CV for Tianyi Bi

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Academic Background

Southern University of Science and Technology (SUSTech) 09/2023-Present
Bachelor of Engineering in Robotics Expected in 06/2027

Publications

Jiaqi Yin, **Tianyi Bi**, Wenzeng Zhang*, "SPARK Hand: Scooping-Pinching Adaptive Robotic Hand with Kempe Mechanism for Vertical Passive Grasp in Environmental Constraints", *2025 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2025) [Hangzhou, China]*.

Research Experience

Artifical Intelligence and Machine Learning Summer Research **Oxford, United Kingdom**
Summer Research Camp / Advisor: Prof. Adel Bibi in University of Oxford 04/08/2025-08/15/2025

- ✓ **Purpose:** to apply fundamental machine learning mathematical formulas (linear regression, logistic regression, loss function derivation) to optimize models, and implement end-to-end code via Python (NumPy, Scikit-learn) to build core algorithm modules.
- ✓ **Workload:**
  1. Led the CV module development: designed/optimized CNN architectures (LeNet, ResNet) for image classification tasks, preprocessed datasets (augmentation, normalization), and fine-tuned parameters.
  2. Built LLM preprocessing pipelines by implementing tokenization (BPE, WordPiece) and text processing scripts.
  3. Used dataset to train the model to generate text in the style of William Shakespeare.

Inprovement of SPARK Hand with Belts **Shenzhen, China**
Summer Research Camp / Advisor: Prof. Wenzeng Zhang in X-institute, Tsinghua University 05/2025-Present

- ✓ **Innovation point:** to replace traditional rigid connecting rods with belts, utilizing the flexible characteristics of belts to achieve uniform distribution of gripping force, improving gripping stability and adaptability.
- ✓ **Ongoing Work:**
  1. Modify the structure of the original SPARK Hand.
  2. Iterate the original Kempe mechanism structure, add a slider to adjust the belt length, and actively control the switching of the grabbing mode.

SPARK Hand: Scooping-Pinching Adaptive Robotic Hand with Kempe Mechanism for Vertical Passive Grasp in Environmental Constraints **Shenzhen, China**
Winter Research Camp / Advisor: Prof. Wenzeng Zhang in X-institute, Tsinghua University 10/2024-03/2025

- ✓ **Innovation point:** to develop an innovative passive adaptive robotic finger capable of executing both parallel pinching and scooping grasps.
- ✓ **Workload:**
  1. Incorporated a multi-link mechanism with Kempe linkages to achieve a vertical linear fingertip trajectory.
  2. Used a parallelogram linkage to ensure the fingertip maintaining a fixed orientation relative to the base, facilitating effective interaction with surfaces to handle challenging objects.
  3. Employed a passive switching mechanism that facilitated seamless transitions between pinching and scooping modes, adapting automatically to various object shapes and environmental constraints without additional actuators.

- ✓ **Results:** Equipped with two fingers, this system exhibits enhanced grasping performance and stability for objects of diverse sizes and shapes, particularly thin and flat objects that are traditionally challenging for conventional grippers.

Competition Experience

2025 ABU-Robocon: Design of Robot for Basketball Match **Shenzhen, China**
Position: Group Member / Advisor: Prof. Chenglong Fu, Prof. Wende Ke, SUSTech 10/2024-Present

- ✓ **Innovation point:** to address the stability problem of shooting launch through engineering and mechanism optimization in a robotic team project.
- ✓ **Workload:**
  1. Designed two schemes, namely conveyor belt and pushing launch, for basketball throwing.
  2. Cooperated with the Embedded Systems Team to determine the placement of LiDAR sensors and batteries, as well as the wiring layout.
  3. Tested Dispersion Landing Points and Improving Shooting Hit Rate Solutions.
- ✓ **Results:**
  1. Second Prize in the National Finals of Robocon Competition.
  2. First Prize in the National Skills Challenge Competition.

CUMCU: Modeling and Analysis of the Laws of Motion of the Bench Dragon (板凳龙) Based on Physical Models **Shenzhen, China**
Position: Team Leader / Advisor: Department of Mathematics, SUSTech 05/09/2024-08/09/2024

- ✓ **Purpose:** to establish a mathematical model to analyze the movement laws of the bench dragon, so as to enhance the spectacle and safety of this traditional cultural activity.
- ✓ **Workload:**
  1. Simplified the motion of the bench dragon as a rigid body motion in a two-dimensional plane.
  2. Conducted dynamic analysis of the motion of the bench dragon, calculated the safety distance, detected the collision, optimized pitch and turnaround space, designed the shortest turnaround path, and determined the maximum safe speed of the dragon head using MATLAB.
  3. Realized the mathematical description of the complex motion through coordinate transformation and differential equation solving.
- ✓ **Results:**
  1. By reasonably adjusting the model parameters, the motion trajectory of the bench dragon can be effectively predicted and controlled, so as to improve the safety and spectacle of the performance.
  2. The Provincial **Third Prize** in China Undergraduate Mathematical Contest in Modeling (CUMCU).

Skills & Others

Programming Language: HTML, MATLAB, Python, LaTeX, 3D modeling and model simulation.
Honors: The Third Prize of the Freshmen Entrance Scholarship for the Class of 2023
Extracurricular Experience: Vice President of the Bartending Club
Hobby: Piano Grade 10