


# Tianyi Xia

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## EDUCATION

### Harbin Institute of Technology at Weihai

Aug 2021–June 2025

*Bachelor of Science in Information and Computing Science*

*Current GPA: 87.53/100*

**Core Modules:** Mathematical Analysis, Advanced Algebra, Space Analytic Geometry, Discrete Mathematics, Ordinary Differential Equation, Modern Algebra, Real Analysis, Complex Analysis, Preliminary Functional Analysis, Numerical Analysis, Probability and Statistics, Optimization Theory

*Bachelor of engineering in Cybersecurity*

*Current GPA: 87.48/100*

**Core Modules:** C&C++ language programming, Data Structures, Database system and application, Algorithm Design and Analysis, Linux operating system, Operating System Principles and Security, Computer Network Technology and Applications, Network and Social Analysis

**Honours:** First Class Scholarship(3%), Excellent League Member, Innovation and Entrepreneurship Pioneer

## TECHNICAL SKILLS

**Languages:** C/C++, Python, MATLAB, Mathematica, SQL, R, Julia, L<sup>A</sup>T<sub>E</sub>X

**Techniques:** ROS, OpenCV, PyTorch, Scikit-learn, Matplotlib, ODE, PDE, Gazebo, Qt, Socket, STM32, MATLAB Simulink Toolbox, Git/GitHub, Unix Shell

**Platforms:** Windows, Linux, VS Code, SPSS, Keil, Jupyter, Overleaf, Excel

## PROJECTS

### Automatic tracking and block grabbing vehicle based on STM32 | C, STM32

Oct. 2021–Dec. 2021

- Developed a smart car based on the STM32 as the **main control board, a power module, L298N electric drive module, etc.** which can automatically track and remotely retrieve blocks using a robotic arm in the specific area.
- Utilized **infrared photocell** and ADC to collect voltage signal and used serial port debugging to identify tracks.
- Developed a **tracking and maze algorithm** that can walk out of unknown maze environments while tracking.
- Used **Bluetooth module with serial port** to achieve remote control of the car and the robotic arm servo.

### The Automated Guided Vehicle Based On Jetson Nano For Delivery | C++, ROS, Qt Jan. 2022–Aug. 2022

- Developed and implemented an automated guided vehicle with the functions of **SLAM, navigation, traffic light recognition, lane detection and tracking** using OpenCV and other technologies on STM32 and Jetson Nano.
- Applied **lidar and camera** as sensors with AMCL and **path planning algorithms** such as A\*, Dijkstra and genetic algorithms, to perceive the surroundings to avoid static and dynamic obstacles automatically quickly move to the target point. Tested **ORB-SLAM series algorithms**.
- Developed of **Navigation Visualization Interface** based on ROS and Qt including functions such as target sending, terminal input, map and trajectory visualization.
- Tested well in real scenarios and showcased as **an excellent work in university innovation competitions**.

### Research on Chemical Composition Analysis and Identification of Ancient Glass | Machine Learning Sep 2022

- Used existing data, SPSS and other **data analysis** software to establish a **classification statistical model** between glass type and weathering, as well as the content of various chemical components in cultural relics.
- Utilized chi square independence test and Yates's correction for continuity to make correlation judgments and then used PEARSON correlation analysis to identify factors with high correlation.
- Established a **binary Logistic Regression Model** for different elements and weathering conditions, and tested the significance above 0.9, with a classification accuracy of over 95%.
- Used the **SVM method** to classify chemical components and glass types, then used **K-means and hierarchical classification algorithms** for subcategories and finally conducted sensitivity analysis.

## RESEARCH EXPERIENCE

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### Distributed Algorithm for Matrix-variable Optimization Problems with General Constraints | *Second Author*

Supervisor: Prof.Sitian Qin, Dean of School of Science, HIT

Sep.2022–Sep.2023

- Investigated the matrix-variable optimization problems with general constraints and a **novel distributed continuous-time algorithm** is designed based on **derivative feedback and modified Lagrange function**, rigorously **proving the global convergence** of the proposed algorithm under any initial conditions.
- Designed a provably correct **distributed event-triggered communication scheme** without Zeno behavior in order to reduce communication losses of agents and ensure stable information exchange.
- Applied the proposed algorithm to **blind image restoration problems** and compared with general vector and centralized algorithms, the experiment results show the well performance of our algorithm, which enjoys better performance in multiple indicators.
- Prepared to submit the paper to **Neural Networks**.

### Target Tracking and Aiming System in Complex Motion Environment | *Vision Engineer*

Supervisor: Assistant Professor Tong Yao, School of Information Science and Engineering, HIT

Sep.2022–Jul.2023

- Developed a recognition algorithm using **OpenCV and Object Detection Algorithms** for robust monocular and binocular camera ranging algorithm to select and track the target using corresponding coordinate conversion strategies.
- Designed an object tracking and prediction algorithm based on various **Kalman Filter schemes**, such as KF, EKF, UKF, and other algorithm fusion. And enriched the strategies to better fit for different scenes.
- Developed the functions of localization, navigation, obstacle avoidance and others for unmanned control robots based on **ROS and information fusion technology** with multi sensors to meet the functional requirements of autonomous movement and decision-making in complex environments.
- Achieved good performance in the RoboMaster University Championships Competition.

### Experiment on Generalizable Ultrasound Image Segmentation | *Main developer*

Sep.2023–Nov.2023

Supervisor: Prof.Jianrui Ding, Associate Professor, School of Computer Science and Technology, HIT

- Evaluated and validated the model in paper:**Adapting Segment Anything Model for Clinically-Friendly and Generalizable Ultrasound Image Segmentation** with the open-source datasets and our datasets on Gout ultrasound images.
- Conducted experiments on **SAM(Segment anything model)**and designed algorithm for **lesion detection in ultrasound images**.
- Designed a stronger feature feedback network based on **FPN** and performed diffusion generation on a small medical image dataset. Utilized **convolutional networks** to achieve precise localization of lesions.
- Worked with colleagues on the paper related to **Medical Image Segmentation and its applications**.

### Spatial modelling of animal movements | *Summer intern*

Aug.2024–Jul.2024

Supervisor: Tier 1 Canada Research Chair in Mathematical Biosciences, Hao Wang, University of Alberta

- I have been selected as the **2024 Mitacs Globalink Research Intern** in University of Alberta, supported by China Scholarship Council(CSC) and Mitacs.
- This research project is to study the spatial memory and cognition as well as social interactions of animals for mechanistic modeling of animal movements.
- Some mathematical tools like **ODE&PDE** will be used for modeling and numerical simulations, mathematical analysis are also needed.

## RESEARCH INTEREST

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I'm proficient in multiple programming languages, software and open-source libraries with extensive coding experience. Also I'm skilled in mathematical modeling, data analysis, machine learning. I'm Highly interested in the intersection of medical science, computer technology and mathematics and I aim to leverage interdisciplinary background to its fullest potential since I'm confident in learning new things quickly and love challenges.

## COMPETITION EXPERIENCE

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**RoboMaster University Championship** | *Algorithm developer*

National Second Prize

**National University Students Intelligent Car Race** | *Algorithm developer*

National Third Prize

**National Physics Competition for College Students** | *Participant*

Provincial First Prize

**Contemporary Undergraduate Mathematical Contest in Modeling** | *Team Captain*

Provincial Second Prize