TINGTING YAO

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EDUCATION

Huazhong University of Science and Technology (HUST), Wuhan, China Sept. 2020 – Present

B.S. in Computer Science and Technology (CS), expected graduation June 2024

GPA: 3.71/4.00, TOEFL iBT: 92 scores

PUBLICATIONS

- Unsupervised 3D Object Detection via Vision-Language Model.

  Tingting Yao, Xin Zhou, Dingkang Liang, Jinghua Hou, Dingyuan Zhang, Zhikang Zou, Xiaoqing Ye, Bai Xiang. Single blinding, **Under Review**.
- Diffusion-based 3D Object Detection with Random Boxes.

  Xin Zhou, Jinghua Hou, **Tingting Yao**, Dingkang Liang, Zhe Liu, Zhikang Zou, Xiaoqing Ye, Jianwei Cheng, Xiang Bai. Chinese Conference on Pattern Recognition and Computer Vision (**PRCV**), 2023.

RESEARCH EXPERIENCES

Vision and Learning Representation Group, HUST, Wuhan, China
Research Intern Advisor: Xiang Bai and Dingkang Liang

Main Focus: *Computer Vision, 3D Object Detection, Point Clouds, Perception of Autonomous Driving, Unsupervised Learning, Vision-Language Model, Open-Vocabulary Object Detection*

Multi-frame Simulation for 3D Object Detection Nov. 2022 – Jan. 2023

Abstraction: In autonomous driving, sensors collect consecutive frame data and experiments have shown that the fusion of multi-frame data can effectively promote the detection and tracking performance. However, not all datasets provide multi-frame data, and in practical scenarios, sensors may suffer from frame drop, leading to irreparable tragedies when driving at high speeds. Therefore, our goal is to make single-frame data comparable to multi-frame data by multi-frame simulation using only single-frame data, expecting to break away from the dependence on multi-frame datasets in existing methods.

- Designed and implemented multi-frame simulation algorithms based on the OpenPCDet framework.
- Trained and tested the model of different multi-frame simulation configurations on KITTI dataset using PyTorch framework.
- With PV-RCNN as the baseline model, the multi-frame simulation outperformed the baseline with remarkable improvements, i.e., increasing the mAP@R11 by 0.56%, 0.39%, 1.41%, on moderate car, pedestrian and cyclist on the validation set of KITTI dataset, respectively.

Unsupervised 3D Object Detection via Vision-Language Model Mar. 2023 – Sept. 2023

Abstraction: Existing supervised 3D object detection heavily relies on fine-grained annotations, which are very laborious and expensive to obtain, leading to high costs and tricky training. While our method, by transferring vision-language knowledge, manages to get predictions without any supervision, which is more economic and totally training-free. To the best of our knowledge, we are the first to propose a pipeline for unsupervised 3D object detection from point clouds.

- Produced a paper: *Unsupervised 3D Object Detection via Vision-Language Model* (under review).
- Conducted surveys on existing methods and verified the feasibility of the idea.
- Implemented the pipeline, devised the algorithms, conducted the experiments, and realized the visualization of these experiments.
- Analyzed the results and wrote the paper.

Project Experience

SOC Summer Workshop 2023, National University of Singapore

3 weeks in July 2023

Rasberry Pi, SSH Communication, ArUco Markers Collaborated with other 3 teammates

Brief introduction: An intelligent car based on Rasberry Pi, with functions including remote control, automatic obstacle avoidance, automatic tracking, video real-time transmission, DIY controllable electromagnet, object recognition, etc. And I was responsible for the following work.

- Realized SSH communications between the Rasberry Pi and the laptop.
- Installed ultrasonic sensors and realized the automatic obstacle avoidance.
- Realized the automatic localization and tracking by utilizing the ArUco markers.
- Designed and completed the final report poster.

Realization of A SAT Problem Solver and Its Application to Sudoku

1 week in Sept. 2021

C/C++, Data Structure, Backtracking Search Algorithm Individual Project

Brief introduction: SAT is an abbreviation for SATisfiability problem. It is a classic NPC problem in CS and AI. For a Boolean variable x, x and $\neg x$ are called literals. The *and* operation of literals is called a clause. What I completed: Given a set of Boolean variables $\{x_1, ..., x_n\}$ and a corresponding set of clauses $\{c_1, ..., c_m\}$ in the conjunctive normal form (CNF): $F = c_1 \wedge ... \wedge c_m$, determine whether there is a set of truth assignments to each Boolean variable that makes F true, and when true (satisfiable), output the corresponding assignments.

- Parsed CNF files, and designed data structures to efficiently store variables, literals, clauses, etc.
- Realized an SAT solver based on DPLL algorithm.
- Detected clause conflict and optimized the branch variable selection strategy of DPLL, enabling my algorithm to solve more difficult CNF SAT problems.
- Generated complete Sudoku boards randomly under the constraints of Sudoku rules, and used the hole-digging method to generate game start of different difficulties.
- Converted Sudoku puzzles into a SAT problem and applied the realized SAT solver to handle it.
- Got an excellent remark from assistant professor Guiping Xu.

Mathematical Contest in Modeling

4 days in Feb. 2022

Python, Modeling, Paper Writing Collaborated with other 2 teammates

Brief introduction: Participants had to use the given price data of gold and bitcoin to design a trading strategy that maximizes returns, and consider factors such as commissions, volatility, and risks. The task presented challenges in data processing, modeling, and evaluating effects. And I was responsible for data processing, modeling, programming and paper writing of the prediction part as follows. Our efforts won the Honorable Mention award.

- Proposed to use the gray model for prediction, as it has proven to be successful in predicting various types of stochastic discrete sequences with significant fluctuations.
- After discovering that the plain gray model showed significant deviation over time, I proposed a better alternative - the equal dimension gray model.
- Preprocessed given data using libraries such as Numpy, Pandas, Matplotlib.
- Programmed to realize the equal dimension prediction algorithm.
- Wrote a paper: *Visible Future Benefits Based on Prediction-Decision Model*.
- Won the Honorable Mention award.

Test Paper Score Detection and Recording System

Sept. 2022 – Nov. 2022

OpenCV-Python, PyTorch, Git Collaborated with other 3 teammates

Brief introduction: A complete practical software for detecting and analyzing test paper scores, including front-end, back-end and algorithms. I was responsible for following algorithms with another teammate.

- Analyzed the demand of the school market.
- Designed key algorithm to localize and recognize scores spread across the test paper, combining traditional algorithms and deep learning.
- Participating in the China International "Internet +" College Students Innovation and Entrepreneurship Competition.

Leaderships

School of Science and Technology June 2020 – June 2021

Monitor

Led the class to be rated as a class with excellent academic style.

Research on Community Management under Covid-19 July 2021

Captain

Assembled a team, contacted the community, conducted surveys through observations, questionnaires and interviews, writed a summary and gave an oral report. Led the team to be rated as an excellent team. I myself was rated as an outstanding individual in shool level.

Volunteer Department of Student Council June 2021 – June 2022

Vice Minister

Communicated with organizations on and off campus, organized volunteer activities and got 40+ volunteer hours myself.

Student Council June 2022 – June 2023

Vice President

Represented the student body and coordinated all student council activities. Also planned and led student council meetings, assigned tasks to other officers, and met with faculty. Oversaw budget allocation, fiscal planning, and event planning.

♡ Research Interests

- Computer Vision, Machine Learning.
- Trustworthy AI.
- Large Vision-Language Model, LLM powered agent, Embodied AI.
- Brain-Computer Interface, Brain-Inspired Intelligence.

Skills

- Programming Languages: C == Python > C++
- Frameworks: PyTorch
- Platforms: Linux, Windows
- Development Tools: Conda, PyCharm, JupyterNotebook, MobaXterm, SSH, Git, etc.

Hobbies

- Cycling, Hiking
- Swimming, Kayaking
- Playing the Saxophone
- Exploring the Role-Playing and Open World Games