

# Zhiwei Zheng

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## Education

### University of California, Berkeley

08/2022-05/2023

Master of Engineering in EECS + Summer Session (06/2021-08/2021)

Cumulative GPA: 3.83/4.00; Major GPA: 3.96/4.00

### Huazhong University of Science and Technology

09/2018-06/2022

Bachelor of Engineering in Automation

GPA: 3.83/4.00. Received Graduate Recommendation.

## Research Interests

My research interests lie in the fields of **3D computer vision** and **robotics**. Specifically, I am curious about how we can develop robust algorithms and tools that enable robots to well handle **perception** and **control** problems in **unstructured and unbounded real-world scenes** and **safely interact with the environment**.

## Research Experiences

### Radio Neural Field for Robust Robot Perception

07/2023-Present

*Research Intern, University of Pennsylvania, mentored by Prof. Mingmin Zhao & Prof. Lingjie Liu*

- Built a robot with radar and designed a network to predict the dense depth information and confidence from the collected sparse radar signals.
- Adopted a neural field to represent the geometric scene while optimizing the poses with loop closure detection and the predicted depths, achieving real-time localization and mapping.
- Modeling and utilizing another neural field at a raw radar measurement level to leverage characteristics of radar, including the capability of object detection through obstructions, to achieve a better relocalization performance.

### Object Detection and Velocity Prediction with Single-frame of 4D Point Cloud

02/2022-07/2022(Full-time), 04/2023-07/2023(Part-time)

*Research Intern, Shanghai Artificial Intelligence Laboratory(Autonomous Driving Lab), mentored by Dr. Yikang Li*

- Visualized, checked and corrected the annotation, including bounding boxes and velocities, of a whole new Livox LiDAR dataset.
- Proposed a new temporal-spatial module to extract then combine the temporal and spatial information embedded in 4D(x, y, z, t) point clouds, achieving a better velocity estimation and object detection compared with other SOTA methods.
- Simulated 4D point clouds in the CARLA and evaluated our algorithm on the synthesized dataset, proving the robustness of our method.
- One paper has been submitted to the International Conference on Robotics and Automation (ICRA), which is currently under review.

### Generalizable Multi-Task Extraction of Pathology Reports

08/2022-05/2023

*Graduate Researcher, UC Berkeley & UCSF*

- Built and optimized an LSTM with Attention model using Asymmetric loss to do multi-label classification on an in-house dataset and handle the label imbalance problem, achieving the highest average macro F1 score of 0.83 compared with models based on Random Forest and BERT.
- Adopted Multi-Task Learning based on the correlations among tasks, enhancing the performance by up to 20%.
- Explored few-shot prompt-based multi-task classification using LLM and analyzed model biases.
- Will soon submit one paper to the Journal of the American Medical Informatics Association, won the [Fung Institute Mission Award](#).

### Annotating an Online Suicidal Tweets Dataset with Active Machine Learning

06/2021-12/2021

*Summer Research Intern, University of North Carolina, mentored by Prof. Yang Song*

- Normalized and applied the Down Sampling strategy to the dataset, dealing with the data unbalanced problem and built several basic Machine Learning models as a multi-model voting ensemble classifier.
- Conducted Active Machine Learning by merely presenting an oracle with voting results of low uncertainty from the classifier to reduce unnecessary labor costs and improve the annotation efficiency.
- Publication: Liu, T., Zheng, Z., Zhou, Y., Yang, Y., & Song, Y. (2022, April). [Enriching An Online Suicidal Dataset with Active Machine Learning](#). In *Proceedings of the 2022 ACM Southeast Conference* (pp. 196-200).

### Attention Guided Multi-Scale Regression for Scene Text Detection

06/2019-10/2019

*Summer Research*

- Implemented the EAST model with TensorFlow, investigated the result and found its drawback in detecting long or arbitrary-oriented texts.
- Augmented dataset and introduced Attention Module and Image Pyramid Module, ameliorating Hmean by 2-4 points on different datasets.
- Publication: Zheng, Z. (2020, November). [Attention Guided Multi-scale Regression for Scene Text Detection](#). In *Proceedings of the 2020 European Symposium on Software Engineering* (pp. 110-115).

## Selected Projects & Activities

### Exploring RL Related "Teaching Computers to Paint" and Decision Transformer

- Evaluated Decision Transformer on a near real-world benchmark, NeoRL, and compared its performance with Behavior Cloning's, proving the Decision Transformer can also generalize well in real-world applications apart from Atari and Gym tasks.
- Collected 3,000 trajectories from a trained painting agent's inference on the MNIST and CelebA datasets separately as expert offline datasets.

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- Applied the offline datasets to train Decision transformer and evaluated the results, training the Decision Transformer model to paint characters but failed to generalize very well due to the lack of enough image pre-processing and the computation limitation.

## Mesh Reconstruction from Images

- Applied Ball-Pivoting algorithm to obtain polygon mesh representation given point cloud input, achieving a great result on The Stanford Models.
- Used NeRF to represent the scene from collected images and output point clouds, voxel downsampling was then utilized to ensure a uniformly distributed point cloud so the radius in the Ball-Pivoting algorithm can be constant, finally achieving reasonable mesh reconstruction results.

## Embedded Robotics Competitions - Intelligent Robotics Team of Huazhong University of Science and Technology

### Leader of Programming Group

- **The 3<sup>rd</sup> National College Students' Intelligent Robot Innovation Competition – Vision Drone Racing Group**
  - Coded to process the images obtained from a mounted camera and proved the flight commands, realizing the real-time control of the movement of the drone and finishing the required line tracking and object detection tasks.
  - Developed an algorithm to achieve the tracking of objects or humans, and another one for gesture recognition for taking off and landing.
  - Ranked first out of all teams and won the nation-level first prize.
- **The 15<sup>th</sup> National University Students Intelligent Car Race**
  - Used ROS to collect and fuse information from a camera, a LiDAR, an IMU, and a wheel encoder, as well as employed State Compression Dynamic Algorithm and a pruning strategy for global path planning, achieving the localization, obstacle detection, and path planning.
  - Developed control and planning code in the Gazebo Simulator while the car was still under construction.
  - Assisted in designing the mechanical framework and soldering circuit boards, aiming to get a more stable car and enable motor control.
  - Won the nation-level second prize among ~80 teams from different universities.
- Tasked with instructing freshmen in programming and provided tutoring in both Introduction to Deep Learning and Introduction to ROS.

## Non-woven Fabric Defect Detection Based on Image Processing

- Implemented MFC to simulate an industrial interactive interface and optimized the image processing code to ensure a high frame rate.
- Detected foreign objects like hair and bugs, and wrinkles of non-woven fabric through image processing algorithms.

## Traffic Light Detection Competition (PaddlePaddle)

- Implemented the YOLO model and the Simulated Annealing Algorithm. Ranked at the 1st place in the competition among ~200 teams.

## Awards

- Fung Institute Mission Award (UC Berkeley)
- Outstanding Graduate Award (HUST)
- The National First Prize in the 3rd National College Students' Intelligent Robot Innovation Competition (China)
- The National Second Prize in the 15th National University Students Intelligent Car Race (China)
- Scholarship for Scientific and Technological Innovation (HUST)
- Scholarship for Extracurricular Activities (HUST)
- Scholarship for Academic Progress (HUST)

## Additional Information

- Language: English – Fluent, Chinese – Native
- Programming: C, C++, Python, MATLAB, Golang, CUDA
- Skills: PyTorch, TensorFlow, ROS, Gazebo, OpenCV, PCL, Open3D, Eigen
- Patent: A Multifunctional Life Jacket (Patent Announcement Number: CN209870697U)
- Tests: GRE: 325 + 4.0, TOEFL: 101(24)
- Misc.: A tuba player in high school and college symphony orchestras.