12,13]: Investigated a new space mission to explore martian subsurface with a team of legged robots. Wrote a NASA NIAC Phase 1A proposal.

Autonomous Systems Laboratory (ASL), *ETH Zürich* [2019 – 2020]

Active Information Acquisition for Resource-constrained Navigation [14]: Developed an active SLAM framework to improve robot map accuracy by planning information acquisition of global references.

Text-based Visual Localization: Designed a learning-based method to perform visual localization and mapping using text-based landmark, and leveraging text descriptor with an existing localization method in place recognition task.

Distributed State Estimation: Developed a state estimation method for swarm drones formation estimation using relative distance between agents in a distributed manner.

Multi-Camera Tracking: Extended the Deep Tracking and Mapping(DeepTAM) pipeline for multi-camera setup, and evaluated the benefit of the approach in perceptually degraded environment.

Advanced Robotics Laboratory, *Bandung Institute of Technology* [2017 – 2018]

Guidance system for Autonomous Underwater Glider [15,16]: Developed Line-of-Sight planning method underwater exploration and performed hardware-in-the-loop simulation.

Autonomous Underwater Glider field deployment: Characterized underwater sensor and conducted field testing in a diving pool and in the sea.

CERN Summer Student Program, *CERN* [Jun. - Aug. 2016]

Microcontroller design: Devised a controlled high voltage module for Micro Pattern Gas Detectors (MPGD) and presented the result to the Internation MPGD Collaboration meeting.

Industry Experience

Field AI, *Mission Viejo, CA* [Jun. 2023 – Sept. 2023]
Robotics Research Intern
Developed mission autonomy framework for autonomous robot inspections. Designed a framework called Semantic Belief Behavior Graph (SB2G) for object-based inspection algorithm [2]. Initiated three robot demo leading to pilot projects to deploy robot for oil and gas inspections, surveilance, and construction monitoring.

NASA Jet Propulsion Laboratory, *Pasadena, CA* [Sept. 2019 – Sept. 2021]
Visiting Robotics Student Researcher
Developed novel autonomy algorithm for rapid subsurface exploration in extreme environments. Developed multi-robot data sharing, global localization, sensor calibration, mission planning and object mapping algorithms for multi-robot operation in the DARPA Subterranean Challenge. Field tested multiple legged and wheeled robots in various caves and mines in the US. Participated in two events of the DARPA Subterranean Challenge as one of the pit crews in the field.

ETH Junior, *Zurich, Switzerland* [Mar. 2019 – Aug. 2019]
Mixed Reality Developer
Led a project for one of the world's leading dental company pioneering innovative Mixed Reality solutions to assist dentist works.

Labtek Indie, *Bandung, Indonesia* [Jan. 2017 – May. 2017]
Software Developer Intern
Developed an efficient shopping system for convenience stores with mobile apps.

Research Grants

Stanford Sponsored Research Program (PI: Mykel J. Kochenderfer)
AI for Humanity Inc., October 2023 - June 2024
Amount awarded: $ 75,000
Project title: *Semantic-based Planning for Autonomous Robot Inspection*
Role: *Doctoral Researcher*

Stanford Sponsored Research Program (PI: Mykel J. Kochenderfer)
NASA Jet Propulsion Laboratory, January 2022 - December 2024
Amount awarded: $ 600,000
Project title: *Active Source Seeking in Multi-Robot Exploration Missions*
Role: *Doctoral Researcher*

Stanford Graduate Student Research Fellowship
Stanford University, October 2021 - September 2022
Amount awarded: $ 100,000

ARCS Pre-Doctoral Research Fellowship
Autonomy Research Center for STEAHM (ARCS), October 2020 - September 2021
Amount awarded: $ 36,000
Project title: *Campus Autonomous Robot Tours*

Awards and Recognitions

1st place in the DARPA Subterranean Challenge Urban Circuit
For winning DARPA robotics competition in subterranean exploration
Defense Advanced Research Projects Agency (DARPA), 2020

Best Paper Award in Safety, Security, and Rescue Robotics
For the paper ''Autonomous Spot: Long-range Autonomous Exploration of Extreme Environments with Legged Locomotion''
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2020

NASA Research Affiliate STAR Award
Development of novel autonomy capabilities and maintaining JPL's national leadership in autonomy
NASA Jet Propulsion Laboratory, 2020

Indonesia Endowment Fund for Education Scholarship
Full scholarship to pursue Master's degree at ETH Zurich
Indonesia Ministry of Finance, 2018

Valedictorian
Departement of Electrical Engineering, Bandung Institute of Technology, 2017

Young Leaders for Indonesia Top 10 Graduate
McKinsey Young Leader for Indonesia, 2017

Outstanding Student Award
Departement of Electrical Engineering, Bandung Institute of Technology, 2016

2nd Runner-up of ABU Robocon (Asia Pacific Broadcasting Union Robot Contest)
Asia Pacific Broadcasting Union, 2015

Publications

[1] **SEEK: Semantic Reasoning for Object Goal Navigation in Real World Inspection Tasks**
M. F. Ginting, S. K. Kim, D.D. Fan, M. Palieri, M. J. Kochenderfer, and A. Agha-mohammadi
Under review, 2024

[2] **Semantic Belief Behavior Graph: Enabling Autonomous Robot Inspection in Unknown Environments**
M. F. Ginting, D. D. Fan, S. K. Kim, M. J. Kochenderfer, and A. Agha-mohammadi
arXiv 2401.17191 (Under review), 2024

[3] **Safe and Efficient Navigation in Extreme Environments using Semantic Belief Graphs**
M. F. Ginting, S. K. Kim, O. Peltzer, J. Ott, S. Jung, M. J. Kochenderfer, and A. Agha-mohammadi
IEEE International Conference on Robotics and Automation (ICRA), 2023

[4] **Capability-Aware Task Allocation and Team Formation Analysis for Cooperative Exploration of Complex Environments**
M. F. Ginting, K. Otsu, M. J. Kochenderfer, and A. Agha-mohammadi
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2022

[5] **LAMP 2.0: A Robust Multi-Robot SLAM System for Operation in Challenging Large-Scale Underground Environments**
Y. Chang, K. Ebadi, C. E. Denniston, **M. F. Ginting**, A. Rosinol, A. Reinke, M. Palieri, J. Shi, A. Chatterjee, B. Morrell, A. Agha-mohammadi, L. Carlone
IEEE Robotics and Automation Letters (RA-L), 2022

[6] **Autonomous Mapping and Characterization of Terrestrial Lava Caves Using Quadruped Robots: Preparing for a Mission to a Planetary Cave**
J. G. Blank, B. Morrell, A. Bouman, T. Touma, **M. F. Ginting**, C. Patterson, A. Agha-mohammadi
Workshop on Terrestrial Analogs for Planetary Exploration, 2021

[7] **Nebula: Quest for Robotic Autonomy in Challenging Environments; Team CoSTAR at the DARPA Subterranean Challenge**
Journal of Field Robotics, 2021

[8] **Campus Autonomous Robot Tours**
M. F. Ginting, A. Hartman, N. Busca, C. Bracamontes, N. T. Ho
ASCEND, 2021

[9] **CHORD: Distributed Data-sharing via Hybrid ROS 1 and 2 for Multi-robot Exploration of Large-scale Complex Environments**
M. F. Ginting, K. Otsu, J. A. Edlund, J. Gao, and A. Agha-Mohammadi
IEEE Robotics and Automation Letters (RA-L), 2021

[10] **Copilot MIKE: An Autonomous Assistant for Multi-Robot Operations in Cave Exploration**
M. Kaufmann, T. S. Vaquero, G. J. Correa, K. Otsu, **M. F. Ginting**, G. Beltrame, A. Agha-Mohammadi
IEEE Aerospace Conference, 2021

[11] **Autonomous Spot: Long-range Autonomous Exploration of Extreme Environments with Legged Locomotion**
M. F. Ginting*, A. Bouman*, N. Alatur*, M. Palieri, D. D. Fan, T. Touma, T. Pailevanian, S. K. Kim, K. Otsu, J. Burdick, and A. Agha-Mohammadi
IEEE International Conference on Intelligent Robots and Systems (IROS), 2020
Best Paper Award on Safety, Security, and Rescue Robotics

[12] **Deployable Mesh Network for Enabling Reliable Communication from within Subsurface Voids to the Planetary Surface**
M. F. Ginting, T. Touma, J. A. Edlund, and A. Agha-Mohammadi
American Geophysical Union (AGU), 2020

[13] **Mars Dogs: Biomimetic Robots for the Exploration of Mars, from its Rugged Surface to its Hidden Caves**
T. Touma, J. G. Blank, **M. F. Ginting**, C. Patterson, and A. Agha-Mohammadi
American Geophysical Union (AGU), 2020

[14] **Active Information Acquisition for Resource-constrained Navigation in Unknown Environment**
M. F. Ginting
M.Sc. Thesis, Department of Mechanical and Process Engineering, 2020

[15] **Hardware In the Loop Simulation Development of Guidance System for Autonomous Underwater Glider**
T. W. O. Putri, **M. F. Ginting**, B. R. Trilaksono, E. M. I. Hidayat, and M. F. Sagala
IEEE International Conference on Electrical Engineering and Informatics (ICEEI), 2017

[16] **Guidance System Implementation and Hardware in the Loop Simulation for Autonomous Underwater Glider**
M. F. Ginting
B.Sc Thesis, Bandung Institute of Technology, 2017

Professional Service and Volunteering

Reviewer for Journals and Conferences [2020 – Present]

Robotics and Automation Letters (RA-L)
Institute of Electrical and Electronics Engineers (IEEE)

International Conference on Robotics and Automation (ICRA)
Institute of Electrical and Electronics Engineers (IEEE)

International Conference on Intelligent Robots and Systems (IROS)
Institute of Electrical and Electronics Engineers (IEEE)

Journal of Aerospace Information Systems (JAIS)
American Institute of Aeronautics and Astronautics (AIAA)

Student Mentorship [2017 – Present]

Brian Wu (MS, Stanford University)

Kyle Strickland (BSc, CSUN/NASA JPL)

Nicolae Bucsa (BSc, CSUN/NASA JPL)

Isfan Fauzi (BSc, Bandung Institute of Technology)

Muhammad Hanif (BSc, Bandung Institute of Technology)

Silmi Ath Thahirah (BSc, Bandung Institute of Technology)

Albertus Adrian (BSc, Bandung Institute of Technology)

Volunteering

Career, graduate study, and scholarship seminars for Indonesian student communities. 2020.

Career inspiration class for primary school students in Rusunawa Cakung, Indonesia. Mar. 2018.

Robotics workshop for senior high school students in SMA Negeri 5 Bandung, Indonesia. Jan. 2017.

Robotics demo for local kindergarten and primary school students. 2016.

Field coordinator for university graduation parade. Mar. 2015.

Leadership Program

Leadership and Graduate Study Preparation Program by LPDP Scholarship. Feb. 2018.

McKinsey Young Leader for Indonesia Regional Wave 4. Oct. 2016 - May. 2017.

Teaching

Robotics Senior Design Project [Fall 2020 – Spring 2021]
California State University Northridge, Northridge, CA
Research Mentor

Visual Navigation for Autonomous Vehicles [Fall 2020]
Massachusetts Institute of Technology, Remote
Course Project Mentor

Electronics Laboratory [Spring 2017]
Bandung Institute of Technology, Bandung, Indonesia
Lab Coordinator

Control Systems [Fall 2016]
Bandung Institute of Technology, Bandung, Indonesia
Teaching Assistant

Microprocessor Systems Laboratory [Fall 2016]
Bandung Institute of Technology, Bandung, Indonesia
Lab Assistant

Electronics [Spring 2016]
Bandung Institute of Technology, Bandung, Indonesia
Teaching Assistant

Invited Talks

Planning under Uncertainty for Robotic Space Exploration [2024]
AA229/CS239: Advanced Topics in Sequential Decision Making
Stanford University, Stanford, CA

Commencement Speech for Graduation Event [2022]
School of Electrical Engineering and Informatics
Bandung Institute of Technology, Bandung, Indonesia

SARSOP: Efficient Point-Based POMDP Planning by Approximating Optimally Reachable Belief Spaces [2022]
AA229/CS239: Advanced Topics in Sequential Decision Making
Stanford University, Stanford, CA

Career Prospect as a Roboticist [2021]
Electrical Engineering Student Association
Bandung Institute of Technology, Bandung, Indonesia

Enrich your Future by Studying at ETH Zurich [2020]
Graduate School Seminar
Kobi Education, Indonesia

Robotics Research at NASA Jet Propulsion Laboratory [2020]
IEEEngage Student Seminar
IEEE Student Branch, Bandung, Indonesia

What to do after graduation? Career as a Researcher [2020]
Engineering Physics Student Association
Bandung Institute of Technology, Bandung, Indonesia

Building Robots to Explore Earth and Space [2020]
Student seminar series
Indonesian Student Association in Switzerland, Switzerland

Media Coverage

Interns Lead the Way in DARPA Robotics Challenge and Find Their Futures
NASA JPL News, 2022

Meet Au-Spot, the AI robot dog that's training to explore caves on Mars
Live Science, 2020

How JPL's Team CoSTAR Won the DARPA SubT Challenge: Urban Circuit Systems Track
IEEE Spectrum, 2020

Robots Autonomously Navigate Underground in DARPA Challenge
NASA JPL News, 2020

Organizations

Stanford Intelligent Systems Laboratory (SISL) [2021 – Present]
Part of the Stanford Artificial Intelligence Laboratory (SAIL)
Stanford University, Stanford, CA

Stanford Robotics Center (SRC) [2023 – Present]
Student Committee

Stanford University, Stanford, CA

NASA JPL Team CoSTAR [2020 – 2021]
Strategic Communication Lead
NASA Jet Propulsion Laboratory, Stanford, CA

IEEE Robotics and Automation Society [2020 – Present]
IEEE Student Member

The American Geophysical Union (AGU) [2020]
Student Member

Student Robotics Organization [2015 – 2016]
President
Bandung Institute of Technology, Bandung, Indonesia

Electrical Engineering Student Association [2016]
Senior Staff of Character Development Division
Bandung Institute of Technology, Bandung, Indonesia

Student Tennis Club [2015]
Head of Media and Communication Division
Bandung Institute of Technology, Bandung, Indonesia

Technical Skills

Language: English, Indonesian, German (B1)

Programming languages: Python, Julia, MATLAB, C, C++, JavaScript, Java, LaTeX, POMDPs.jl

Software Systems (Linux, Windows, ROS/ROS 2), Tensorflow, Pytorch, CUDA, OpenCV, PCL, Git, Eigen, LabVIEW, MPI, Eagle, Altium Designer, Visual Studio, Unity, Android Studio

External Links

- Website: https://mfadhilgtg.github.io
- GitHub: https://github.com/mfadhilgtg
- Google Scholar: https://bit.ly/ginting-scholar
- LinkedIn: https://www.linkedin.com/in/mfadhilgtg/