# WEI DU

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## EDUCATION

**Carnegie Mellon University (CMU)** *05/2019*
- Master of Science in Mechanical Engineering
- GPA: 3.89/4.0

**Shanghai Jiao Tong University (SJTU)** *06/2016*
- Mechanical Engineering (Joint Program)
- GPA: 3.83/4.3

**Harbin Institute of Technology (HIT)** *06/2017*
- Bachelor of Engineering in Mechanical Design, Manufacturing and Automation
- GPA: 3.76/4.00

## PUBLICATIONS

**Wei Du**, Fahad Islam and Maxim Likhachev. ***Multi-Resolution A****. (under review)

**Wei Du**, Sung-Kyun Kim, Oren Salzman and Maxim Likhachev. ***Escaping Local Minima in Search-Based Planning using Soft Duplicate Detection***, Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2019

**Wei Du** and Yingxiang Liu.(2017). Design on Test System and Experimental Research of Foot Piezoelectric Ultrasonic Motor. School of Mechatronics Engineering, Harbin Institute of Technology, Harbin, China.

## RESEARCH INTERESTS

In model-based motion planning, it is common that search-based planners run into local minimum region and sampling-based planners sample blindly due to lack of cognition to environments. As a consequence, it is essential to plan with a more comprehensive world model. Specifically speaking, I am dedicated to constructing **prediction models of robots' interactions** with the world and **uncertainties** from dynamic objects and leveraging these models to **guide planners**.

## RESEARCH EXPERIENCE

**Multi-Resolution A* algorithm – Search-based Planning Lab (CMU)** *06/2019 - Present*
- Researched on executing multiple searches simultaneously in search-based planning to explore search spaces with different resolutions.
- Exploited different scheduling policies such as *DTS* to speed up the search.
- Conducted experiments in 2D, 3D, and 7D planning and succeeded with highly increased success rates of planners and drastically accelerated planning processes.
- Enriched the *SMPL* motion planning library with mesh loading functionality.

**Walker Project – Search-based Planning Lab (CMU & UBTech Inc.)** *04/2019 - Present*
- Customized SLAM algorithms for the Walker robot to assist its indoor navigation.
- Mapped out the workspace of the Walker robot with respect to the conveyor.
- Implemented ARA* algorithm on Walker robot for manipulation tasks on conveyor.
- Constructed perception-planning-grasp pipeline for grasping tasks, e.g., grasp a box from the conveyor.

**Cruzr Project – Search-based Planning Lab (CMU & UBTech Inc.)** *10/2018 - 04/2019*
- Customized SLAM algorithms for Cruzr robot to assist its indoor navigation.

- Constructed a state machine to coordinate planning and SLAM.
- Constructed local controllers to execute plans returned from the planner.

**Planning Using Soft Duplicate Detection – Search-based Planning Lab (CMU)** *12/2017 - 02/2019*
- Explored search-based planning approaches in continuous state space with soft duplicate detection scheme.
- Implemented decision trees in prioritizing states and map pattern recognition.
- Wrote one visualization software with the *OpenGL* library to monitor the planning process.

**Research on Control Characteristic Foot Piezoelectric Ultrasonic Motor (HIT)** *10/2016 - 05/2017*
- Designed a mechatronics platform for the experiments.
- Conducted simulation experiments in ADAMS software for dual-foot piezoelectric ultrasonic motor and generated control characteristic curve.
- Conducted experiments with the designed platform for dual-foot piezoelectric ultrasonic motor and produced the characteristic curve for reference in motion control.

**Quad-rotor Tajectory Optimization – the Robotics Institute (SJTU)** *05/2016 - 06/2016*
- Implemented optimization techniques for quad-rotor trajectory planning with dynamic constraints.
- Adopted differential smoothing algorithm to reduce jitter.

**Small Wheeled Jumping Robot – Lab of Advanced Actuation Technologies (HIT)** *08/2015 - 01/2016*
- Designed the cellular wheel structure for the robot and conducted force analysis on it.
- Completed circuit design of a single-chip microcomputer based on the STM32 minimum system board.
- Implemented the PID controller to maintain jumping speed at a high level.

**National College "Freescale Cup" Smart Car Contest** *09/2014 - 04/2015*
- Applied the PID controller to maintain smart car in high speeds.
- Applied Labview software to analyze the performance and control characteristics of the smart car.
- Applied Kalman filter to process magnetic field signals thus localizing the smart car in real-time.

## COURSE PROJECTS (CMU)

**Power plant Substation-to-feeder Path Prediction – Bayesian Machine Learning** *02/2019 - 05/2019*
- Collaborated with Kevala company on predicting feeder-path endpoints and outperformed the peer team at the Facebook company.
- Implemented CNNs to predict the endpoints of power lines with accuracy $92\%$.
- Employed motion planning algorithms in generating the substation-to-feeder paths.

**Trajectory Optimization for Fixed-wing Airplane – Egineering Optimization** *02/2019 - 05/2019*
- Constructed a complex optimization model for NASA's $\mathrm{X}-57$ Electric Research Plane.
- Implemented the Differential Dynamic Programming algorithm to solve the optimization.
- Modeled this problem as a graph search problem and solved this problem with respect to this perspective.

**Offline Hand-written Chinese Characters Recognition – Pattern Recognition Theory** *09/2018 - 12/2018*
- Implemented CNNs in recognizing hand-written Chinese characters with accuracy $98\%$.
- Implemented decision-trees, SVM as baselines against CNNs in recognizing hand-written characters.

**Inserting A Curve Into Mesh – Advanced Engineering Computation** *03/2018 - 05/2018*
- Succeeded in leveraging the *OpenGL* Library to load and render 2D mesh with the *C++* language.
- Reproduced the work of one research paper about inserting a curve into one mesh figure and increased the smoothness on the edges between different components of this figure.

**Aviation Game – Engineering Computation** *09/2017 - 12/2017*
- Designed a GUI for an aviation simulator, which gained popularity among the class.
- Achieved the basic functionality of an aviation game, with the control model of the airplane based on its kinematics, dynamics, and disturbances.

## ACTIVITIES

**The IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Macau** *11/2019*
- Co-Chaired the *Motion and Path Planning III* session.
- Presented my research *Escaping Local Minima in Search-Based Planning using Soft Duplicate Detection*.

**Visitor, HIT Robot Group Inc.** *07/2015*
- Technical communications on the combination of production and academia research about industrial robots.

**Volunteer, HIT Library** *02/2014 - 07/2014*
- Provided consultation services to students.
- Worked with librarians on the book organization system.

**Leadership, Charitable Association to Transmit Childhood** *09/2013 - 01/2014*
- Planned and participated in public service activities for children with autism.
- Took charge of designing activities and games that benefit the mental health of autistic children.

**Member, HIT Magic Club** *09/2013 - 07/2015*
- Participated in magic show design and training.
- Given magic shows to students at HIT.

## HONORS & AWARDS

- People's Scholarship in China for **consecutive three years** *12/2013 - 12/2015*
- SMC Scholarship *09/2015*
- 2nd Prize in Nation College *Freescale Cup* Smart Car Contest *04/2015*
- Shanghai Huiyi Scholarship *09/2014*
- 2nd Prize in the annual project at HIT *09/2014*

## RELATED COURSEWORKS

- Datastructures and Algorithms for Engineers;
- Engineering Computation;
- Advanced Engineering Computation;
- Planning Techniques for Robotics;
- Java for Application Programmers;
- Pattern Recognition Theory;
- Bayesian Machine Learning for Scientists and Engineers;
- Robot Localization and Mapping;
- Engineering Optimization;

## SKILLS

- Programming Language: C/C++, Java, Python, MATLAB;
- Software: ROS, OMPL, SMPL, SBPL, AutoCAD, Solidworks, ADAMS