Seung Eun Rho

RESEARCH INTERESTS

Deep Reinforcement Learning, Language Guided RL, NLP, Robot Learning, Representation Learning, RL from Human Feedback

EDUCATION

Seoul National University 2015 - 2017

- M.S. in Deep Representation Learning Lab, Graduate School of Convergence Sci. and Tech.
- Thesis: A Unified Approach on Bayesian Optimization of Deep Neural Network (link)
- Teaching Assistant in the course of *Introduction to Machine Learning*

Seoul National University 2010 - 2015

- B.S. in Computer Science & Economics
- The President of the Student Council for the *College of Liberal Arts* in 2012

INDUSTRY

Kakao Brain, South Korea 2021 - Present
ML Researcher

- Kakao Brain is one of the top ML research companies in Korea
- Joined to *agent learning* team, and recently moved to *large language model* team to explore the intersection between RL and language models

UNITY Technologies, South Korea 2021
ML Engineer

NCSOFT, Game AI Lab, South Korea 2017 - 2020
RL Researcher

- NCSOFT is the top game company in Korea with a net income of $1.7B in 2021

PUBLICATIONS

[1] **LECO: Learnable Episodic Count for Task-Specific Intrinsic Reward**
Jo, D., Kim, S., Nam, D.W., Kwon. T., Rho, S., Kim, J., Lee, D. NeurIPS, 2022.

[2] **Creating Pro-level AI for a Real-Time Fighting Game Using Deep Reinforcement Learning**
Oh, I.*, Rho, S.*, Moon, S., Son, S., Lee, H., & Chung, J. IEEE Transactions on Games, 2021.
Also published in the AAAI'20 Workshop on RL in Games. *Citation Counts - 33*

[3] **Data Requirements for Applying Machine Learning to Energy Disaggregation**
Shin, C.*, Rho, S.*, Lee, H., & Rhee, W. Energies, 12(9), 1696. 2019. *Citation Counts - 40*

*: co-first author
Google Scholar

RESEARCH EXPERIENCE

Kakao Brain 2021 - Present

- Distributed RL codebase
  - Developed and released *BrainAgent*, a massive throughput scalable RL codebase
  - It can produce and train 34k frames per sec, given 16 GPUs & 384 CPU cores
  - On top of the *BrainAgent*, we implemented TrXL core, V-trace, and PopArt algorithm
  - Succeeded to **reproduce SOTA on DMLab30** multitask training environments
- Exploration
  - Introduced *LECO*: Learnable hash based Episodic Count. paper[1]
  - *LECO* uses VQ-VAE based hash code for state novelty, and the novelty is regulated by the task-specific modulator that is trained to maximize the extrinsic rewards
  - Significantly outperforms previously state-of-the-art exploration methods on the most difficult exploration tasks of MiniGrid and DMLab30
- NLP x RL
  - Ongoing research on enhancing language models using human preference through RL

NCSOFT 2017 - 2020

- Multi-agent RL
  - Our research purpose was to find practical RL approach that can scale out to train ~50 agents
  - Agents also have to play harmonious even with human players
  - Like OpenAI Five, we utilized single agent algorithm with carefully designed action space
  - Agents demo in both StarCraft2 environments and the game
- Self-play RL in simultaneous games
  - Agents need to cover the whole policy space during self-play training
  - Devised a self-play curriculum based on reward shaping to ensure agent diversity
  - Final agent trained with 3 GPUs & 600 CPU cores for two weeks, beat pro-player in 3D real-time fighting game: live match highlights, paper[2]

Seoul National University 2016

- Energy Disaggregation
  - Given aggregated energy usage signal of a household, we trained a CNN/LSTM-based classifier for predicting the on/off status of each appliance. paper[3]

HONORS & AWARDS

RL Competition Honors 2020-2022

- **NeurIPS 2022,** IGLU Challenge RL Track
  - Both 1st place winner & research prize winner
  - Hosted by Microsoft Research, Meta AI, MIPT, Amazon, etc.
  - The task is about following natural language instructions to build a target structure - link
- **Google Research & Manchester F.C**., Football AI Competition
  - 6th / 1,138 (top 0.5%). Won gold medal
  - Our approach and code
- **Kaggle**, HungryGeese RL Competition
  - 44th / 875 (top 5%). Won silver medal

Scholarship Awards

- **NeuroFusion Corporate PhD Fellowship**, for promising PhD applicant 2022-2026
- **Teaching Assistant Scholarship**, in graduate school of SNU 2017
- **National Research Foundation of Korea**, BrainKorea21 research scholarship 2015-2017
- **National Scholarship for Sci. and Eng.**, for students with academic excellence 2012-2013
- **Seoul National University**, scholarship for superior academic performance 2010-2011

Seoul National University, Honor Calculus – ~80th /3,700 (top 2.2%) 2010

- Every freshman in SNU is required to take math test, and up to 80 out of 3,700 students are privileged to take advanced math course named *honor calculus*

National Korea Physics Olympiad

- High school senior part, won silver prize 2009
- High school part, top 50 finalist 2007
- Middle school part, won gold prize 2006

PROJECTS

Book Publication 2020

- Published a book named "*Reinforcement learning from basic*, Rho, S., 2020" in Korean
- The book introduces about the basic concepts of RL and bridge between RL and deep learning
- ISBN13 : 9788931463170 / ISBN10 : 8931463170

MinimalRL 2019

- Minimal implementations of basic deep RL algorithms: github repository (★2.3K+)
- Including PPO, SAC, DQN, ACER, A2C, A3C, V-Trace, …

RELEVANT COURSEWORK

Graduate

- **A+** in Convex Optimization, Information Retrieval, Machine Learning, Introduction to Data Analysis, Neural Networks, Advanced Research Project in Data Science
- **A0** in Learning Deep Neural Networks, Neural Networks Practice

Undergraduate

- **A+** in Linear Algebra, Principles of Programming, Creative Research Seminar, Logic and Critical Thinking
- **A0** in Algorithms, Discrete Mathematics, Physics1, Physics Lab1, Mathematics for Economics, Electrical and Electronic Circuits