

Jian Song

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EDUCATION

The University of Edinburgh, Edinburgh, UK 2021.9 – 2022.8
M.S. in Drug Discovery and Translational Biology (MSc) with Merit(upper-second class)

Central China Normal University, Wuhan, China 2017.9 – 2021.6
B.S. in Biotechnology with 85.01/100

EXPERIENCE

Research Assistant Hangzhou, China
Donglin Wang's lab, Westlake University 2023 – 2024

- The interdisciplinary field of neuromorphic computing and machine learning
 - Event-driven representation learning for computer vision
 - Training and inference of spiking reinforcement learning
 - Employment of spiking neural networks on neuromorphic hardware
- Participate in "Brain Science and Brain-Inspired Research" Major Project: Deep Reinforcement Learning Methods for Brain-Inspired Chips, 2022.01-2027.12.

PUBLICATIONS

Adaptive Spiking TD3+BC for Offline-To-Online Spiking Reinforcement Learning

[IJCNN-2024] Xiangfei Yang, **Jian Song**, Xuetao Zhang, Donglin Wang

This study introduces an offline spiking reinforcement learning algorithm, denoted as SpikTD3+BC, aimed at alleviating power-consumption concerns through the integration of SNN. However, it encountered noticeable performance degradation. To address this challenge, adaptive weighing of behavior cloning loss and randomized ensembles of critic networks are incorporated, resulting in the proposed AdaSpikTD3+BC.

Calibrating the Converted Spiking Reinforcement Learning

[Oral, ICIC-2024] **Jian Song**, Xiangfei Yang, Donglin Wang

Weight conversion from pre-trained neural networks is an ideal method to obtain spiking networks. Although conversion may retain competitive performance, concerns regarding robustness and generalization of such SNNs persist. Motivated by recent calibration efforts in ANN-SNN conversion for image classification tasks, we propose a calibration method tailored to SNNs within the context of reinforcement learning.

PROJECTS

1. *[In Progress]* **Efficient Spike Transformer network for Point Cloud**
There are challenges of representation learning for point cloud data, including large data volumes and the dependence on carefully designed model architectures for state-of-the-art performance. Spiking Neural Networks (SNNs), known for their ability to learn from sparse data, have seen rapid advancements in traditional computer vision. Applying SNNs to 3D point cloud data is an important yet underexplored direction.
2. A Simple Approach to Obtain Spiking Large Language Models
The energy consumption and parameters of Large Language Models increase exceedingly along with performance leap. We are evaluating such performance when removing redundant computation, inspired by

recent simplified attention mechanisms. Spiking language models seem to be the one of missing pieces of the puzzle in embodied intelligence. In this study, our objective is to employ a straightforward approach, ANN-SNN conversion, to acquire SpikLLMs.

3. Trajectories modelling of fruit fly's **visual motor system** (collaborate with [Dr. Yi Sun](#)), served in
 - locomotion programming for WAVEGO quadruped robot
 - training and predicting the coordinates of male-female fruit fly interaction via supervised learning
4. Developed SpikeCEIL (spike generalized contextual imitation learning) and other spike-based imitation learning baselines, including GAIL, AIRL, SQL and IQ-Learn, using complete demonstrations or single observations.

PAST EXPERIENCE

[M.S. Thesis] Assessing machine-learning approaches to analysis of EM data

Cryo EM data offers valuable insight into the structure and conformational changes of proteins. Machine-learning approaches have been developed to determine such conformational changes from standard single-particle cryo-EM datasets. This study aims to evaluate the effectiveness of such approaches in assessing the flexibility of nucleosome, particularly in comparison to longer-established techniques based on multiple class reconstruction.

[Undergraduate Projects]

phr1 phl1 double mutant identification and phenotypic analysis

Exploration of *PHR1* gene on senescence in *Arabidopsis thaliana*

Molecular regulation of root system response to mechanical resistance in *Arabidopsis thaliana*

SKILLS

- Python Pytorch SpikingJelly
- IELTS: 7.0 (March 2021); GRE: 311 (December 2020)
- C, C++, HTML, MySQL

AWARDS

- CCNU Eighty-Two Academic Excellence Scholarship
- CCNU Mathematics Modeling Summer Camp Competition, 2nd Prize
- CCNU Undergraduate Innovation and Entrepreneurship Training Program, National Excellent Project
- Hubei Province Experimental Skills Competition, 3rd Prize