

# Lucas Kwok (Lujiale Guo)

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## EDUCATION

### University of Malaya (UM) (QS 60)

*M.Phil. in engineering science (By Research)*

- Advised by Prof. CHUAH JOON HUANG at the Image Processing (VIP) Lab.
- The selected courses and research progress are all A+

Sep.2022 – Feb.2025

Kuala Lumpur, Malaysia

### Shijiazhuang Tiedao University (STDU)

*B.Sc. in Mechanical Design Manufacture and Automation*

Sep. 2018 – July.2022

Shijiazhuang, China

## PUBLICATION

- L. Guo, J. H. Chuah, W. J. K. Raymond, X. Gu, J. Yao and X. Chang, "Unsupervised Feature-Preserving CycleGAN for Fault Diagnosis of Rolling Bearings Using Unbalanced Infrared Thermal Imaging Sample," in IEEE Access, vol. 12, pp. 28449-28461, 2024, doi: 10.1109/ACCESS.2024.3365551
- L. Gao, L. Zhang, J. Chen, L. Peng, L. Guo and L. Yang, "Autoencoder-CatBoost Model for Accurate Hyperspectral Quality Assessment of Yunling Snowflake Beef," in IEEE Access, vol. 12, pp. 184701-184713, 2024, doi: 10.1109/ACCESS.2024.3510035

## RESEARCH ACTIVITY

- Reviewer of IEEE ACCESS
- Reviewer of PLOS ONE
- Yangtze River Delta Single Cell Genomics Technology Application Conference
- Research assistant of ZhongShan Hospital of Fudan University (2024.1.1-present)

## RESEARCH EXPERIENCE

### Attribute Graph Clustering Driven Cell Map of Single Cell Spatial Transcriptome

Sep. 2024 – 2025

*First author, ready to submitting*

Shanghai, China

- With the development of precision and speed of spatial transcriptomics (ST) in sequencing, it is becoming more and more important to use the unique characteristics of ST data for cell analysis. Here, we introduce STAGC, which is a graph self-encoder method developed based on the clustering of ST data. In view of the problem that traditional graph clustering algorithms are task-oriented rather than clustering, STAGC monitors the clustering process of self-training graphs by introducing soft labels generated from graph embedding itself, which can iteratively refine the clustering results. In addition, unlike the existing methods that directly construct graphs by calculating Euclidean distance between cell coordinates, STAGC constructs graphs that are more conducive to clustering task objectives by finding cells with similar gene expression patterns within the threshold specified by the results of Euclidean distance.
- In addition, we try to use different methods to explore the tumor microenvironment with single cell resolution. This will be based on the transcriptome data of the surrounding cells of each cell (excluding this cell) for fusion and cluster analysis. Comparing the results with the traditional pca method or gnn method, we find that different operation methods will bring different interesting results. For example, the potential comparative experiments include: whether to carry out pca and its parameters, the way to fuse the data of surrounding cells, whether to use gnn, the number of surrounding cells selected, and is it possible to define the central cell only by the surrounding cells
- Source of dataset: Merfish.

### Generative Aging Prediction for Endometrium

Sep. 2024 – 2025

*Second author, under reviewing with nature communication*

Shanghai, China

- Aging significantly impacts the reproductive organs, particularly the endometrium, where it can lead to issues such as repeated implantation failure (RIF). However, current predictive models for endometrial aging lack specificity and accuracy. In this study, we propose a novel approach GAPE, that integrates generative adversarial networks (GAN) and attention mechanisms to predict endometrial aging and generate corresponding corrected transcriptomic data. By using over 390 pre-processed endometrial samples from patients aged 18-43, our Age Prediction Model achieved an accuracy of approximately 90%, significantly outperforming traditional models such as CNN and Lasso. We further developed an Adversarial Transcriptomic Generation Model (ATGM) to expand the data set and improve model performance, with the enhanced model demonstrating improved accuracy and predictive power. Integrated Gradient analysis revealed key transcriptomic features driving endometrial aging, highlighting the role of genes such as RBM39 and ZNF14. These findings provide a new tool for quantifying and predicting endometrial aging, offering potential clinical applications in reproductive health, particularly for aging patients facing RIF.
- Source of dataset: Fudan University Affiliated Zhongshan Hospital Reproductive Center.

### Unsupervised Feature-Preserving CycleGAN for Fault Diagnosis of Rolling Bearings using Unbalanced Infrared Thermal Imaging Sample

Sep. 2022 – 2024

*M.Phil. thesis supervised by Professor CHUAH JOON HUANG (UM)*

Kuala Lumpur, Malaysia

- To solve the problem that the data of infrared thermal image of bearing is unbalanced when using machine learning model, the

improved CycleGAN network is used to amplify the data robustly. The quality and usability of the amplified image and the final detection accuracy are better than the previous algorithms. The accuracy is improved by 10-20% compared with the previous methods.

- The paper has been accepted by the journal "IEEE Access".

### **Heterogeneous Graph Attention Neural Network for Single Cell Annotations using Multiplex Mode**

Sep. 2023 – Present  
Kuala Lumpur, Malaysia

- A heterogeneous graph attention neural network based on multimodal data for single cell annotation is proposed. This model can construct multiple heterogeneous subgraphs through the multi-omics or multimodal information about single cells, and through the attention mechanism at Node-Level and Path-Level levels.
- The model has been tested in the CODEX Multiplied Imaging B004 dataset, which contains about 248,285 cells, and each cell contains a panel of 47 oligonucleic-barcoded antibodies expression.
- The results accuracy = 0.9102 and weighted F1 score = 0.9101 is better than the best F1 score = 0.8 before. (In Manuscript)

### **BTFormer: An accurate classification technique of bacteria with deep learning**

Feb. 2023 – 2024  
Kuala Lumpur, Malaysia

- A new method of self-attention mechanism is proposed, which can significantly reduce the parameters of neural network and improve the performance of neural network.
- A new cross-connected neural network, BTFormer network, is proposed, which can make different feature maps interact with each other with the help of information interaction module to combine information about bacteria at macro and micro levels.
- A data set containing five kinds of bacteria was collected, including 3384 original images. The network can classify bacteria within a few seconds after collecting bacterial images, which has high accuracy of 98.077%.

### **ACADEMIC AWARDS AND SCHOLARSHIPS**

The third prize of "Chinese college students' engineering training ability competition--UAV"	2021-2022
The second prize of "Chinese college students' engineering training ability competition--Automatic Tracking Vehicle" (CETC)	2021-2022
The first prize of "Chinese University Student Innovation Capacity Competition"	2020-2021
Shijiazhuang Tiedao University "Most Beautiful College Students"Scholarship	2020-2021

### **LEADERSHIP EXPERIENCE**

#### **Automatic Tracking Vehicle Team of CETC**

Sep. 2020 – May. 2021  
Shijiazhuang, China

*Captain and Team Member*

- Participate in national competitions on behalf of the whole school, use MATLAB to model the data of vehicle paths, and use mechanical processing knowledge to process and manufacture vehicles.
- Set up a team as a team leader and applied for 20,000 CNY from the school to make Automatic Tracking Vehicle and communicate with other schools.

#### **Engineering Innovation Training Lesson**

Mar. 2021 – Mar. 2022  
Shijiazhuang, China

*Assistant teacher*

- In Industrial Training Center of Shijiazhuang Tiedao University from March 2021 to March 2022, The main responsibilities are assisting the teaching of mathematical modeling, the use of Matlab in the course of "Engineering Innovation Training".

#### **University Students' Science and Technology Innovation Association**

Sep. 2020 – June. 2021  
Shijiazhuang, China

*President*

- Leading more than 100 students to hold and participate in various competitions in the school, and taught mathematical modeling, machinery manufacturing, machine learning and other knowledge.

#### **Chairman of Engineering Training Center for University Students.**

Mar. 2020 – Mar. 2021  
Shijiazhuang, China

*President*

- Responsible for assisting in courses such as mathematical modeling and engineering application.

### **SKILLS**

- *Programming* Matlab, Python {Pytorch, Tensorflow, Pyg, Pandas, Numpy, sklearn}.
- *Tools* LATEX, Linux, Anaconda, Git, Docker, Adobe Illustrator.