Sunmook Choi, 최선묵

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EDUCATION

Ph.D. student in Center of Applied Mathematics (CAM), Cornell University   Aug. 2024 – May 2029

M.S. in Mathematics, Korea University   Mar. 2022 – Aug. 2024
- Advisor: Seungsang Oh
- Thesis title: Three-dimensional dicube tilings of augmented Aztec bipyramids
- GPA: 4.5 / 4.5

B.S. in Mathematics, Korea University   Mar. 2016 – Feb. 2022
- Overall GPA: 4.3 / 4.5,   Major GPA: 4.36 / 4.5
- Korean Mandatory Military Service (Auxiliary Police)   Jun. 2017 – Feb. 2019

RESEARCH INTERESTS
- **Theoretical Aspects of Data Science and Machine Learning**
- **Deep Learning, Deep Reinforcement Learning**
- **Enumerative Combinatorics**

PUBLICATIONS

Refereed Journal Publications

[1] **S. Choi**, S. Lee and S. Oh, *Augmented Aztec bipyramid and dicube tilings*, Discrete Mathematics **347 (1)** (2024) 113735, doi: 10.1016/j.disc.2023.113735.

Refereed Conference Publications

[2] **S. Choi**, S. Chung, S. Lee, S. Han, T. Kang, J. Seo, I.-Y. Kwak and S. Oh, *TB-ResNet: Bridging the gap from TDNN to ResNet in Speaker Verification with Temporal-Bottleneck Enhancement*, 2024 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Seoul (2024) 10291-10295, doi: 10.1109/ICASSP48485.2024.10448221.

[3] S. Han[*], T. Kang[*], **S. Choi**[*], J. Seo, S. Chung, S. Lee, S. Oh and I.-Y. Kwak, *CAU KU deep fake detection system for ADD 2023 challenge*, Proceedings of IJCAI 2023 Workshop on Deepfake Audio Detection and Analysis, Macao, S.A.R (2023) 23-30. [link]   ([*]: equal contribution)

[4] I.-Y. Kwak, **S. Choi**, J. Yang, Y. Lee, S. Han and S. Oh, *Low-quality Fake Audio Detection through Frequency Feature Masking*, Proceedings of the 1st International Workshop on Deepfake Detection for Audio Multimedia (DDAM '22), New York (2022) 9-17, doi: 10.1145/3552466.3556533.

[5] **S. Choi**, I.-Y. Kwak and S. Oh, *Overlapped Frequency-Distributed Network: Frequency-Aware Voice Spoofing Countermeasure*, Proceedings of Interspeech 2022, Incheon, Korea (2022) 3558-3562, doi: 10.21437/Interspeech.2022-657.

[6] **S. Choi**, S. Oh, J. Yang, Y. Lee and I.-Y. Kwak, *Light-weight Frequency Information Aware Neural Network Architecture for Voice Spoofing Detection*, Proceedings of 2022 26th International Conference on Pattern Recognition (ICPR), Montreal (2022) 477-483, doi: 10.1109/ICPR56361.2022.9956079.

Preprints

[7] T. Kang, S. Han, **S. Choi**, J. Seo, S. Chung, S. Lee, S. Oh and I.-Y. Kwak, *Experimental Study: Enhancing Voice Spoofing Detection Models with wav2vec 2.0.*, arXiv:2402.17127

[8] S. Choi, S. Lee and S. Oh, *Three-dimensional dicube tilings of an Aztec pyramid*, submitted to *Graphs and Combinatorics*

Thesis

[9] *Three-dimensional dicube tilings of augmented Aztec bipyramids*, Master's thesis, Korea University

PRESENTATION

Oral Presentations
- Aztec bipyramid and dicube tilings, *Knots and Spatial Graphs 2023*, KAIST, Daejeon Korea.

- Aztec bipyramid and dicube tilings, *2022 Global KMS International Conference*, Korean Mathematical Society (KMS), Seoul Korea.

Poster Presentations
- Overlapped Frequency-Distributed Network: Frequency-Aware Voice Spoofing Countermeasure, *Interspeech 2022*, Incheon Korea
- Light-weight Frequency Information Aware Neural Network Architecture for Voice Spoofing Detection, *ICPR 2022*, Montreal Quebec Canada

Invited Talk
- My Know-how of TF Tutorial based on Problem Solving, *Spring 2024 Tutorial TF Workshop* (online), Center for Teaching and Learning, Korea University
- My Know-how of TF Tutorial based on Problem Solving, *Autumn 2023 Tutorial TF Workshop* (online), Center for Teaching and Learning, Korea University

RESEARCH
EXPERIENCE

Joint research on drug discovery with DRL (Researcher)   Jan. 2023 – Present
- Description: Design potent and safe drug candidates through DRL algorithms
- Principal Investigator: Hyun-Kil Shin (Korea Institute of Toxicology)
- * H.-K. Shin, **S. Choi**, S. Lee and S. Oh, *Deep reinforcement learning to design drug molecules with improved efficacy and safety* (working title)

Joint research on three-dimensional tessellation (Researcher)   Feb. 2022 – Present
- Description: Construct an enumeration method of dicube tilings of three-dimensional polycubes
- Principal Investigator: Seungsang Oh (Korea University)
- * **S. Choi**, S. Lee and S. Oh, *Variants of augmented Aztec bipyramids and dicube tilings* (preprint)

Joint research on audio domains with deep learning (Researcher)   Feb. 2021 – Present
- Description: Design audio spoofing countermeasure system, automatic speaker verification system, audio data augmentation methods
- Principal Investigator: Il-Youp Kwak (Chung-Ang University), Seungsang Oh (Korea University)
- * S. Han, **S. Choi**, T. Kang, J. Yang, Y. Lee, S. Oh, I.-Y. Kwak, *Frequency Feature Masking Augmentation for Voice Spoofing Detection.* (preprint, Journal ver. of [3])

Veritas Program (REU), Korea University
- Introduction to Deep Learning, supervised by Professor Seungsang Oh   May. 2020 – Jan. 2021
- Introduction to Mathematica, supervised by Professor Seong-Deog Yang   Jan. 2017 – Feb. 2017
- Introduction to Group theory, supervised by Professor Sangjib Kim   Jul. 2016 – Aug. 2016

TEACHING
EXPERIENCE

Teaching Assistant, Dept. of Mathematics, Korea University
- Linear Algebra II With LAB (MATH 222)   Fall 2023
- Linear Algebra I With LAB (MATH 221)   Spring 2023
- Linear Algebra II With LAB (MATH 222)   Fall 2022

Research Assistant, Dept. of Mathematics, Korea University
- Linear Algebra I With LAB (MATH 221)   Spring 2022

AWARDS
& HONORS

Scholarships, Korea University
- Teaching Fellow Scholarship   Spring 2023, Fall (2022, 2023)
- Teaching Assistant Scholarship   Spring 2023, Fall 2023
- Research Scholarship   Fall 2022, Fall 2023

- Research Assistant Scholarship   Spring 2022, Fall 2022
- Special Scholarships   Spring (2019, 2020, 2021), Fall (2019, 2020, 2021)
- Special Scholarship   Spring (2020, 2021), Fall (2020, 2021)
- Veritas Program Scholarship   Spring 2016, Fall (2016, 2020)

Fund Scholarship
- Sigma (Dept. of Mathematics Alumni Association)   Fall 2021
- SAMSUNG Welfare Foundation Scholarship (Dream Class), SAMSUNG   Spring 2019

Honors, Korea University
- Dean's List, College of Science   Fall 2020
- Semester High Honors   Spring (2016, 2019, 2020, 2021), Fall (2019, 2020, 2021)

Challenge Awards
- IJCAI 2023 Competition and Challenge Award   Aug. 2023
  * Ranked in the 3rd place of Track 1.2 (Audio Fake Game - Detection, FG-D)
    from the Second Audio Deepfake Detection Challenge (ADD 2023)
- ICASSP 2022 Grand Challenge Award   Mar. 2022
  * Ranked in the 3rd place of Track 1 (Low-quality Fake Audio Detection, LF)
    from the 1st Audio Deep Synthesis Detection Challenge (ADD 2022)

Awards
- Editors' Choice Award 2024, Discrete Mathematics   11th Mar. 2024
- Poster Encouragement Award, The Korea Statistical Society   Nov. 2021
  * Poster Title: Light-weight model for voice spoofing detection using BC-ResNet

SEMINARS   **Deep Learning Seminar Season 1 & 2** (Leader)
- https://github.com/smfelixchoi/MATH-DL-study-2   Jun. 2023 – Aug. 2023
- https://github.com/smfelixchoi/MATH-DL-study   Sep. 2022 – Feb. 2023
- Theoretical Review and Python Implementation of SGD, MLP, CNN, RNN, AE, VAE, GAN.

Deep Reinforcement Learning Seminar (Leader)   Mar. 2023 – Sep. 2023
- https://github.com/smfelixchoi/MATH-DRL-study
- Theoretical Review and Python Implementation of MDP, DP, RL, DQN, PG, AC, PPO.

WRITING   **Summary Writing**
SAMPLES
- Deep Reinforcement Learning (https://github.com/smfelixchoi/All-about-DRL, in progress)
- Deep Learning (https://github.com/smfelixchoi/All-about-DL, in progress)

COMPETENCES **Languages** Korean (native), English (proficient)

Techniques LaTeX, Python, Deep Learning frameworks (TensorFlow, PyTorch), R

EXTRA-   **SAMSUNG Dream Class**   Spring 2019
CURRICULAR
- Teaching Mathematics to middle school students as an after-school program.

REFERENCES
- Dr. Seungsang Oh   seungsang@korea.ac.kr
  Professor, Department of Mathematics, Korea University
  https://sites.google.com/view/seungsangoh

- Dr. Il-Youp Kwak   ikwak2@cau.ac.kr
  Associate Professor, Department of Applied Statistics, Chung-Ang University
  https://ikwak2.github.io

- Dr. Donghun Lee   holy@korea.ac.kr
  Assistant Professor, Department of Mathematics, Korea University
  https://dhl.korea.ac.kr