

INFORMATION SYSTEMS LABORATORY (ISL)		<div>■ Contact Information</div> <div>•Prof: N1 building #912 •TEL: 042-350-7429</div> <div>•Lab: N1 building #920 •TEL: 042-350-7529</div> <div>•Website: https://csuh.kaist.ac.kr</div>
<div>■ Members • PhD students: 3 • Undergraduate students: 2</div> <div>■ Alumni • Postdoctoral Fellow: 1 (Professor at UW Madison) • PhD/Master/Undergraduate: 17 (Professor at Kwangwoon Univ, PhD students at MIT/Berkeley/UIUC, Research scientists at Samsung, Lunit and Krafton)</div>		
<div>■ Research interests</div> <div>Our research agenda aims to leverage tools from information theory, coding theory, optimization, and statistics to tackle fundamental challenges in modern AI systems. More broadly, we seek to establish a comprehensive information-theoretic foundation for a wide range of information systems—from AI-driven platforms such as responsible AI [2,3,5,7,8], search engines [13,14], recommender systems [1,11,12], and self-driving systems [6,9], to traditional systems including communication networks [10,17] (e.g., 4G-LTE and 5G) and distributed storage architectures [16] (e.g., Google's data centers and Meta's Hadoop file system). Over the years, we have made progress toward this vision through interdisciplinary work that spans information theory, communications, coding theory, optimization, machine learning, and deep learning. Below are some of our recent contributions aligned with these directions.</div>		
	Research topics	Achievements and recognitions
1	Fairness in machine learning [2,3,5,7,8]	<div>• Developed fair classifiers (e.g. fair AI judge and AI loan decision maker)</div> <div>• Won the 2022 Google Research Award (collaboration with Google) [5]</div> <div>• Won the 2021 IEEE ITSoc James Massey Award [7,8]</div> <div>• Top 10 KAIST Research Achievements of 2020</div>
2	Driving in the matrix: Self driving through video games [6,9]	<div>• Deep-learning-based collision predictor using a game simulator (GTA V)</div> <div>• A paper published in AAAI (oral presentation, rate = 6.48%) [6]</div> <div>• 2018 KAIST Technology Innovation Award & JCCI Best Paper Award</div> <div>• Received the two-year grant from the US Air Force (2019.4 ~ 2021.3)</div>
2	AI tutor: Recommender systems for education [12]	<div>• Our algorithm commercialized (product app: SANTA TOEIC)</div> <div>• Received +W50 billion investment (company: Riid)</div> <div>• 2018 IEIE/IEEE Joint Award (given to the Best Young IT Engineer)</div>
3	Recommender systems with social networks [1,11]	<div>• Improves prior algorithms by an order of magnitude</div> <div>• Implemented in Kakao's recommender systems (news feed)</div> <div>• Relevant papers accepted in NeurIPS [11]</div>
4	Real-time search engine [13,14]	<div>• Speeds up Google's search engine (PageRank) by an order of magnitude</div> <div>• Relevant papers accepted in NeurIPS/ICML [13,14]</div> <div>• 2016 IEIE Haedong Young Engineer Award, Bell Labs Prize finalist [14]</div>
<div>■ Collaborations with top researchers from leading institutions</div> <div>• MIT: Lizhong Zheng (fair machine learning) • Stanford: David Tse (network information theory)</div> <div>• UC Berkeley: Kannan Ramchandran (general purpose AI) • UW Madison: Kangwook Lee (self driving)</div> <div>• Univ of Minnesota: Soheil Mohajer (recommender systems) • National Univ of Singapore: Vincent Tan (recommender systems)</div>		
<div>■ Recommended courses</div> <div>• EE202: Signals and systems • EE210: Probability and introductory random processes • MAS212: Linear algebra</div> <div>• EE326: Introduction to information theory and coding • EE424: Introduction to optimization techniques</div>		
<div>■ Recommended books</div> <div>• C. Suh, "Convex optimization for machine learning" <i>Now Publishers</i>, 2022 • C. Suh, "Communication principles for data science" <i>Springer</i>, 2023</div> <div>• C. Suh, "Information theory for data science" <i>Now Publishers</i>, 2023 • C. Suh, "Probability for information technology" <i>Springer</i>, 2024</div>		
<div>■ Our vision</div> <div>We are looking for highly motivated students with strong fundamentals and practical skills. If you aspire to become an independent researcher capable of critical thinking, solid theoretical understanding, and proficient programming, the ISL is the right place. Professor Suh provides individualized mentorship through weekly one-on-one meetings with each student. These sessions focus on: (i) formulating impactful research problems; (ii) developing effective approaches to solve them; (iii) writing papers with rigor and clarity; and (iv) delivering well-structured, accessible presentations to a broad audience.</div>		
<div>■ Selected publications (Google Scholar Citations: 7,374 as of June 12 2025)</div> <div>[1] J. Ahn, A. Elmahdy, S. Mohajer and C. Suh, "On the fundamental limits of matrix completion: Leveraging hierarchical similarity graphs," <i>IEEE Transactions on Information Theory</i>, Mar. 2024.</div> <div>[2] Y. Roh, K. Lee, S. E. Whang and C. Suh, "Improving fair training under correlation shifts," <i>ICML</i> 2023.</div> <div>[3] S. Um and C. Suh, "A fair generative model using LeCam divergence," <i>AAAI</i> 2023.</div> <div>[4] Q. Zhang, G. Suh, C. Suh and V. Y. F. Tan "MC2G: An efficient algorithm for matrix completion with social and item similarity graphs," <i>IEEE Transactions on Signal Processing</i>, 2022.</div> <div>[5] Y. Roh, K. Lee, S. Whang and C. Suh, "Sample selection for fair and robust training," <i>NeurIPS</i>, Dec. 2021 (2022 Google Research Award).</div> <div>[6] H. Kim, K. Lee, G. Hwang and C. Suh, "Predicting vehicle collisions using data collected from video games," <i>Journal of Machine Vision and Applications</i>, vol. 32, no. 93, June 2021.</div> <div>[7] J. Cho, G. Hwang and C. Suh, "A fair classifier using kernel density estimation," <i>NeurIPS</i>, Dec. 2020 (2021 IEEE ITSoc James Massey Research & Teaching Award for Young Scholars).</div> <div>[8] Y. Roh, K. Lee, S. Whang and C. Suh, "FR-Train: A mutual information-based approach to fair and robust training," <i>ICML</i>, July 2020.</div> <div>[9] H. Kim, K. Lee, G. Hwang and C. Suh, "Crash to not crash: Learn to identify dangerous vehicles using a simulator," <i>AAAI</i>, 2019 (oral presentation, US AF Grant)</div> <div>[10] C. Suh, J. Cho and D. Tse, "Two-way interference channel capacity: How to have the cake and eat it too," <i>IEEE Transactions on Information Theory</i>, June 2018 (cracked a 40+ year-old open problem in information theory).</div> <div>[11] K. Ahn, K. Lee, H. Cha and C. Suh, "Binary rating estimation with graph side information," <i>NeurIPS</i>, 2018 (collaboration with Kakao).</div> <div>[12] K. Lee, J. Chung and C. Suh, "Large-scale and interpretable collaborative filtering for educational data," <i>KDD Workshop</i>, 2017 (Our algorithm has been implemented in an online education platform, Santa TOEIC of Riid).</div> <div>[13] M. Jang, S. Kim, C. Suh and S. Oh, "Optimal sample complexity of M-wise data for top-K ranking," <i>NeurIPS</i>, 2017.</div> <div>[14] Y. Chen and C. Suh, "Spectral MLE: Top-K rank aggregation from pairwise comparisons," <i>ICML</i>, July 2015 (IEIE Haedong Young Engineer, Bell Labs Prize finalist).</div> <div>[15] C. Suh and D. Tse, "Feedback capacity of the Gaussian interference channel to within 2 bits," <i>IEEE Transactions on Information Theory</i>, 2011(2009 ISIT Best Student Paper Award; David Sakrison Memorial Prize from UC Berkeley EECS; 221 citations).</div> <div>[16] C. Suh and K. Ramchandran, "Exact-repair MDS code construction using interference alignment," <i>IEEE Transactions on Information Theory</i>, Mar. 2011 (2010 ISIT Best Student Paper Award finalist; A customized version of our codes implemented in Meta's file system; 372 citations)</div> <div>[17] C. Suh, M. Ho and D. Tse, "Downlink interference alignment," <i>IEEE Transactions on Communications</i>, Sep. 2011 (2013 IEEE Communications Society Stephen O. Rice Prize; 974 citations).</div>		