

Education

- 2016–present **Ph.D., Mathematics**, *University of Michigan–Ann Arbor*
• Leave of Absence from June 2017 to July 2021 due to military service and pandemic.
- 2012–2016 **B.S., Mathematics**, *POSTECH, Pohang, Korea*

Research Interests

Extremal Combinatorics, Geometric Optimization, Enumerative Combinatorics, Experimental Mathematics

Publications – Mathematics

- 2019 **Johnson’s bijections and their application to counting simultaneous core partitions**, *European Journal of Combinatorics*, 75: 43-54, with H. Nam and M. Yu.
- 2018 **A bijective proof of Amdeberhan’s conjecture on the number of $(s, s+2)$ -core partitions with distinct parts**, *Discrete Mathematics*, 341(5): 1294-1300, with H. Nam and M. Yu.

Preprints

- 2023 **A new upper bound on the moving sofa problem**, *Preprint*.
- 2023 **The Erdős–Szekeres Theorem for Split Polygons**, *Preprint*, with M. Balko.
- 2023 **Formalizing Mason–Stothers Theorem and Fermat’s Last Theorem for Polynomials**, *Preprint*, with S. Lee.
- 2023 **$n^2 + 1$ unit equilateral triangles cannot cover an equilateral triangle of side $> n$ if all triangles have parallel sides**, *Under Review*, with S. Lee.
- 2022 **On the Erdős–Tuza–Valtr Conjecture**, *Under Review*.

Publications – Artificial Intelligence

Journal Papers

- 2019 **Unpaired image denoising using a GAN in X-ray CT**, *IEEE Access*, 7: 110414-110425
Hyoun Suk Park, **Jineon Baek**, Sun Kyoung You, Jae Kyu Choi, Jin Keun Seo

Conference Papers

- 2021 **Condensed Discriminative Question Set for Reliable Exam Score Prediction**, *Artificial Intelligence in Education*, 2021: 446-450
JungHoon Kim, **Jineon Baek**, Chanyou Hwang, Chan Bae, Juneyoung Park
- 2021 **Recommendation for Effective Standardized Exam Preparation**, *Learning Analytics and Knowledge*, 2021: 397-404
Hyunbin Loh, Dongmin Shin, Seewoo Lee, **Jineon Baek**, Chanyou Hwang, Youngnam Lee, Yeongmin Cha, Soonwoo Kwon, Juneyoung Park, Youngduck Choi

- 2020 **EdNet: A Large-Scale Hierarchical Dataset in Education**, *Artificial Intelligence in Education*, 2020: 69-73
 Youngduck Choi, Youngnam Lee, Dongmin Shin, Junghyun Cho, Seoyon Park, Seewoo Lee, **Jineon Baek**, Chan Bae, Byungsoo Kim, Jaewe Heo
- 2020 **Deep Attentive Study Session Dropout Prediction in Mobile Learning Environment**, *CSEDU*, 2020: 26-35
 Youngnam Lee, Dongmin Shin, Hyunbin Loh, Jaemin Lee, Piljae Chae, Junghyun Cho, Seoyon Park, Jinhwan Lee, **Jineon Baek**, Byungsoo Kim, Youngduck Choi
- 2020 **Prescribing Deep Attentive Score Prediction Attracts Improved Student Engagement**, *Educational Data Mining*
 Youngnam Lee, Byungsoo Kim, Dongmin Shin, JungHoon Kim, **Jineon Baek**, Jinhwan Lee, Youngduck Choi
- 2020 **Towards an Appropriate Query, Key, and Value Computation for Knowledge Tracing**, *Learning at Scale*, 2020: 341-344
 Youngduck Choi, Youngnam Lee, Junghyun Cho, **Jineon Baek**, Byungsoo Kim, Yeongmin Cha, Dongmin Shin, Chan Bae, Jaewe Heo

Presentations

Invited

- Feb 2024 **Algebra, Combinatorics and Geometry Seminar**, *University of Pittsburgh*
 (future) Title: On the moving sofa problem
- May 2022 **Algebra and Discrete Mathematics Seminar**, *University of California–Davis*
 Title: On the Erdős-Tuza-Valtr conjecture
- Sep 2018 **KAIST Discrete Math Seminar**, *KAIST, Daejeon, Korea*
 Title: On the off-diagonal Erdős-Szekeres convex polygon problem
- Sep 2018 **The 89th KPPY Combinatorics Seminar**, *Pusan National University, Busan, Korea*
 Title: On the off-diagonal Erdős-Szekeres convex polygon problem

Contributed

- Aug 2023 **Combinatorics Workshop**, *Yonsei University, Seoul, Korea*
 Title: $n^2 + 1$ unit equilateral triangles cannot cover an equilateral triangle of side $> n$ if all triangles have parallel sides
- Aug 2018 **Combinatorics Workshop**, *Seoul National University, Seoul, Korea*
 Title: On the off-diagonal Erdős-Szekeres convex polygon problem

Internal

- Oct 2022 **Combinatorics Seminar**, *University of Michigan–Ann Arbor*
 Title: On the Erdős-Tuza-Valtr conjecture

Honors and Awards

- 2023 **Arthur H. Copeland Memorial Award**
 Department of Mathematics, University of Michigan–Ann Arbor
- 2022 **Edward Simpson and Amanda Cowen Everett Memorial Scholarship**
 Department of Mathematics, University of Michigan–Ann Arbor
- 2016 **Overseas Ph.D. Scholarship**
 Korea Foundation for Advanced Studies

Professional Activities

Teaching Experience

- 2016–2017 **University of Michigan**, *Graduate Student Instructor, Ann Arbor, MI*
2021–present
- Math 105 (Precalculus), 2016 Fall
 - Math 115 (Calculus I), 2017 Winter, 2021 Fall
 - Math 116 (Calculus II), 2022 Fall, 2023 Fall
 - Math 216 (Differential Equations), 2022 Winter

Refereeing Services

- Computing in Geometry and Topology
- Discrete Mathematics

Public Services

- 2017–2023 **Donga Science**, *Problemsetter, Seoul, Korea*
- Posted monthly challenging math problems over six years on *Donga Science Polymath*, a website for gifted Korean students from elementary to high school.
 - Mentored gifted students in-person.

Work Experiences

Skills

- Fields Artificial Intelligence, Data Analysis, Neural Networks, Formal Proofs
Languages C++, Python, Mathematica (Working/Proficient), Lean, Haskell, JavaScript (Novice)
Tools Pandas, NumPy, PyTorch, Google OR-Tools, SAT Solvers (Kissat/CaDiCaL)

Military Service

I gained industrial experiences in artificial intelligence, data analysis and software development during my military service from June 2017 to July 2021 in Korea.

- Aug 2019 **Riiid! Inc.**, *AI Research Scientist, Seoul, Korea*
–Jul 2021
- Organized an AAAI'21 workshop on Artificial Intelligence in Education and a paired Kaggle data analysis challenge on student performance prediction.
 - Collaboratively developed and deployed a student performance prediction model serving more than 3 million users worldwide.
 - Sped up inference of a Transformer prediction model by a factor of ~ 100 by algorithmically optimizing tensor calculations.
 - Improved prediction accuracy by ensembling with a new model, and mathematically proved that the new model satisfies desirable properties for interactive education.
- Jun 2017 **National Institute for Mathematical Sciences**, *Research Scientist, Daejeon, Korea*
–Jul 2019
- Proposed a GAN framework that improves the quality of medical CT images from unpaired low-quality/high-quality image database.

Freelance

- Jul 2022 **Cryptolab Inc.**, *Research Engineer, Seoul, Korea*
–Aug 2022
- Homomorphic encryption of matrix operations and ONNX neural network models.
- Dec 2020 **Team Samoyed**, *Freelancer, Seoul, Korea*
–Feb 2021
- Developed an improved enemy AI for *Teamfight Managers*, an e-sports team simulation game, by training neural networks suited for many-to-many combat situations.
 - Users reported a steep increase in difficulty and more human-like game-play with the new AI.

Personal

2022–present **mdmath**, *Developer*

- Markdown to \LaTeX transpiler written in Haskell for personal use.

415 Felch St. – Ann Arbor, MI 48103

✉ jineon@umich.edu • 🌐 jcpaik.github.io • 🐙 [jcpaik](https://github.com/jcpaik)

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