HAO ZHU

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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

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

- Designed, implemented, and released a general reinforcement learning environment for rodent behavior simulation (Python module, available on GitHub).
- Expanded conventional Q-learning framework for the mathematical modeling of rodent learning and decision making process during a two-bandit discriminative-reversal learning task.

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

SOFTWARE

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

PROGRAMMING

Language	Python, C++, Rust, MATLAB, R, Shell
Scientific Programming	NumPy, SciPy, scikit-learn, JAX, 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

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

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