

# WEI DU

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## EDUCATION

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<b>Carnegie Mellon University (CMU)</b>	05/2019
<ul style="list-style-type: none"><li>- Master of Science in Mechanical Engineering</li><li>- GPA: 3.89/4.0</li></ul>	
<b>Shanghai Jiao Tong University (SJTU)</b>	06/2016
<ul style="list-style-type: none"><li>- Mechanical Engineering (Joint Program)</li><li>- GPA: 3.83/4.3</li></ul>	
<b>Harbin Institute of Technology (HIT)</b>	06/2017
<ul style="list-style-type: none"><li>- Bachelor of Engineering in Mechanical Design, Manufacturing and Automation</li><li>- GPA: 3.76/4.00</li></ul>	

## PUBLICATIONS

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**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

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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

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<b>Multi-Resolution A* algorithm – Search-based Planning Lab (CMU)</b>	06/2019 - Present
<ul style="list-style-type: none"><li>- Researched on executing multiple searches simultaneously in search-based planning to explore search spaces with different resolutions.</li><li>- Exploited different scheduling policies such as <i>DTS</i> to speed up the search.</li><li>- Conducted experiments in 2D, 3D, and 7D planning and succeeded with highly increased success rates of planners and drastically accelerated planning processes.</li><li>- Enriched the <i>SMPL</i> motion planning library with mesh loading functionality.</li></ul>	
<b>Walker Project – Search-based Planning Lab (CMU &amp; UBTech Inc.)</b>	04/2019 - Present
<ul style="list-style-type: none"><li>- Customized SLAM algorithms for the Walker robot to assist its indoor navigation.</li><li>- Mapped out the workspace of the Walker robot with respect to the conveyor.</li><li>- Implemented ARA* algorithm on Walker robot for manipulation tasks on conveyor.</li><li>- Constructed perception-planning-grasp pipeline for grasping tasks, e.g., grasp a box from the conveyor.</li></ul>	
<b>Cruzr Project – Search-based Planning Lab (CMU &amp; UBTech Inc.)</b>	10/2018 - 04/2019
<ul style="list-style-type: none"><li>- Customized SLAM algorithms for Cruzr robot to assist its indoor navigation.</li></ul>	

- 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 Trajectory 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 and used Labview software to analyze the performance 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 – Engineering Optimization** *02/2019 - 05/2019*

- Constructed a complex optimization model for NASA's 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

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**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.
- In charge of designing activities and games that benefit the mental health of autistic children.

**Member, HIT Magic Club** 09/2013 - 07/2015

- We communicate with each other in magic performance designs and skills.
- Given magic shows to students at HIT.

## HONORS & AWARDS

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- 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

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- 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

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