Seungwoong Ha

STATISTICAL PHYSICIST · DATA/NETWORK/ML RESEARCHER

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"Be careful when you judge others,
since everything in this universe is merely a single realization of a stochastic process, not an ensemble average."

Summary

Postdoctoral research fellow in KIAS (from 23.03.16), studying and reasearching **statistical physics**, **network science**, **data science** and **machine learning**. Interested in applying (1) a tool of ML to physics and (2) a tool of physics to every other domain.

Currently working on & interested in -

- Automatically discovering new **scientific concepts**
- Substituting fundamental models in physics and network science by **data-driven** ones
- Formulating emergence and evolution of **social phenomena**
- Constructing **collective intelligence** with self-organization and game-theoretical approach

- via modern machine learning techniques, especially with **deep neural networks**.

Education

KAIST (Korea Advanced Institute of Science and Technology) — *Daejeon, S. Korea*

B.S. IN PHYSICS — *Mar. 2013 - Feb. 2017*

KAIST (Korea Advanced Institute of Science and Technology) — *Daejeon, S. Korea*

M.S. &PH.D. IN PHYSICS (INTEGRATED) — *Mar. 2017 - Feb. 2023*

Advisor : Hawoong Jeong

Skills

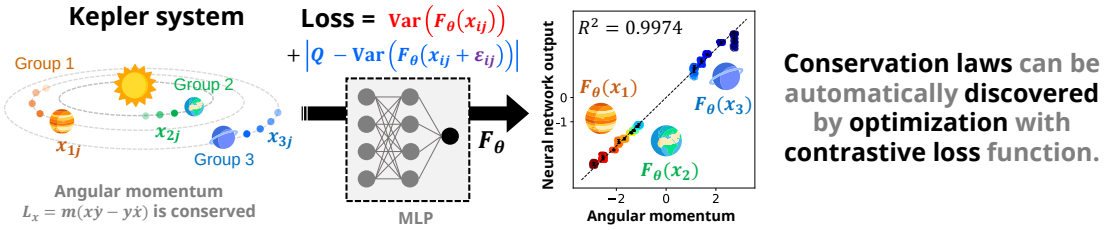
Programming Java, R, Matlab, Python(Main), Pytorch(ML Main), JAX

Languages Korean (Native), English (B2 ~ C1), Japanese (B1)

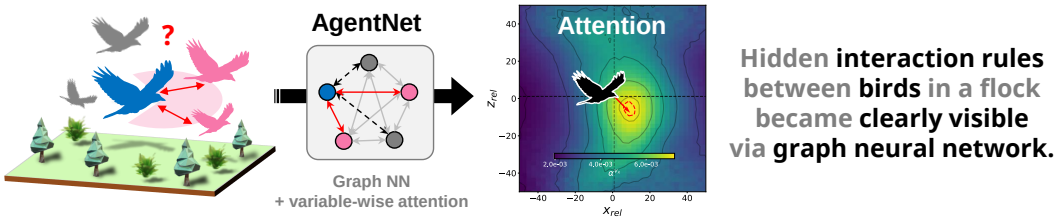
Publications

PEER-REVIEWED

2021 **Ha, S.**, & Jeong, H., Discovering invariants via machine learning. *Physical Review Research 3(4), L0402035.* (🔗)



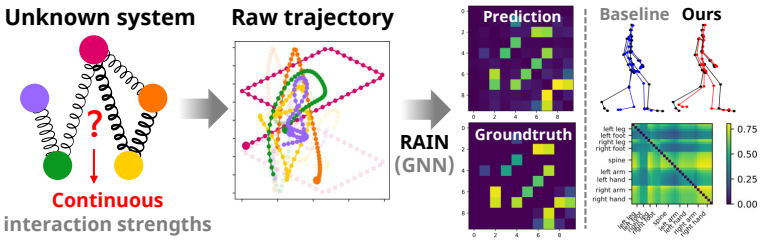
2021 **Ha, S.**, & Jeong. H., Unraveling hidden interactions in complex systems with deep learning. *Scientific reports*, **11**(1), 1-13. (🔗)



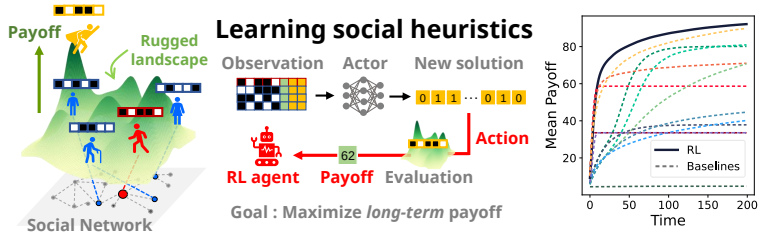
2016 Ahn. S.[†], **Ha. S.**[†], & Kim, S. Y., Optimization strategy for and structural properties of traffic efficiency under bounded information accessibility. *Physica A: Statistical Mechanics and its Applications*, **451**, 578-591. (🔗)

Submitted & In review

2022 **Ha, S.**, & Jeong, H. Learning Heterogeneous Interaction Strengths by Trajectory Prediction with Graph Neural Network, *arXiv:2208.13179* (🔗) : *NeurIPS 2022 Workshop paper (Oral),* ***Accepted in ICLR 2023*** (🔗)



2022 **Ha, S.**, & Jeong, H. Social learning spontaneously emerges by searching optimal heuristics with deep reinforcement learning, *arXiv:2204.12371* (🔗) : *Currently submitted to ICML2023*



In preparation

2022 Bae. Y[†]., **Ha. S.**[†], & Jeong, H. Langevin neural networks: learning Langevin dynamics from stochastic trajectories *(working title)*

[†] : co-first author

Presentations

Academic

2022 **Invited talk**, Northwestern Institute on Complex Systems (NICO), Evanston, IL, *Studying social phenomena via modern machine learning* (Oral)

2022 **NeurIPS 2022 Workshop**, New Orleans, LA, *Learning Heterogeneous Interaction Strengths by Trajectory Prediction with Graph Neural Network* (Oral)

2022 **Conference on Complex Systems 2022**, Palma de Mallorca, Spain, *Spontaneous emergence of Social learning by searching optimal heuristics via deep reinforcement learning* (Oral)

2022 **15th Asia Pacific Physics Conference**, Gyeongju, S. Korea (virtual), *Langevin Neural Network: Inferring Force and Diffusion Fields from Trajectories* (Oral)

2022 **2022 Physics and AI Winter school** *(Invited)*, The Korean Physical Society, S. Korea (virtual), *Discovering Invariants via Machine Learning* (Lecture)

2021 **Quantum intelligence group seminar** *(Invited)*, Perimiter institute for Theoretical Physics, Waterloo, Canada (virtual), *Complex system as a playground for deep learning* (Oral)

2021 **APCTP Workshop for Physics and Machine Learning**, Ramada Plaza Jeju, Jeju Island, S. Korea (virtual), *Connectivity inference by trajectory prediction with graph attention neural network* (Oral)

2021 **Workshop on Artificial Scientific Discovery 2021**, Max Planck Institute for the Science of Light, Erlangen, Germany (virtual), *Discovering invariants via machine learning* (Poster)

2021 **2021 The Korean Physical Society Spring Meeting**, S. Korea (virtual), *Discovering conservation laws from trajectories via machine learning* (Oral)

2021 **Online seminar** *(Invited)*, Seoul National University, Seoul, S. Korea (virtual), *Automated interaction discovery in complex systems with machine learning* (Oral)

2020 **2020 The Korean Physical Society Spring Meeting**, S. Korea (virtual), *Extracting hidden network from interacting system with graph neural network* (Oral)

2020 **NetSci 2020**, Rome, Italy (virtual), *Extracting hidden network from interacting system with graph neural network* (Poster)

2020 **Online seminar** *(Invited)*, Hongkong Baptist University, Kowloon, Canada (virtual), *Deep learning unravels hidden interactions in Complex system* (Oral)

2019 **2019 The Korean Physical Society Fall Meeting**, Kimdaejung Convention Center, Gwangju, S. Korea, *Disentangling single agent from Stochastic complex system using Neural Network* (Oral)

2019 **2019 The Korean Physical Society Spring Meeting**, Daejeon Convention Center, Daejoen, S. Korea, *Disentangling single agent from complex system using Vertex Attention Neural Network (VAIN)* (Poster)

2018 **Korea Academy of Complexity Studies Fall Conference**, Yonsei University, Seoul, S. Korea, *ConservNet : Neural network approach to search invariants from complex systems* (Oral)

2018 **The 10th BK21+ Young Physicists Workshop**, Seoul National University, Seoul, S. Korea, *Recovering rules from Simplified Neural Network* (Poster)

General

2021 **Online Seminar** *(Invited)*, Kakao Corp., S. Korea (virtual), *Unraveling hidden interactions in complex systems with deep learning* (Oral)

2020 **Online Seminar** *(Invited)*, MakinaRocks Co., Ltd, S. Korea (virtual), *Introduction to Graph Neural Network* (Oral)

2018 **Seminar** *(Invited)*, Hyoja High School, Gyeonggi-do, S. Korea, *AI: Neural network and Deep learning* (Oral)

Honors & Awards

International

2021 **Best research seller**, RHINO 2021 Research Fair

Domestic

2021 **Silver Prize**, 27th Samsung Humantech Paper Award, Basic Science division

2021 **Excellence Presentation Award**, 2021 The Korean Physical Society Spring meeting

2019 **Excellence Presentation Award**, 2019 The Korean Physical Society Fall meeting

2019 **Excellence Presentation Award**, The 20st Statistical Physics Workshop

2018 **Excellence Paper Award**, 2018 Korea Academy of Complexity Studies Fall Conference

2018 **Bronze Prize**, 2018 BK21 Young Physicists Workshop Poster session

Experience

Academic

KAIST *Daejeon, S. Korea*

Computational Physics T. A. *September. 2018 - December. 2018*

- Teaching assistant for *Computational Physics*.
- Conducted student practice class with a short lecture and (custom) jupyter notebook practice materials, every Thursday

KAIST *Daejeon, S. Korea*

General Physics T. A. *March. 2017 - December. 2017*

- Teaching assistant for *Advanced Physics 1*, March to June (1st semester).
- Teaching assistant for *General Physics 2*, September to December (2nd semester).

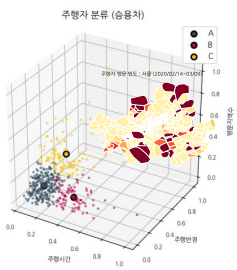
General

addd Co., Ltd. *Seoul, S. Korea*

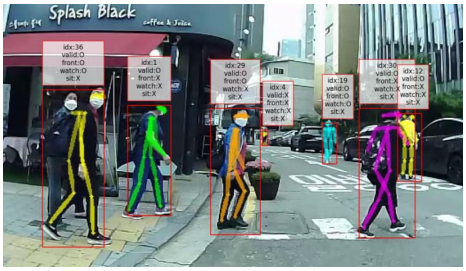
AI Team Manager *April. 2022 - March. 2023*

- Analyzing and categorizing driving patterns of app users via GPS trajectories
- Developing an expert system for advertising effectiveness measurement via GPS trajectories from a mobile advertising medium
- Developing AI vision model for pose estimation and advertising effectiveness measurement for mobile vehicles and billboards

Mobile digital **outdoor ad + effect** measurement



GPS **driving pattern** analysis



Pedestrian **pose & attention** estimation