SUMIN BYUN

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EDUCATION

Swarthmore College Expected Graduation Date May 2025

B.A. Mathematics (emphasis in Statistics) and Computer Science

Awards/Scholarships: Student Korean Ambassador, World Korean Foundation (*present*) | Frances Velay Science Research Fellowship (2024) | Tarble Summer Research Fellowship (2023) | Carol Lorber Fellowship (2022) | Induction in Sigma Xi Honors Research Society (2022) | Youth Delegate, Business Ideathon by Ministry of Foreign Affairs of Korea (2022) | Excellence Award (1st Place), Data Science Competition (2021) | 2 Book Publications, one about Chinese traditional poetry and the other titled *World without Bullying*

RESEARCH & PUBLICATIONS

Ordination and visualization of ecological traits in marine phyla · Swarthmore College, PA

Research Assistant, advised by Dr. Steve C. Wang and Dr. Phil Novack-Gottshall, supported by NSF *May 2024 - Aug 2024*

- Using multidimensional scaling, produced an ordination of ecological traits of marine phyla over the last 550 million years.
- Developed interactive visualizations using R Shiny App to show changes in adaptive zones of marine phyla throughout geological time.
- Estimated each phylum's distribution using two-dimensional kernel density estimation and estimated the all-phylum distribution using multivariate mixture models.

Research in Computational Cognitive Neuroscience · Swarthmore College, PA

Coauthor and Presenter, advised by Dr. Benjamin Zinszer, CONE Lab *May 2023 – May 2024*

- Tested whether a classifier for fNIRS data could be used to predict developmental outcomes 18 months later, to achieve early identification of children at risk for developmental delays.
- Optimized image feature to maximize classification of social stimuli from infant fNIRS brain imaging data.
- Discovered that including fNIRS data from a single subject-level classification test of visual stimuli improved prediction accuracy by 12% (AUC=.83) beyond behavioral testing alone (manuscript in preparation).
- Presented at 3 Neuroscience conferences including the Organization for Human Brain Mapping 2024 (manuscript in revision).

Bayesian modeling of North Atlantic right whale population size · Swarthmore College, PA *Jan 2022 - Apr 2022,*

Coauthor and Presenter, advised by Dr. Steve C. Wang *Sep 2022 - May 2023*

- Estimated the abundance of a critically endangered whale species using a database of 70,000 sightings.
- Modeled the probability of each individual being alive and accounted for individuals that have never been sighted.
- Arrived at an estimated population size of approximately 350 individuals, information that is crucial for conservation efforts (manuscript in preparation).

Confidence Intervals for the Duration of a Mass Extinction · Swarthmore College, PA

Coauthor and Presenter, advised by Dr. Steve C. Wang *May 2022 - Aug 2022*

- Developed a new method for estimating the duration of a mass extinction event, while accounting for the incompleteness of the fossil record.
- Computed a confidence interval for the duration using a Monte Carlo (simulation-based) methodology and tested the method on synthetic datasets.
- Ran simulations with different combinations of parameters to investigate the performance of the confidence interval.
- Presented at the Geological Society of America Annual Meeting (manuscript in preparation).

Research in Neurobiology · Swarthmore College, PA

Research Assistant, advised by Dr. Jeff Gauthier *Sep 2022 - Apr 2023*

- Conducted imaging and analysis of neural spike trains data in reward cells of mice as they respond to positive stimuli, within a virtual reality simulator in which mice run on a wheel while perceiving a virtual track.
- Identified findings suggesting that CA1 activity may predict reward-related behavior.

- Derived connections between the hippocampus and nucleus accumbens, exploring the mental map within the hippocampus that becomes active as mice travel down a track to reach a reward.

Student Academic Achievement Research Program · Seoul, Korea
Coauthor *Mar 2018 - Oct 2019*
- "Using Data Mining Classifiers to Predict Academic Performance of High School Students." Scientific and Practical Cyber Security Journal, 3(2), 18-35 _Byun, S., Yao, Y., Chen, Z., & Liu, Y. (2019).
- Designed and developed a multi-layer perceptron neural network model to predict students' academic achievement.

Functional Fusion Protein-Based Biochip for Diagnosis and Monitoring of Heart Failure · Seoul, Korea
Research Assistant, Professor Sungho Ko, Cha Bio Complex Center *Feb 2018 - Jan 2019*
- Constructed a novel fusion protein of gold binding polypeptides GBP-ProG in order to develop an electrochemical biosensor for rapid and simple diagnosis and monitoring heart failure, eventually to create *U-Healthcare Service System*
- Built a sensitive and low-cost electrochemical immunosensor that can diagnose and monitor heart failure cases.
- Won Silver Medal in International Genetically Engineered Machine Competition and was nominated for three parts.

LEADERSHIP & TEACHING EXPERIENCE

Mathematics and Statistics Department · Swarthmore College, PA
Teaching Assistant in Mathematics and Statistics *Jan 2024 - Present*
- Engaged with students enrolled in courses of various levels including Statistical Methods I, Statistical Methods II, Probability, Real Analysis, Linear Algebra, Discrete Math, and Calculus.
- Coordinated with professors to develop plans to facilitate learning for students, 4.5 hours weekly.

World Korean Foundation · Seoul, Korea
Korean Student Ambassador & Next-Generation Executive *Feb 2018 - Present*
- Attended the celebration event of the establishment of Republic of Korea and received *Achievement Award* for promoting Korean traditional culture; had an opportunity to share my thoughts on Korean Reunification with Rhee In-soo, the son of the First President of South Korea Rhee Seung-man.
- Was invited to "Korean Reunification Conference" held by former US Ambassador Lee Tae Sik as a student representative and explored the past and present of division in the Korean Peninsula—advocating for collective responsibility.

Dare 2 Soar Program · Chester, PA
Math Tutor *Sep 2021 - Apr 2022*
- Dare 2 Soar is an academic support program founded by Swarthmore College students seeking to help students in the under-resourced Chester-Upland school district.
- Tutored a high school freshman in math focusing on Geometry and Calculus for 4 hours weekly (40% increase in test/assignment scores).
- Collaborated with teachers to reinforce lesson plans and help the teachers and students achieve classroom objectives.
- Administered placement exams to assess student grade level and then developed learning goals to bolster achievement.