Jinhee Paeng

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Last Updated : December 9, 2023

Education

Seoul National University (SNU), Seoul, Korea *Mar 2018 - Jun 2024 (Expected)*
Left for Mandatory Military Service May 2022 - Feb 2024 Overall GPA: 4.01/4.3
- o B.S. in Mathematics (Major) Mathematics Major GPA: 4.08/4.3
- o B.S. in Statistics (Double Major) Statistics Major GPA: 4.01/4.3

Gyeonggi Science High School for the Gifted, Suwon, Korea *Mar 2015 - Feb 2018*
- o High school for the gifted in science and mathematics

Research Interest

Neural Networks, Convex Optimization, Deep Learning, PDE, Stochastic Process, Data Analysis, Mathematical Biology

Publications

†: 1st author, *: corresponding author

[1] **J. Paeng**†, J. Park, and E. K. Ryu*, *"Coordinate-Update Algorithms can Efficiently Detect Infeasible Optimization Problems"*, Preprint, Submitted and Under Review at JMAA, arXiv:2305.12211, [Overview Video]

[2] **J. Paeng**†, K. Myoung, S. Lee, S. Ha*, and J. Yoon, *"Applications of Renormalization group method for generalized Kuramoto type models"*, Preprint, [PDF], [Poster]

Selected Awards & Honors

Scholarships/Fellowships:

The National Presidential Science Scholarship, Korea Student Aid Foundation *(8 semesters) 2018 - 2021*
- o Full tuition plus $5,000 each year for honorable undergraduates from the Korean government

Work-Study Scholarship (Type 1), Seoul National University *Mar 2020 - Aug 2020*
- o Financial support of $1,800 for the work on the student society

Honors:

Dean's List, SNU College of Natural Sciences *2018 - 2021*

SNU CNS Model Student Awards, SNU College of Natural Sciences *2021*

Selected Awards:

Undergraduate's Research Program: Participation Prize(Top 8), SNU Faculty of Liberal Education *2022*
- o "Applications of Renormalization group method for generalized Kuramoto type models" [2], with [Poster]

University Students Contest of Mathematics: Silver Medal, Korean Mathematics Society *2018*
- o Awarded in division of Mathematics major

International Mathematical Modeling Challenge (IMMC), COMAP with NeoUnion ESC Organization
- o **Meritorious Prize (2^{nd} Prize), Invited to Awards Ceremony(Top 4)** [Link] *2017*
- o **Meritorious Prize (2^{nd} Prize)** *2016*
- o Selected and participated as the Representative of South Korea in both years

QHack 2023 - Quantum computing coding challenge: Third Place, Xanadu *2023*

Education Outreach for Free Semester Classes: Top Prize, Korean Ministry of Education *2018*

Teaching Experiences

Teaching Assistant: Mathematical Foundations of Deep Neural Networks *Fall 2021*
- o Lecture(M1407.001200 001) by Professor *Ernest K. Ryu*, Opened office hours in English once a week SNU

Python basics and Mathematical modeling *Summer 2021*
- o Open a class in Major Tutor School for Undergraduate, 10 week course SNU CNS

Talks & Seminars

Academic Talks:

Peer Mathematics Seminar, Speaker of following topics: *Fall 2023*
- Convex Optimization and First Order Methods [Note]
- Personal Research: Asymptotic behavior of Inconsistent case RC-FPI [1] [Slides] [Overview Video]
- Automata Theory and Halting Problem [Slides 1, 2, 3]
- Deep Learning Theory: Approximation Guarantees of Neural Networks [Slides 1, 2]

Quantum teleportation with Quantum Information Theory
- In Professor Sunghoon Jung's group seminar [Slides] *May 2023*

Application of Renormalization Group Method on Lohe Sphere Model [2]
- Poster session on the Undergraduate's Research Program [Poster] *Dec 2021*

Maximum entropy and Spectrum estimation
- Professor Seung-Yeal Ha's HYKE group seminar *Spring 2021*

Public Lectures:

Basics of Natural Language Processing and how computers read emotion
- Natural Science Concert (GLEAP's Public Lecture for High school), about 250 audiences *Aug 2020*

Mathematical modeling and Prediction of disease infection via SIR model
- Natural Science Concert (GLEAP's Public Lecture for High school), about 250 audiences *Aug 2019*

Academic Exchanges:

Why is it hard to predict: Incompleteness theorems and Halting problem
- The Night of GLEAP (GLEAP's Alumni event) *Nov 2023*

Explanation of Hallucination patterns in vision using mathematics
- GLEAP Academic Exchange with STEM(Academic students club of Engineering) *Nov 2020*

P vs NP problem and Turing machine: How computers think
- In GLEAP's monthly academic seminar *May 2020*

Research Experiences

Ryu Optimization Group Department of Mathematics, SNU
Advisor: Ernest K. Ryu *Jan 2022 - Present*

- Topic: Asymptotic behavior of Randomized Coordinate FPI without any fixed points [1]
  - Proved L^2 and almost sure convergence of the normalized iterate x_k/k to the infimal displacement vector.
  - Discovered the tight upper bound for $\limsup_{k\to\infty} k\mathrm{Var}(x_k/k)$.
  - Developed an infeasibility detection for randomized FPI-type methods.
  - Extended the result to general M-norm, allowing applications to solvers such as the decentralized optimization method.
  - This work is currently under review of *Journal of Mathematical Analysis and Applications.*

HYKE Research Group Department of Mathematics, SNU
Advisor: Seung-Yeal Ha *Mar 2021 - Dec 2021*

- Topic: Applications of Renormalization Group Method on Lohe Sphere Model [2]
  - Proved that Complete synchronized state among particles with identical natural frequencies forms a stable manifold of the Lohe Sphere model, using the Renormalization Group method.
  - Developed lemmas on the integration of matrix exponential by using Jordan form for the calculation of RG method.
  - 2021 Undergraduate's Research Program (Research Fund of $6,000 per Team) by *SNU Faculty of Liberal Education.*
- Topic: Estimation of Spectrum Density function using Maximum Entropy Rate
  - Reviewed p-th order Markov process $AR(p)$ and its spectrum density function.
  - Using the notion of maximum entropy, Burg's theorem and its application on the method of estimation on the spectrum density function were reviewed.
  - Spring 2021 Undergraduate's Research Internship (Research Fund of $700) by *SNU CNS.*

Numerical Computing & Image Analysis Research Group Department of Mathematics, SNU
Advisor: Myungjoo Kang *Nov 2020 - Mar 2021*

- Topic: Comparison between Chan-Vase and Normalized cut for Image Segmentation
  - Reviewed methods for the image segmentation. Compared the performance of Chan-Vase model and the normalized cut method in various image settings.
  - Winter 2020 Undergraduate's Research Internship (Research Fund of $500) by *SNU CNS.*

SNU Quantum Research Team Department of Physics, SNU
Advisor: Sunghoon Jung *Sep 2022 - May 2023*
- Topic: Quantum teleportation with Quantum Information Theory
  - o Described necessary condition of generalized quantum teleportation using the language of the quantum Entropy. Prior works on Fidelity estimation and quantum teleportation with non-maximally entangled qubits were reviewed.
  - o Project of SNU Quantum Research Team, members selected by Professor S.Jung.

Software Maestro Korean Ministry of Science and ICT
- Project Topic: AI on Facial expression using web camera *Apr 2020 - Dec 2020*
  - o Developed an AI to quantify the user's concentration via recognizing the facial expression.
  - o Implemented with the WebRTC and developed an AI coach to adjust break sessions in the online study/work groups.
  - o Program for selected 150 students, among 2000 or more applicants.
  - o Financial support of $1000 per month with additional $6000 project grant.

Educational Outreaches

Talk-Talk Science Mentoring *2019 - 2021*
- o Tutored local high school students about topics in Natural Sciences, once in a two week GLEAP
- o Tutored in both theoretical and experimental topics, including laboratory experiment sessions

Natural Science Camp *Summer 2019*
- o Mentored high school students about careers in Natural Sciences GLEAP

Education Outreach for Free Semester Classes *Fall 2018*
- o Lectured in middle school about topics in mathematics, once a week for whole semester Ministry of Education
- o Topics ranging from Euclidean Construction and Quadratic Curves to Cryptography

Science Outreach Volunteers *Summer 2018*
- o Tutored students in rural area(Yeongdeok-gun, Korea) for 5 consecutive days SNU CNS

Extracurricular Activities

Student President of SNU Department of Mathematical Sciences *2019 - 2020*

Student Council of SNU Department of Mathematical Sciences *2018 - 2020*
- o Head of *Mathematical Encountering* Task Force(Department's largest event involving professors and students) *2019*

Student Council of SNU College of Natural Sciences *2018*

GLEAP (Recognized undergraduate student organization at SNU CNS) [Link] *2019 - 2021*
- o Academic activities: GLEAP Monthly Seminar, Academic Exchange with STEM, KPF, National Taiwan University
- o Educational Outreach: Talk-Talk Mentoring, Natural Science Camp
- o Public Lectures: Natural Science Concert, Monthly Science column & Science Card-news
- o Leader of Design and Publicity Task Force, Designer of current GLEAP logo *2020 - 2021*

SQRT (SNU Quantum Research Team) *2022 - 2023*
- o Students club with the interests in Quantum computing, one of the starting member

IBM Quantum Spring Challenge 2022 *2022*

IBM Qubit by Qubit *2020 - 2021*
- o Quantum Computing online course by IBM Quantum

MASTA: Math & Stats student's dance club *2018 - 2019*
- o Leader of the club *2019*

Skills

Skilled in **R, Python, C, C++, Matlab**

Languages

- o **English**: Fluent
- o **Korean**: Native