

# Haotian Teng

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## RESEARCH EXPERIENCE

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### Ph.D. Research Project, RNA methylation basecalling using Nanopore sequencer.

2019.10 - present

- Using semi-supervised deep learning to train a m6A methylation basecaller for the ONT RNA sequencer.

### Ph.D. Research Project, combine deep learning and probabilistic graphical model to clustering the spatial transcriptomics data in single cell level.

2019.9 – 2021.2

- Developed a dimensional reduction tool for gene expression profile (Program page: <https://github.com/haotianteng/GECT>).
- Developed a probabilistic Graphical model to clustering the cell from the spatial gene expression data (Program page: <https://github.com/haotianteng/FICT>).
- Produce a simulation pipeline for validate the spatial transcriptomics clustering tools and benchmark and visualization the clustering result. (Program page: <https://github.com/haotianteng/FICT-SAMPLE>)
- Conduct differential gene expression analysis and GO term annotation.

### Masters Research Project, Using Machine learning algorithm in Nanopore Basecalling

2017.2 – 2019.1

#### Advisor: Prof. Lachlan Coin, Institute for Molecular Bioscience, University of Queensland

- Built a deep learning-based basecaller **Chiron** using Tensorflow, for Oxford Nanopore sequencer basecalling (Program page: <https://github.com/haotianteng/Chiron>)
- Developed a preprocessing tool **Nanopre** to identify the polyA region in the Nanopore RNA sequencing platform. (Program page: [https://github.com/haotianteng/Nanopre\\_Tool](https://github.com/haotianteng/Nanopre_Tool))
- Prepared training dataset of DNA and RNA Nanopore basecalling reads, using Nanoraw and graphmap to label the data.
- Implemented a pipeline in Google Cloud and Google Compute engine for end-to-end genome analysis.

### Internship and Winter Scholar, The development of spontaneous neural activity in the zebrafish

2016.3 – 2017.2

#### Advisor: Prof. Geoffrey Goodhill, Queensland Brain Institute, University of Queensland

- Built a pipeline for laboratory automation and data analysis in Zebrafish neuron experiment with Aduino, LabVIEW and MATLAB.
- Constructed PHANTOM toolbox for projecting visual stimulation with conformal transformation, used for zebrafish tectum research. Program page in Github: <https://github.com/haotianteng/PHANTOM-toolbox>
- Developed algorithms for functional connectivity reconstruction using regularization method under scale free assumption, correct the false positive correlation due to common input, transition connection and latent common input.

### Internship, Feedback in AIY neurons in Thermotaxis behavior of C.elegans

2015.7-2015.12

#### Advisor: Prof. Aravinthan D.T. Samuel, Center for Brain Science, Harvard University, Boston

- Studied thermotaxis in C.elegans with tracking and multi-neuron fluorescent marked.
- Cross & keep the worm, experiment using a spinning disk confocal microscope and the afterwards data acquisition & processing with combination of ImageJ (Miji) and Matlab
- Proved the derivation dependence between AFD neuron and temperature, designed and conducted the experiment to measure the parameters of the AFD-temperature relationship with temperature signal input under different shape.

### Research Assistant, Locomotion and PH sensing mechanism in C.elegans & fast reaction tracking System development

2012.7-2015.6

#### Advisor: Dr. Louis Tao, Center for Bioinformatics, Peking University, Beijing

- Marked GCaMP6 into the C.elegans ASH, AWC, ASE neurons to testify and determine the neuron responsible for PH sensing.
- Developed a neuro-muscle model of C.elegans motor system and proved the theoretical prediction of gait adaptation in C.elegans.
- Recorded and analyzed long-term locomotion parameter of C.elegans by using a tracking and photographing system.
- Developed a visualization tool with OpenGL to describe and simplify the neuron network in C.elegans, and enabled the tool to search the whole neural pathway through any two given neurons.
- Built a tracking system as one of the contributors, which could achieve high-precision (accuracy below 1 micron) tracking and photographing and simultaneous data collection & processing
- Modified and developed a “snake” model based algorithm for robust and precise C.elegans center line extraction.

### Internship, Micro-fluid chip preparation for C.elegans PH sensing experiment

2014.3-2014.10

#### Advisor: Prof. Huang Yanyi, Biodynamics Optical Imaging Center, Peking University

- Designed, fabricated and tested a micro-fluid chip for fast generating stable linear gradient field.
- Designed, fabricated and tested a micro-fluid chip to achieve temporal change separately in 6 rooms, realizing record the

- temporal responses of *C.elegans* 6 worms at the same time
- Developed a Computational Fluid Dynamics (CFD) module for the micro fluid chips fluid field calculation in Fluent, which could draw the flow field from the CAD design sketch.

## **PUBLICATIONS**

- Teng, H.**, Yuan, Y., & Bar-Joseph, Z. (2021). Clustering Spatial Transcriptomics Data. (in press) *Bioinformatics*.
- Pitt, M. E., Nguyen, S. H., Duarte, T. P., **Teng, H.**, Blaskovich, M. A., Cooper, M. A., & Coin, L. J. (2020). Evaluating the genome and resistome of extensively drug-resistant *Klebsiella pneumoniae* using native DNA and RNA Nanopore sequencing. *GigaScience*, 9(2), g1aa002.
- Teng, H.**, Cao, M. D., Hall, M. B., Duarte, T., Wang, S., & Coin, L. J. (2018). Chiron: translating nanopore raw signal directly into nucleotide sequence using deep learning. *GigaScience*, 7(5), giy037.
- Avitan, L., Pujic, Z., Mölter, J., Van De Poll, M., Sun, B., **Teng, H.**, Amor, R., Scott, E.K. and Goodhill, G.J., 2017. Spontaneous activity in the zebrafish tectum reorganizes over development and is influenced by visual experience. *Current Biology*, 27(16), pp.2407-2419.
- Teng, H.** "A neuron-muscle circuit model of *C.elegans*'s locomotion." *Bachelor of Science Thesis: Peking University*, 2015

## **EDUCATION**

**Carnegie Mellon University**, Pittsburgh, United States

Ph.D., Computational Biology

- Advisor: Ziv Bar-Joseph, Machine Learning Department and Computational Biology department, School of Computer Science, Carnegie Mellon University.  
2020 - present

**University of Queensland**, Queensland, Australia

M.S., Bioinformatics

2016 – 2019

- Advisor: Prof. Lichlan Coin, Institute of Molecular Bioscience, University of Queensland
- Advisor: Prof. Geoffrey Goodhill, Queensland Brain Institute, University of Queensland

**Peking University**, Beijing, China

B.S., Physics

2011 – 2015

## **HONORS AND AWARDS**

- The 1<sup>st</sup> Prize at 27<sup>th</sup> Chinese Physics Olympiad, Zhejiang Province (rank 1/1232 in theory part) 2011
- The Silver Medal at 27<sup>th</sup> Chinese Physics Olympiad, Finals 2011
- The 1<sup>st</sup> Prize at 29<sup>th</sup> Parts of the National College Students Physics Competition 2012

## **ACTIVITIES**

**Workshop in Concepts in Bioinformatics**, University of Queensland, Queensland

Feb 2016 – July 2012

- Led a team of 5 members in python programming for sequence analysis and phylogenetic analysis.
- Constructed phylogenetic tree and determined the protein family based on UPGMA, reconstructed ancestral protein sequences based on ASR methods and evolutionary models.
- Given a new protein weighting matrix constructed based on DNA codons and a modified Sankoff algorithm of ASR.

**Final project contest in Methods of Mathematical Physics**, Beijing

Oct 2012 – Jan 2013

- Led a team of 5 members to do numerical simulation and theoretical analysis of energy level in hydrogen atom.
- Calculated the asymptotic behavior of radial equation (confluent hypergeometric equation) and verified it with the numerical simulation.
- Derived the analytical solution of the confluent hypergeometric which truncated by certain quantum number
- Studied the ionization state, calculated asymptotic behavior and the phase shifting analytic expression.

## **SKILLS**

- Programming: Python, C, C++, Matlab, R, Linux, LaTeX,
- Packages&Platforms: Tensorflow, MXNet, Caffe, CUDA, cuDNN, OpenGL, BWA, SAMtools, Velvet, DIAMOND, BLAST+, Minimap2, H5py, Psychtoolbox, LabVIEW, Arduino.
- Software: PyMOL, Fluent(ANSYS), Origin, AutoCAD, Primer Premier, DNA Man, Microsoft Office,
- Wet-lab experiment skill: Molecular cloning, Microinjection
- Language: Chinese(Mother Language), English(Fluent), Spanish(basic), German (Pizza-orderable)
- TOEFL: Cumulative 103 (R 29, L 29, S 23, W 22); GRE: V 150, Q 169, AW 3.0
- Proficient in Piano playing, accomplished the Piano highest-grade (grade 10) in 2005, learned since 6 years old. Skillful in saxophone.