Curriculum Vitae

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1 Education

Yonsei University **Sep. 2022 – Present**
Master of Arts in Statistics and Data Science in progress Seoul, South Korea

Yonsei University **Feb. 2016 – Aug. 2022**
Bachelor of Science in Mathematics(Minor in Statistics) Seoul, South Korea

- Math and Statistics GPA of 4.03/4.30

Yonsei University **Feb. 2016 – Aug. 2022**
Bachelor of Arts in Economics Seoul, South Korea

- Economics GPA of 4.03/4.30, Total GPA of 3.97/4.30

University of California, Berkeley **Jan. 2019 – Dec. 2019**
Undergraduate Exchange Program California, USA
(*Grades are not included in the Undergraduate GPA in the transcript.)

Leave of Absence **2017**

2 Fields of Interests

Applied Math with focus on Harmonic Analysis and Geometry, Stochastic Process, Mathematical theory of Machine Learning, Graph Network, Microeconomics, Applications to neuroscience and finance.

3 Selected Honors, Awards and Fellowship

Brain Korea 24 Academic Research Fellowship **2023**

- National Research Foundation of Korea(NRF) funded by the Ministry of Education

Excellence Prize, Yonsei Big Data Contest 2023 **2023**

- Utilize Latent Dirichlet Allocation and Graph Neural Network for consumer and store classification and develop a data-driven marketing strategy for Neovalue Real Estate Company

Honorable Mention, Qiskit Hackerton Korea 2022 **2022**

- Proved and implemented the Quantum Algorithm for the Hidden Shift Problem of bent functions works with significant time speed up

Honors, Yonsei University **2016**

Deputy Prime Minister's Award **2014**

- Conducted the ODA policy, which was selected as the best proposal in the Economic Policy Proposal Contest held by the Korean Ministry of Economy and Finance

Math Award, Waterloo University **2010**

- Best Grade(1st Place) in Canada

4 Scholarships

Brain Korea 24 Scholarships, the National Research Foundation of Korea **2022 – present**

(Merit-based) Provides approximately 2,000,000 KRW every month funded by the Ministry of Education

Teaching Assistant, Yonsei University **2022 – present**

(Merit-based) Provides 1,021,000 KRW per semester

National Merit Scholarship, Republic of Korea **2016 – 2020**

(Merit-based) Full undergraduate tuition for four years, totaling 29,681,000 KRW

5 Working Paper

Electroencephalography source localization **2023**

(Advised by Kyung-Ho Yoon)

Graphical Abstraction of Time-Series Data: A Novel Approach to Data Dynamics **2024**

(Advised by HyunSoo Yoon) *Submitted to ICML (Under Review)*

Abstract Time-series data poses challenges due to its susceptibility to noise and complexity. This paper introduces an innovative non-parametric approach aimed at simplifying time series data by extracting spatial graphical dynamics from seemingly random time series. Our approach transforms time-series data into an ergodic state, allowing the principles of ergodic theory to be applied effectively. This is achieved via an innovative state space segmentation technique that unveils the ergodic graphical dynamics within bounded time-series data, providing a robust theoretical framework. The versatility of our method is demonstrated through its applications in volatility measurement, classification, anomaly detection, and data imputation, enhancing time-series analysis with the integration of topological data analysis and graph neural networks. Empirical validation of our approach is provided through simulations of sensor data from semiconductor manufacturing and stock classification across various sectors, showcasing its practical effectiveness and broad applicability.

6 Presentations

Graphical abstraction of Time-Series data: A Novel Approach to Data Dynamics

- 2023 Winter BK24 Academic Conference *Yonsei University, Seoul, Korea*
- 2023 Fall Conference, Korean Institute of Industrial Engineers *Ulsan National Institute of Science & Technology*

7 Research Experience

Quantum Algorithms for the Hidden Shift Problem **2022**

Co-worked with Boseong Kim, Sekang Kwon, Sehoon Bahng, Inhyuk Oh, Adel Sohbi, Hyukjoon Kwon

Abstract The hidden shift problem is defined over an unknown function f and a hidden element s that shifts the input of the function. Provided an oracle that can compute the function with and without the shift, the problem asks to recover s. One of the most remarkable cases is when f is highly nonlinear, whereas best known classical algorithms take exponentially many oracle queries to retrieves. In particular, the hidden shift problem over maximally nonlinear Boolean functions (bent functions) reduces to the abelian hidden subgroup problem, or equivalently, the factorization problem. In this talk, we walk through two examples of quantum algorithms on the hidden shift problem over bent functions, namely the Roetteler's and the Gavinsky's algorithms which provide an exponential speedup compared to known classical algorithms.

Best Strategy for Malaria Eradication **2021**

Co-worked with Minhyuk Seo, Sangwon Choi : Written in Korean

Abstract In this paper, we conduct both deterministic and stochastic malaria epidemiological model. The deterministic model is informed by African data, representing areas with established disease prevalence. Meanwhile, the stochastic model is based on Korean data, reflecting regions where the disease has newly emerged. We found that in the deterministic model, using both drug control and vector control with mid-intensity is economically optimal strategy to eradicate malaria infection. In stochastic model, there is no one absolute optimal strategy and therefore, additional case studies should be accompanied to find the suitable approach.

Heterogeneous Responses to Monetary Policy Shock in Industry Levels and Responses of Equity Market : Case in Korea **2020**

Abstract This paper empirically studies the dynamic amongst monetary policy, output, and equity market in Korea. More specifically, it shows the heterogeneous responses of output in industry level to monetary policy shocks using Structural Vector Autoregression model. The study further examines whether equity market responds to monetary policy shock with respect to output changes. I find that industry sectors have different responses to monetary policy shocks in Korea, to which equity market does not react with respect to expected output changes.

8 Other Academic Experience

Yonsei Statistics Basic Research Laboratory **Jan. 2022 – Present**

A lab focused on the theoretical work at the intersection of Statistics and Machine Learning

Advisor : Prof. Yongho Jeon, Prof. Jongho Im, Prof. Ilmun Kim, Prof. Kibok Lee

- Presented at the seminar on "Regularization under diffusion and anti-concentration of the information content" (Eldan & Lee, 2017)
- Presented at the seminar about the recent research on Transformer
- Presented at the seminar on "Banach Space Representer Theorems for Neural Networks and Ridge Splines" (Parhi & Nowak, 2020)

Microeconomics Reading Group **Mar. 2023 – June.2023**

An Honor society at Yonsei University for Graduate students interested in Microeconomics Yonsei University

Director : Prof. Jaypil Choi, Prof. JongHee Hahn, Prof. ChangKoo Chi, Prof. Jaeok Park, Prof. Jihwan Do, Prof. Jinyeop Kim, Prof. Semin Kim, Prof. SangHyun Kim

- Presented at the weekly seminar on "Public Information for Markov Game" (Kloosterma, 2014)

Junior Scholar Club, Economics Chapter **Sep.2018 – June.2022**
An honor society at Yonsei University for undergraduate students seeking a doctoral degree Yonsei University
Advisor : Prof. Youngse Kim, Prof. Jaeok Park, Prof. Semin Kim, Prof. Sangyup Choi, Prof. MyungKyu Shim, Prof. JinYeub Kim

- ***Leader of Microeconomics reading group*** *(Jan.2021 – Jun.2021, Jan.2022 – Jun.2022)*

- Presented at the weekly discussion on "Homotopy Methods to compute Equilibriums" (P. Jean-Jacques Herings · Ronald Peeters, 2010, Econ Theory) as a leader
- Presented at the weekly discussion on "Two-sided markets" (Rochet, Tirole, 2003, Oxford Journals) as a leader
- Presented at the weekly discussion on "Bayesian Persuasion" (Kamenica, Gentzkow, 2011, AER) and "Beeps"(Ely, 2017)

Knowledge Fusion and Artificial Intelligence Lab **Dec.2021 – Aug.2022**
A laboratory in department of industrial engineering researching in machine learning. Yonsei University
Advisor: Prof. Hyunsoo Yoon

- Presented on "Kernel and Gaussian Process" at the weekly seminar
- Presented on "Gaussian Process & Variational Inference Deep Gaussian Process & Stochastic Variational Inference" at the weekly seminar

Study and Conference for Creative research **Aug.2021–June.2022**
A Society at Yonsei University for students interested in Physics Yonsei University
Advisor: Prof. Young-Joon Kwon

- Presented at the weekly discussion on Quantum walk, Quantum Game Theory and Black-Scholes Equations.
- Participated in Quantum Mechanics study

Junior Scholar Club, Preparatory Chapter **Mar. 2016 – Dec.2016**
A Book Club at Yonsei University for freshman students with academic pursuits Yonsei University

- Participated and organized weekly reading discussions

9 Teaching Experiences

- Calculus, Linear Algebra, Discrete Math Tutoring(Undergraduate at University of Torronto) 2024
- Regression Analysis, Teaching Assistant (Undergraduate) Spring, Fall 2023
- Mathematical Statistics for Financial Engineering, Teaching Assistant (Graduate) Fall 2023
- Mathematical Statistics 1, Teaching Assistant (Undergraduate) Fall 2022
- Introduction to Statistics, Teaching Assistant (Undergraduate) Fall 2022
- Real Analysis 1 Undergraduate Tutoring Summer 2022

10 Skills and Other Info

Languages : Korean (*native*), English (*fluent*), Deutsch (*elementary*)

- IBT TOEFL(August 27, 2022) : Total 108 (Reading: 30, Listening: 30, Speaking: 22, Writing: 26)
- GRE(August 26, 2022) Verbal : 157/170 (74%), Quantitative : 170/170(96%), Analytical Writing : 4.0/6.0(54%)

Programming Skills : Python, MATLAB, R, LaTeX

11 Leadership, Community Service

Tennis Club : Found a Tennis Club for graduate students at Statistics department 2023 - present

Journal Reviewer : IEEE Transactions on Automation Science and Engineering 2022

English Tutoring for local high school students 2017