Dong-Kyum **Kim**

Postdoc

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Summary

I am a physicist passionate about AI and did my PhD in physics at KAIST, Korea. Under professor Hawoong Jeong's supervision, I worked on applications of ML in complex systems and statistical physics. My current research focus is understanding highly complex nonequilibrium systems, such as biological systems, active matter, and others in nature, through stochastic thermodynamics with ML-based approaches.

Education

Korea Advanced Institute of Science and Technology (KAIST) — Daejeon, Korea
DOCTOR OF PHILOSOPHY (PhD) IN PHYSICS, ADVISOR: PROF. HAWOONG JEONG — Mar. 2016 - Feb. 2022
- Dissertation: Nonequilibrium Statistical Physics Study using Deep Learning

Seoul National University (SNU) — Seoul, Korea
BACHELOR OF SCIENCE (BS) IN PHYSICS WITH A MINOR IN COMPUTER SCIENCE & ENGINEERING — 2011 - 2015

Experience

Institute for Basic Science (IBS) — Daejeon, Korea
SENIOR RESEARCHER — Mar. 2022 - present
- Hosted by prof. Meeyoung Cha (Chief Investigator).
- Data Science Group, Center for Mathematical and Computational Sciences.

Samsung Electronics — Hwaseong, Korea
MACHINE LEARNING INTERN — Sep. 2017 - Dec. 2017
- Collaborated with Daniel Kim, PhD (Senior Data Scientist).
- Improved anomaly image classification tasks via distributed multi-GPU training methods of Keras & Spark.
- Implemented a distributed image searching framework to detect similar patterns in images through Elasticsearch.

Publication

Estimating entropy production in a stochastic system with odd-parity variables
D.-K. KIM, S. LEE & H. JEONG, *arXiv Preprint arXiv:2112.04681*, 🐙 *kdkyum/odd_neep* (UNDER REVIEW) — 2021

Spontaneous emergence of music detectors in a deep neural network
G. KIM, D.-K. KIM & H. JEONG, *bioRxiv 2021.10.27.466049*, 🐙 *kgspiano/Music* (UNDER REVIEW) — 2021

Attaining entropy production and dissipation maps from Brownian movies via neural networks
Y. BAE, D.-K. KIM & H. JEONG, *arXiv preprint arXiv:2106.15108*, 🐙 *qodudrud/CNEEP* (UNDER REVIEW) — 2021

Deep reinforcement learning for feedback control in a collective flashing ratchet
D.-K. KIM & H. JEONG, *Phys. Rev. Research* **3**, L022002, 🐙 *kdkyum/RatchetDRL* — 2021

Learning Entropy Production via Neural Networks
D.-K. KIM, Y. BAE, S. LEE & H. JEONG, *Phys. Rev. Lett.* **125**, 140604, 🐙 *kdkyum/neep* — 2020

Multi-Label Classification of Historical Documents by Using Hierarchical Attention Networks
D.-K. KIM, B. LEE, D. KIM & H. JEONG, *J. Korean Phys. Soc.* **76**, 368 — 2020

Skills

Programming Languages	Python*, R, JAVA, Scheme, C, C++ (* skills daily used)
ML Frameworks	JAX*, PyTorch*, Keras, TensorFlow
Distributed Computing	Slurm*, Spark, Elasticsearch

Award

2021.8.30 Pre-doctoral Fellow of Physics at KAIST   Daejeon, Korea

Presentation

Exploring optimal mechanisms in active Brownian particles via deep reinforcement learning
APCTP Workshop for Physics and Machine Learning (Invited talk)

Jeju, Korea
Nov. 26, 2021

Methods of estimating entropy production
Seoul National University Statistical Physics Seminar (Invited talk)

(Online) Korea
Feb. 1, 2021

Deep reinforcement learning for feedback-controlled flashing ratchets
Korean Physical Society Fall Meeting (Conference)

(Online) Korea
Nov. 6, 2020

Discovering wiring patterns of neural networks via backboning
NetSci2020 (Conference)

(Online) Rome, Italy
Sep. 22, 2020

Neural estimator for entropy production
Korean Physical Society Spring Meeting (Conference)

(Online) Korea
Jul. 13, 2020

Quantifying Individual Reputation in Large-scale Historical Documents
Quantifying Success satellite at NetSci2019 (Conference)

Burlington, Vermont, USA
May. 27, 2019

Teaching Experience

General Physics II
Teaching Assistant

KAIST, Korea
2016 (Fall), 2017 (Spring)

References

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