CHUNXIANG WANG

Degree: Master of Science (graduate in July, 2021)

School: Harbin Institute of Technology

Major: Control Science and Engineering

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🔍 Research interest

👁 Computer Vision, especially in image processing, object detection and tracking, real-time visual feedback for micromanipulation robots.

🔬 Control algorithms, especially in Kalman filter and its improvements, conventional PID control, Adaptive Robust control, etc.

🤖 Robotic micromanipulation with its biomedical applications.

🏛 Education

Year:	2015—2016
School:	Harbin Institute of Technology
	School of Energy Science and Engineering
Status:	Undergraduate
Major:	Advanced Power
Score:	92.1/100
Rank:	1/203

Year:	2016—2019
School:	Harbin Institute of Technology
	School of Astronautics
Status:	Undergraduate
Major:	Automation
Score:	95.8/100
Rank:	5/100
Supervisor:	Huijun Gao (HIT, Fellow of IEEE)

Year:	2019—2021
School:	Harbin Institute of Technology
	School of Astronautics
Status:	Postgraduate
Major:	Control Science and Engineering
IELTS Band:	7.0/9.0
Supervisor:	Huijun Gao (HIT, Fellow of IEEE)

🔏 Representative projects

1. Zebrafish Larva morphology and orientation tracking algorithm   Date: 2018.11– 2019.1
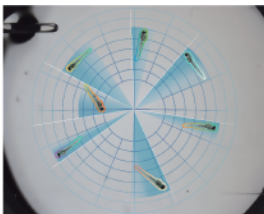
This algorithm is the **visual feedback** part of the zebrafish larva heart injection system, a fully automatic robotic micromanipulation system for zebrafish larva , which localizes multiple zebrafish larvae and extracts their morphology features for position and posture control.

A layout locus method is adopted to determine the order where the system processes this sequence of objects. An alignment control process is conducted where each blob's position and direction are tracked with Kalman Filter until they arrive at the desired position for further injection.

This algorithm has been incorporated into the micromanipulation system with C++ language, and its performance is quite satisfying, effective for larvae aged between 1 to 4 dpf with various morphological features.

Tracking accuracy: <20 µm (position)
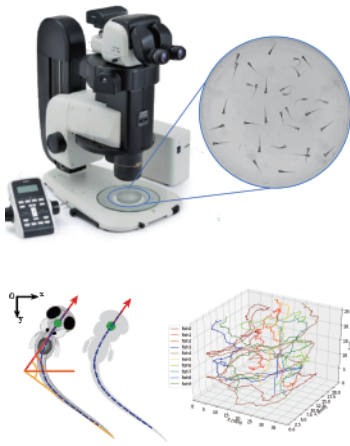
                            <5 deg. (orientation)

Tracking efficiency: >60 frames/s

This project has applied for 4 patents.
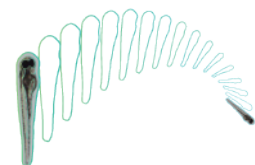
2. Multi-object Tracking Algorithm for Zebrafish Larvae Group

Date: 2018.11– 2020.7

Video tracking has become a standard procedure for studying model organisms' functional characteristics. This algorithm is to track a group of zebrafish larvae in an unconstrained environment.

It is required to locate multiple objects, maintain their identities, and yield their trajectories. Nevertheless, due to larvae's bursty locomotor activity, similar appearance, and frequent occlusions, this remains a challenge for relevant applications.

This method succeeds in overcoming these challenges by adopting the Gaussian Mixture Model, Neural network, and Adaptive Kalman filter. It **automates** group larvae behavioral observations, enabling researchers to study larvae in a reliable and consistent way and highly boosting the experimental productivity.

It is coded in Python and has been implemented in practical use.

This project won the **Best Graduation Thesis** of HIT (2%) in 2019 and was submitted to IEEE Transactions on Automation Science and Engineering.

3. Robotic Zebrafish Larva Aspiration and Positioning

Date: 2019.11–Now
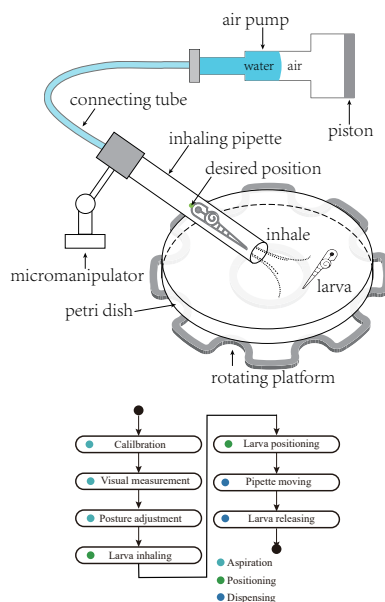
This system aims to transfer a larva from one location to another and adjust its posture **for** micromanipulation, organ imaging, drug-specific phenotypic observation, etc.

Positioning the larva inside a micropipette accurately and robustly plays a pivotal role in the transportation process.

First, operation units are calibrated. Then, the rotating plate aligns the object to the designated orientation. Afterward, the inhaling pipette approaches the target and inhale it to any pre-set position inside the tube. Finally, the pipette moves and releases the larva to the desired position.

This Visual Servo System is written in C++ language with a Graphical User Interface. All components ranging from calibration process, visual feedback method, control algorithm to application framework are completed by the author himself.

This system manages to position a larva to a desired position in the inclined micropipette for larva transfer and manipulation, which could hardly be achieved manually.

Presently, the author is writing a paper for this project and planning to submit it to IEEE Transactions on Automation Science and Engineering.

4. Other projects

Date: 2019.8—2020.1
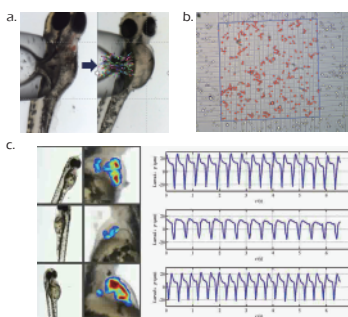
a. Larva yolk deformation tracking. This algorithm uses optical flow to track the deformation of the zebrafish larva yolk, which serves as a visual feedback module for larva yolk soft capture in the process of larva heart injection.

b. Cell counting. This algorithm automates the task of counting the number of stem cells for automatic stem cell culture apparatus. It overcomes the uneven illumination, the low intensity between objects and background, and thin lines interference.

c. Larva heart status monitoring. After heart injection, the heart rate is often measured to evaluate the toxicity of certain drugs. This algorithm automates the monitoring process.

Publications

"DanioSense: Automated High-throughput Quantification of Zebrafish Larvae Group Movement"

Skills

Computer vision:
- Adept in developing image processing algorithms, especially object detection and tracking methods with conventional CV algorithms, correlation filtering, deep learning, etc.
- A deep insight into a number of CV , Data analysis, machine learning toolkits, such as Opencv, Numpy, Pandas, etc.
- Quite familiar with Tensorflow and Keras.

Control theory:
- Capable of designing an entire Visual Servo System and putting it into practice, including visual feedback methods, control algorithms, application framework, etc.
- A good knowledge of Kalman Filter and its improvements, including Unscented Kalman Filter, Particle Filter, Adaptive Filter, etc. Also, they are all implemented in practical use .
- Skilled at Matlab/Simulink.

Coding:
- Proficient in Python coding.
- Skilled at C++ programming.
- Familiar with HTML and CSS.

Graphical design and Video editting:
- Mastery of Adobe Illustrator, Adobe Photoshop, Microsoft Powerpoint and Microsoft Word.
- Have provided media support to a multitude of big campaigns, such as graduation ceremony, celebrity lecture, national contest, etc.
- Once worked as the president of the Media Technology Department of the Student Council of HIT.
- Experienced in making videos, such as laboratory promotion video, warmup video for large campaigns, etc.
- A great grasp of Adobe After Effects and Adobe Premier Pro.

Representative awards

Time	Awards	Rate	Issued by
2016	-Best Learner Award	1%	Undergraduate School of HIT
	-First-class People Scholarship	2%	Undergraduate School of HIT
	-Second prize of Undergraduate Annual Project	10%	Undergraduate School of HIT
2017	-President of the Media Technology Department of the Student Union		Undergraduate School of HIT
	-National Special Scholarship	10%	Ministry of Education of the People's Republic of China
2018	-Honorable winner of Mathematical Contest in Modeling	30%	COMAP
	-Second prize of National University Student Social Practice and Science Contest on Energy saving and Emission Reduction	5%	Ministry of Education of the People's Republic of China
	-National Encouragement Scholarship	10%	Ministry of Education of the People's Republic of China
2019	-Best Graduation Thesis	2%	Undergraduate School of HIT
	-Outstanding Undergraduate Award	10%	Undergraduate School of HIT
	-First-class Special Scholarship	2%	Postgraduate School of HIT
	-First-class Scholarship	30%	Postgraduate School of HIT
2020	-First-class Scholarship	40%	Postgraduate School of HIT

Hobbies

Graphical design   Badminton   Kalimba

PS: For more detailed information about my publications and projects, please refer to my personal website
https://luoyeguigenno1.github.io