Soan KIM

Ph.D. Candidate in Reinforcement Learning

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AI Researcher specializing in enhancing reinforcement learning algorithms with insights from human meta-reasoning. Expertise in developing and implementing computational models (MCTS, DQN) and neurofeedback systems to solve complex problems in sparse-reward environments. Seeking to apply a deep understanding of learning and decision-making to a Machine Learning Engineer or AI Scientist role.

Technical Skills

Languages: Python (10+ years), MATLAB, R, JavaScript, Bash

AI/ML Frameworks: PyTorch, TensorFlow, Scikit-learn

Core Competencies: Reinforcement Learning (DQN, MCTS, Actor-Critic), Computational Modeling, Algorithm Development, Data Analysis, Neuroimaging (fMRI)

Professional Experience

Predoctoral Researcher in Reinforcement Learning — **Donostia, Spain**
Basque Center on Cognition, Brain, and Language — *09.2021 - 08.2025*

- Developed Monte Carlo Tree Search (MCTS) and Deep Q-Network (DQN) models in Python to simulate and quantitatively analyze human problem-solving strategies.
- Applied a real-time fMRI closed-loop system with decoded neurofeedback (MVPA) to modulate neural signals, demonstrating a causal link between prediction error and cognitive enhancement.
- Led end-to-end reinforcement learning experiments, from conceptual design and implementation to statistical analysis, to investigate decision-making under uncertainty.

Teaching Assistant, Deep Learning — **USA (Remote)**
Neuromatch Academy Inc. — *07.2024 - 07.2024*

- Supervised 26 international graduate students on 5 hands-on coding projects in deep RL and neuroscience.

Teaching Assistant, Deep Learning — **USA (Remote)**
Neuromatch Academy Inc. — *07.2023 - 07.2023*

- Supervised 23 international graduate students on 5 hands-on coding projects in deep RL and neuroscience.

Research Assistant — **Donostia, Spain**
Basque Center on Cognition, Brain, and Language — *12.2020 - 08.2021*

- Preprocessed and analyzed fMRI datasets using Python and MATLAB to identify neural correlates of cognitive function.

Projects

- **Mathematical Problem-Solving by DQN Agent** [Git]: Architected a custom OpenAI Gym-like environment and successfully trained a Deep Q-Network agent to find optimal solutions, showcasing end-to-end RL project development.
- **Human Behavior Simulation with MCTS** [Git]: Implemented a Monte-Carlo Tree Search model to simulate human decision-making in a sparse-reward task, providing a robust quantitative framework for analyzing behavioral data.
- **Real-time Neurofeedback System for Cognitive Enhancement** [Poster]: Designed and built a closed-loop system using real-time fMRI and MVPA to train participants to voluntarily modulate their own brain activity, resulting in measurable improvements in problem-solving performance.

Education

Ph.D. Candidate in Neuroscience, Reinforcement Learning — **Donostia/San Sebastián, Spain**
University of the Basque Country (UPV/EHU) — *09.2021 - Present*

- *Thesis: Metareasoning in Reinforcement Learning with Sparse Rewards (Expected Graduation: Spring 2026)*

M.S.c in Neuroscience — **Seoul, South Korea**
Korea University (Cumulative GPA: 4.15 / 4.5) — *09.2016 - 08.2019*

B.A. in English Lang. & Lit., Business Admin. — **Seoul, South Korea**
Korea University (Double Major) — *03.2013 - 08.2016*

Grants

- **Predoctoral Researcher-Plan Nacional FPI fellow 2021-2025**, Ministry of Science, Innovation and Universities, Spain
- **Travel grant**, Brain-AI Hybrid travel grant, the Japan Science and Technology Agency, Japan

Conferences

- **Confidence Prediction Error: A Metacognitive Monitoring and Teaching Signal in a Reward-Based Problem-Solving**
  ***Kim, S.**, Cortese, A., & Soto, D. (2023). Poster presentation at Winter Workshop Mechanism of Brain and Mind, Hokkaido, Japan.*
- **Confidence Prediction Error Predicts Learning and Insight during Problem-Solving**
  ***Kim, S.**, Bramlage, L., Cortese, A., & Soto, D. (2024). Poster presentation at the Association for the Scientific Study of Consciousness, Tokyo, Japan.*
- **Inducing reward prediction error with decoded neurofeedback to enhance problem-solving**
  ***Kim, S.**, Margolles, P., Cortese, A., & Soto, D. (2024). Poster presentation at Real-Time Functional Imaging and Neurofeedback meeting, Heidelberg, Germany.*

Internship/Research Stays

Research Intern — **Tübingen, Germany**
Max Planck Institute for Biological Cybernetics (Computational Neuroscience) — *08.2024 – 11.2024*

Research Intern — **Kyoto, Japan**
ATR Institute International (Decoded Neurofeedback Lab) — *11.2022 – 02.2023*

Research Intern — **Nijmegen, Netherlands**
Donders Institute (Computational Neuroscience Lab) — *06.2020 – 11.2020*

Research Intern — **Nijmegen, Netherlands**
Max Planck Institute for Psycholinguistics (Cultural Brain Lab) — *09.2019 – 03.2020*

Certificates

HarvardX Calculus Applied
edX — *05.2022 – 08.2022*

Unity Deep Reinforcement Learning Nanodegree
Udacity — *10.2021 – 12.2021*

Neuromatch Academy Deep Learning
Neuromatch Academy Inc. — *08.2021 – 08.2021*

Modeling Electrophysiological Activities
Science Beam — *05.2021 – 06.2021*

Dissemination

Reinforcement Learning: Animal, Machine, & Human
Pint of Science, Spain — *05.2025*