HAO ZHU

Master in Neuroscience, Optophysiology Lab, University of Freiburg
Georges-Köhler-Allee 201, 79110 Freiburg im Breisgau, Germany
(+49) (0) 152 57161024 hao.zhu.10015@gmail.com HaoZhu10015 haozhu10015

EDUCATION

University of Freiburg (Freiburg im Breisgau, Germany) *Oct. 2021 – expected July 2023*
Master of Science, Biology (major Neuroscience)
GPA: 1.7/1.0

Nankai University (Tianjin, China) *Sep. 2016 – July 2020*
Bachelor of Science, Chemical Biology
GPA: 89.4/100, Rank: 3/20

PUBLICATIONS

JOURNAL ARTICLE

[1] Wang, Baifan, Zhang, Zijuan, **Zhu, Hao**, Niu, Congwei, Wen, Xin, and Xi, Zhen. The hydrogen bonding network involved Arg59 in human protoporphyrinogen IX oxidase is essential for enzyme activity. *Biochemical and Biophysical Research Communications*, 557:20–25, June 2021.

TOOLBOX

[1] **Zhu, Hao**. Neugym: A python package for reinforcement learning environment of animal behavior modeling. https://github.com/HaoZhu10015/neugym, 2022.

RESEARCH EXPERIENCE

Optophysiology Lab, IMBIT//BrainLinks-BrainTools *Aug. 2022 – present*
University of Freiburg, Germany
Research Assistant ***Supervisor:*** *Prof. Dr. Ilka Diester*

- Designed the Parallel Q-Learning with Hidden Markov Model (PQL-HMM) framework for the mathematical modeling of animal evidence based decision-making behavior.
- Designed, implemented, and released a general reinforcement learning environment for rodent behavior simulation (Python module, available on GitHub).

Institute of Biology I & Bernstein Center Freiburg *July 2022 – Nov. 2022*
University of Freiburg, Germany
Research Assistant ***Supervisor:*** *Prof. Dr. Andrew D. Straw*

- Implemented a Tree of Parzen Estimators (TPE) method based parameter auto-tuning process of Kalman filter used for animal tracking.
- Designed and implemented an event-camera-based lock-on tracker prototype, which is able to steer a multiple camera system for bee tracking in the wild.

State Key Laboratory of Elemento-organic Chemistry *Aug. 2017 – Jan. 2021*
Chemistry College, Nankai University, China
Undergraduate Researcher / Research Assistant ***Supervisor:*** *Prof. Dr. Xin Wen, Prof. Dr. Zhen Xi*

- Led National Training Program of Innovation and Entrepreneurship for Undergraduates: “Computational Simulation and Biological Verification for Different Species of Protoporphyrinogen IX Oxidase Amino Acid Interactions”.
- Completed bioinformatic analysis of multiple genera protoporphyrinogen oxidase (PPO) amino acid conservative property.

- Constructed global dynamical amino acid interaction network for multiple genera PPO and mutants with data sampled from Molecular Dynamics (MD) simulation, with which further identified 67 potential key residues of *human*PPO using graph algorithms and network theory.
- Optimized our previous *human*PPO mutant enzyme activity prediction method Prenzyme, tenfold increase in efficiency.

State Key Laboratory of Elemento-organic Chemistry *Oct. 2016 – Sep. 2017*
Chemistry College, Nankai University, China
Undergraduate Researcher ***Supervisor:*** *Prof. Dr. Xuncheng Su*

- Synthesized an 1,3,4-oxadiazole-Based trifluoromethyl protein tag.
- Conducted sampling and data analysis of ^{1}H, ^{13}C-NMR spectrum.

SKILLS

PROGRAMMING

Language	Python, C++, Rust, MATLAB, R, Shell
Scientific Programming	NumPy, SciPy, scikit-learn, JAX, PyMC, NetworkX, FilterPy, Hyperopt, NEURON
Deep Learning	PyTorch, TensorFlow, Keras
Reinforcement Learning	Gym
Data Visualization	Matplotlib, Seaborn, pandas
Camera System	Kalibr, Metavision-SDK
Documentation	LaTeX, Markdown, reStructuredText, Sphinx

SOFTWARE

Chemical Software	Gaussian, GaussView, ChemDraw, Chem3D
Biological Software	Amber, AutoDock, Galaxy, PyMOL, ImageJ, WinEDR
Data Visualization	Origin, Graphpad Prism 9, Cytoscape, Gephi

COURSE WORK

"Optogenetics & Behavior" (Module SP1-05 Neurobiology, University of Freiburg, *2022*)

- Designed behavioral experiment and confirmed the feasibility of generating an innate reward in the *Drosophila melanogaster* brain through artificial activation of neurons with gustatory receptors (Gr43a) using Channelrhodopsin Chrimson, and further proved the existence of a weak activation effect of Chrimson under blue light ($\sim$450nm).

"Neural Networks and Deep Learning" (Coursera & DeepLearning.AI, *2019*)

- Implemented a deep neural network for image classification of MNIST dataset with Python and Numpy module, including the image data loading, model optimizing and predicting.

"Machine Learning" (Coursera & Stanford University, *2019*)

- Implemented basic supervised machine learning algorithms with MATLAB, including linear regression, logistic regression, shallow neural network, and support vector machine algorithm.
- Implemented basic unsupervised machine learning algorithms for clustering and dimension reduction with MATLAB, indlucing k-means clustering and principal component analysis algorithm.

AWARDS

- Kaggle research code competition "Plant Pathology 2021 – FGVC8" (Fine-Grained Visual Categorization, CVPR 2021) (**Top 35%**) (*May 2021*)
- Innovative Scientific Research Award for College Students of Nankai University (**Excellence Award**) (*June 2020*)
- Mathematical Contest In Modeling (MCM/ICM) (**Successful Participant**) (*2019*)
- Asymchem Scholarship of Chemistry College, Nankai University (*2017 – 2018*)

- Asymchem Scholarship of Chemistry College, Nankai University (*2016 – 2017*)

REFEREES

Prof. Dr. Ilka Diester
IMBIT//BrainLinks-BrainTools
University of Freiburg, Germany
+49 (0)761 203 8440
ilka.diester@biologie.uni-freiburg.de

Prof. Dr. Andrew D. Straw
Institute of Biology I & Bernstein Center Freiburg
University of Freiburg, Germany
+49 761 203 67685
straw@bio.uni-freiburg.de

Prof. Dr. Xin Wen
State Key Laboratory of Elemento-organic Chemistry
Chemistry College, Nankai University, China
+86 23498337
xinwen@nankai.edu.cn