Zhirui Dai
Intelligent System, Robotics and Control
Electrical and Computer Engineering
University of California, San Diego

zhdai@eng.ucsd.edu
(858)-200-5325
https://daizhirui.github.io

RESEARCH INTEREST

My current research interest is quite broad, covering computer vision, artificial intelligence, robot manipulation, path planning, user interface design, physics modeling etc. All are applied to robotics.

EDUCATION

University of California, San Diego, La Jolla, CA 06/2021
M.S. Electrical and Computer Engineering (Expected)
Intelligent System, Robotics and Control
- Current GPA: 4.0/4.0

Fudan University, Shanghai, China 06/2019
B.S. Physics
- Graduated with Excellent Student Award

Humboldt Universität, Berlin, Germany 2018
Exchange, Computer Science

AWARDS AND HONORS

Scholar, Excellent Graduated Student Award 2019
Scholar, Outstanding Student Scholarship, Fudan University 2017-2018
Scholar, Honors Student Scholarship in Physics 2017
Scholar, Xu Zeng-shou Scholarship 2016
Champion, China Undergraduate Physics Tournament 2016

PUBLICATIONS

BEV-Net: Social Distancing Detection with Geometric Reasoning
Zhirui Dai, Yi Li, Bo Liu, Nuno Vasconcelos
CVPR2021, Under Review

Study of the Physical Process of the Pipette Hot Fountain
Zhirui Dai, Cuiqin Bai
College Physics, 2019, 38(4): 42-44

RESEARCH EXPERIENCE

University of California, San Diego, La Jolla, CA 09/2019 – Present

BEV-Net: Social Distancing Detection with Geometric Reasoning

This project makes real-time high-accuracy detection of high contagious risk area become possible. It provides geometry information of the crowd in public with privacy-protection for COVID-19 prediction and alert.

- Designed a multi-task privacy-protected network for detecting area where people are violating social distancing restriction with a monocular surveillance system. Implementation including
- Developed pipeline for hyperparameter searching, training and testing with different configuration
- Created an extended dataset, CityUHK-X-BEV for social distancing task
- Defined and solved the geometry problem of reasoning people's ground position
- Designed the user interface for geometry calibration using PyQt5
- Developed and verified the differentiable homography transformation module

Faster Neural Path Planner (FNPP) based on MPNet
This project proposes an improved path planner using neural network, MPNet, for path planning in environments with obstacles. FNPP reaches a real-time performance when implemented by Python.

Making UC San Diego Snowy Again
This project proposes a cycleGAN with attention mechanism to transform a picture of UCSD into another one in snow.

Autonomous Driving System for Mail Delivery in UC San Diego
Developed tools for quick deployment and maintenance of autonomous vehicle software.

R&D of Commercial Low-power SoC Software 2018-2019
Camel Microelectronics Inc. San Jose, CA

CamelStudioX: An Integrated Development Environment (IDE) For Commercial Usage
I was the leader of this project. This project aims to develop an IDE for education purpose and commercial software development using low-power SoCs. The IDE enables the users to develop SoC software on a robust and efficient platform. The work includes

- Designed the user interface and programmed all the functional modules.
- Developed a hardware abstract layer library to provide users with concise APIs to manipulate modules on SoC, including essential standard GCC library functions, such as soft-float library, standard input-output, etc.

Built the cross-compiler toolchains, including the GNU C/C++ compilers, custom make system, an ELF analyzer and converter which generates firmware for bare metal systems.

- Designed robust serial-port software for the communication between the SoC and the upper PC, e.g. uploading firmware, debugging interface etc.
- Deployed the IDE on servers for software distribution and update release

SoC Test and Hotfix

- Worked with teammates to test SoC and developed software patches for hardware hotfix.

Fudan University, Shanghai, China 2015-2019

Prototype Ultrasonic System for Measuring Blood Flow Field

- Used AutoCAD and SolidWorks to design the system and finished the system construction.
- Established the electronic system for measurement
- Designed algorithm for data collection and analyze to reconstruct the flow velocity distribution.

Robot Capable of Self-balancing on a Pivot

- Designed and built the mechanical system using SolidWorks
- Implemented the PID controller and finished the hyper-parameter tuning

TEACHING EXPERIENCE

Fudan University, Shanghai, China

Teaching Assistant of Physics Modeling 01-2019 – 07/2019
Assisted the professor with teaching, grading and logistics. For instance, held demo for lab equipment operations and led students to build experiment platforms for their projects.

Teaching Assistant of SoC Theory and Implementation 2018-2019
Held the lab sessions and office hours.

The Second Affiliated Junior School of Fudan University, Shanghai, China

Arduino Programming 01/2019 – 07/2019

- Designed the course for students aged about 12.
- Taught them basic knowledge of circuits and programming.
- Guided them to realize their ideas with Arduino.

SKILLS

PROGRAMMING	C, C++, Python, Assembly, Swift, Java, Shell Script, HTML, CSS, JavaScript
SOFTWARE DEVELOPMENT	Qt5, macOS App, iOS App, Android App
MACHINE LEARNING	PyTorch, MXNet, TensorFlow
VIRTUALIZATION	Docker, VMWare
MATH SOFTWARE	MATLAB, Mathematica
DESIGN SOFTWARE	AutoCAD, SolidWorks
CIRCUIT DESIGN	Verilog, Cadence, Quartus, Modelsim
HARDWARE	STM32, Arduino, Raspberry, FPGA
OTHER	Git, Latex

MULTI-DISCIPLINE ABILITIES

ROBOTICS	Machine Learning
	Computer Vision
	Probabilistic Robotics
	Path Planning
	Robot Manipulation
CIRCUIT AND SOFTWARE	VLSI Digital Circuit Design
	VLSI High-level Synthesis
	SoC Software Development
PHYSICS	Physics Modelling
	Classical Mechanics
	Thermal Dynamics
	Electrodynamics
	Quantum Mechanics