

Sanghyuk Chun

Lead Research Scientist at NAVER AI Lab

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(Last update: December 5, 2023)

Research Interests

Scalable and Reliable Machine Learning with Language-guided Representation Learning. Ensuring the real-world applicability of machine learning (ML) models poses a primary challenge, namely, the ability to generalize effectively to unseen scenarios encountered beyond the training phase. There are three prominent scenarios frequently encountered in practical applications: (1) when input data significantly differs from the training data; (2) when the model faces the target behavior beyond the scope of training targets, such as unexplored labels; and (3) when the application needs human opinions or subjective value judgments. Addressing all three scenarios relies on more than just massive large-scale datasets; it demands the inclusion of human knowledge that extends beyond web-crawled content. Yet, the question remains: How can we effectively integrate large-scale training and human knowledge guidance? To answer the question, my research aims to develop large-scale ML models exhibiting greater controllability and interpretability, thereby enabling human intervention to guide model behavior, even beyond the training phase. My work revolves around three main research themes towards this goal: Language-combined Representation Learning, Machine learning reliability and Optimization techniques for large-scale ML.

Please check my research statement for more details.

Selected Publications

* indicates equal contribution.

Sanghyuk Chun, “Improved Probabilistic Image-Text Representations”, arXiv preprint arXiv:2305.18171.

Sanghyuk Chun, Seong Joon Oh, Rafael Sampaio de Rezende, Yannis Kalantidis and Diane Larlus, “Probabilistic Embeddings for Cross-Modal Retrieval”, IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2021.

Sanghyuk Chun, Wonjae Kim, Song Park, Minsuk Chang, Seong Joon Oh, “ECCV Caption: Correcting False Negatives by Collecting Machine-and-Human-verified Image-Caption Associations for MS-COCO”, European Conference on Computer Vision (ECCV), 2022.

Geonmo Gu*, **Sanghyuk Chun***, Wonjae Kim, Yoohoon Kang, Sangdoon Yun, “Language-only Efficient Training of Zero-shot Composed Image Retrieval”, arXiv preprint arXiv:2312.01998

Geonmo Gu*, **Sanghyuk Chun***, Wonjae Kim, HeeJae Jun, Yoohoon Kang, Sangdoon Yun, “CompoDiff: Versatile Composed Image Retrieval With Latent Diffusion”, arXiv preprint arXiv:2303.11916

Byeongho Heo*, **Sanghyuk Chun***, Seong Joon Oh, Dongyoon Han, Sangdoon Yun, Gyuwan Kim, Youngjung Uh, Jung-Woo Ha, “AdamP: Slowing Down the Slowdown for Momentum Optimizers on Scale-invariant Weights”, International Conference on Learning Representations (ICLR), 2021.

Junbum Cha, **Sanghyuk Chun***, Kyungjae Lee*, Han-Cheol Cho, Seunghyun Park, Yunsung Lee, Sungrae Park, “SWAD: Domain Generalization by Seeking Flat Minima”, Conference on Neural Information Processing Systems (NeurIPS), 2021.

Hyojin Bahng, **Sanghyuk Chun**, Sangdoon Yun, Jaegul Choo, Seong Joon Oh, “Learning De-biased Representations with Biased Representations”, International Conference on Machine Learning (ICML), 2020.

Sangwon Jung, **Sanghyuk Chun***, Taesup Moon*, “Learning Fair Classifiers with Partially Annotated Group Labels”, IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2022.

Junbum Cha, Kyungjae Lee, Sungrae Park, **Sanghyuk Chun**, “*Domain Generalization by Mutual-Information Regularization with Pre-trained Models*”, European Conference on Computer Vision (ECCV), 2022.

Sangwon Jung*, Taeon Park*, **Sanghyuk Chun**, Taesup Moon, “*Re-weighting based Group Fairness Regularization via Classwise Robust Optimization*”, International Conference on Learning Representations (ICLR), 2023.

Sangdoon Yun, Dongyoon Han, Seong Joon Oh, **Sanghyuk Chun**, Junseok Choi, Youngjoon Yoo, “*CutMix: Regularization Strategy to Train Strong Classifiers with Localizable Features*”, International Conference on Computer Vision (ICCV), 2019 (Oral).

Sanghyuk Chun, Seong Joon Oh, Sangdoon Yun, Dongyoon Han, Junsuk Choe, Youngjoon Yoo, “*An Empirical Evaluation on Robustness and Uncertainty of Regularization methods*”, Uncertainty & Robustness in Deep Learning Workshop at International Conference on Machine Learning (ICML UDL), 2019.

Song Park, **Sanghyuk Chun**, Junbum Cha, Bado Lee, Hyunjung Shim, “*Multiple Heads are Better than One: Few-shot Font Generation with Multiple Localized Experts*”, International Conference on Computer Vision (ICCV), 2021.

Academic Papers (peer-reviewed conferences and workshops)

* indicates equal contribution.

See also at my  Google Scholar

- [31] **Sanghyuk Chun**, “*Improved Probabilistic Image-Text Representations*”, (non-archival short paper), Workshop on Closing The Loop Between Vision And Language at International Conference on Computer Vision (ICCV CLVL).
- [30] Song Park*, **Sanghyuk Chun***, Byeongho Heo, Wonjae Kim, Sangdoon Yun “*SeiT: Storage-Efficient Vision Training with Tokens Using 1% of Pixel Storage.*”, International Conference on Computer Vision (ICCV), 2023.
- [29] Gyeongsik Moon, Hongsuk Choi, **Sanghyuk Chun**, Jiyoun Lee, Sangdoon Yun, “*Three Recipes for Better 3D Pseudo-GTs of 3D Human Mesh Estimation in the Wild*”, Computer Vision for Mixed Reality workshop (CV4MR) at IEEE Conference on Computer Vision and Pattern Recognition (CVPR CV4MR), 2023.
- [28] Sangwon Jung*, Taeon Park*, **Sanghyuk Chun**, Taesup Moon, “*Re-weighting based Group Fairness Regularization via Classwise Robust Optimization*”, International Conference on Learning Representations (ICLR), 2023.
- [27] Chanwoo Park*, Sangdoon Yun*, **Sanghyuk Chun**, “*A Unified Analysis of Mixed Sample Data Augmentation: A Loss Function Perspective*”, Conference on Neural Information Processing Systems (NeurIPS), 2022
- [26] **Sanghyuk Chun**, Wonjae Kim, Song Park, Minsuk Chang, Seong Joon Oh, “*ECCV Caption: Correcting False Negatives by Collecting Machine-and-Human-verified Image-Caption Associations for MSCOCO*”, European Conference on Computer Vision (ECCV), 2022.
- [25] Junbum Cha, Kyungjae Lee, Sungrae Park, **Sanghyuk Chun**, “*Domain Generalization by Mutual-Information Regularization with Pre-trained Models*”, European Conference on Computer Vision (ECCV), 2022.
- [24] Saehyung Lee, **Sanghyuk Chun**, Sangwon Jung, Sangdoon Yun, Sungroh Yoon, “*Dataset Condensation with Contrastive Signals*”, International Conference on Machine Learning (ICML), 2022.
- [23] Sangwon Jung, **Sanghyuk Chun***, Taesup Moon*, “*Learning Fair Classifiers with Partially Annotated Group Labels*”, IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2022.

- [22] Hwanjun Song, Deqing Sun, **Sanghyuk Chun**, Varun Jampani, Dongyoon Han, Byeongho Heo, Wonjae Kim, Ming-Hsuan Yang “*ViDT: An Efficient and Effective Fully Transformer-based Object Detector*”, International Conference on Learning Representations (**ICLR**), 2022.
- [21] Luca Scimeca*, Seong Joon Oh*, **Sanghyuk Chun**, Michael Poli, Sangdoon Yun, “*Which Shortcut Cues Will DNNs Choose? A Study from the Parameter-Space Perspective*”, International Conference on Learning Representations (**ICLR**), 2022.
- [20] Junbum Cha, **Sanghyuk Chun***, Kyungjae Lee*, Han-Cheol Cho, Seunghyun Park, Yunsung Lee, Sungrae Park, “*SWAD: Domain Generalization by Seeking Flat Minima*”, Conference on Neural Information Processing Systems (**NeurIPS**), 2021.
- [19] Michael Poli*, Stefano Massaroli*, Luca Scimeca, Seong Joon Oh, **Sanghyuk Chun**, Atsushi Yamashita, Hajime Asama, Jinkyoo Park, Animesh Garg, “*Neural Hybrid Automata: Learning Dynamics with Multiple Modes and Stochastic Transitions*”, Conference on Neural Information Processing Systems (**NeurIPS**), 2021.
- [18] Byeongho Heo, Sangdoon Yun, Dongyoon Han, **Sanghyuk Chun**, Junsuk Choe, Seong Joon Oh, “*Rethinking Spatial Dimensions of Vision Transformers*”, International Conference on Computer Vision (**ICCV**), 2021.
- [17] Song Park, **Sanghyuk Chun**, Junbum Cha, Bado Lee, Hyunjung Shim, “*Multiple Heads are Better than One: Few-shot Font Generation with Multiple Localized Experts*”, International Conference on Computer Vision (**ICCV**), 2021.
- [16] **Sanghyuk Chun**, Seong Joon Oh, Rafael Sampaio de Rezende, Yannis Kalantidis and Diane Larlus, “*Probabilistic Embeddings for Cross-Modal Retrieval*”, IEEE Conference on Computer Vision and Pattern Recognition (**CVPR**), 2021.
- [15] Sangdoon Yun, Seong Joon Oh, Byeongho Heo, Dongyoon Han, Junsuk Choe, **Sanghyuk Chun**, “*Re-labeling ImageNet: from Single to Multi-Labels, from Global to Localized Labels*”, IEEE Conference on Computer Vision and Pattern Recognition (**CVPR**), 2021.
- [14] Byeongho Heo*, **Sanghyuk Chun***, Seong Joon Oh, Dongyoon Han, Sangdoon Yun, Gyuwan Kim, Youngjung Uh, Jung-Woo Ha, “*AdamP: Slowing Down the Slowdown for Momentum Optimizers on Scale-invariant Weights*”, International Conference on Learning Representations (**ICLR**), 2021.
- [13] Song Park*, **Sanghyuk Chun***, Junbum Cha, Bado Lee, Hyunjung Shim, “*Few-shot Font Generation with Localized Style Representations and Factorization*”, AAAI Conference on Artificial Intelligence (**AAAI**), 2021 and AI for Content Creation workshop (AICCW) at IEEE Conference on Computer Vision and Pattern Recognition (**CVPR AICCW**), 2021.
- [12] Junbum Cha, **Sanghyuk Chun**, Gayoung Lee, Bado Lee, Seonghyeon Kim, Hwalsuk Lee, “*Few-shot Compositional Font Generation with Dual Memory*”, European Conference on Computer Vision (**ECCV**), 2020.
- [11] Hyojin Bahng, **Sanghyuk Chun**, Sangdoon Yun, Jaegul Choo, Seong Joon Oh, “*Learning De-biased Representations with Biased Representations*”, International Conference on Machine Learning (**ICML**), 2020.
- [10] Junsuk Choe*, Seong Joon Oh*, Seongho Lee, **Sanghyuk Chun**, Zeynep Akata, Hyunjung Shim, “*Evaluating Weakly Supervised Object Localization Methods Right*”, IEEE Conference on Computer Vision and Pattern Recognition (**CVPR**), 2020.
- [9] Junbum Cha, **Sanghyuk Chun**, Gayoung Lee, Bado Lee, Seonghyeon Kim, Hwalsuk Lee, “*Toward High-quality Few-shot Font Generation with Dual Memory*”, AI for Content Creation workshop (AICCW) at IEEE Conference on Computer Vision and Pattern Recognition (**CVPR AICCW**), 2020. (Oral) (**Best paper runner-up award**)

- [8] Minz Won, **Sanghyuk Chun**, Oriol Nieto, Xavier Serra, “*Data-driven Harmonic Filters for Audio Representation Learning*”, IEEE International Conference on Acoustics, Speech, and Signal Processing (**ICASSP**), 2020
- [7] Sangdoon Yun, Dongyoon Han, Seong Joon Oh, **Sanghyuk Chun**, Junseok Choi, Youngjoon Yoo, “*CutMix: Regularization Strategy to Train Strong Classifiers with Localizable Features*”, International Conference on Computer Vision (**ICCV**), 2019 (**Oral**).
- [6] Jaejun Yoo*, Youngjung Uh*, **Sanghyuk Chun***, Byungkyu Kang, Jung-woo Ha, “*Photorealistic Style Transfer via Wavelet Transforms*”, International Conference on Computer Vision (**ICCV**), 2019.
- [5] Minz Won, **Sanghyuk Chun**, Oriol Nieto, Xavier Serra, “*Automatic Music Tagging with Harmonic CNN*”, Late Break Demo in International Society for Music Information Retrieval (**ISMIR LBD**), 2019.
- [4] Minz Won, **Sanghyuk Chun**, Xavier Serra, “*Visualizing and Understanding Self-attention based Music Tagging*”, Machine Learning for Music Discovery Workshop at International Conference on Machine Learning (**ICML ML4MD**), 2019. (**Oral**)
- [3] **Sanghyuk Chun**, Seong Joon Oh, Sangdoon Yun, Dongyoon Han, Junsuk Choe, Youngjoon Yoo, “*An Empirical Evaluation on Robustness and Uncertainty of Regularization methods*”, Uncertainty & Robustness in Deep Learning Workshop at International Conference on Machine Learning (**ICML UDL**), 2019.
- [2] Jisung Hwang*, Younghoon Kim*, **Sanghyuk Chun***, Jaejun Yoo, Jihoon Kim, Dongyoon Han, “*Where To Be Adversarial Perturbations Added? Investigating and Manipulating Pixel Robustness Using Input Gradients*”, Debugging Machine Learning Models Workshop at International Conference on Learning Representations (**ICLR DebugML**), 2019.
- [1] Hyunjong Lee, Youngin Jo, **Sanghyuk Chun**, Kwangseob Kim, “*A Study on Intelligent Personalized Push Notification with User History*”, IEEE International Conference on Big Data (**Big Data**), 2017

Academic Papers (Journals)

* indicates equal contribution.

Junsuk Choe*, Seong Joon Oh*, **Sanghyuk Chun**, Zeynep Akata, Hyunjung Shim, “*Evaluation for Weakly Supervised Object Localization: Protocol, Metrics, and Datasets*”, Accepted at IEEE Transactions on Pattern Analysis and Machine Intelligence (**PAMI**) (IF:24.314).

Song Park*, **Sanghyuk Chun***, Junbum Cha, Bado Lee, Hyunjung Shim, “*Few-shot Font Generation with Weakly Supervised Localized Representations*”, Submitted to IEEE Transactions on Pattern Analysis and Machine Intelligence (**PAMI**) (IF:24.314).

Academic Papers (Preprints and under review papers)

* indicates equal contribution.

Geonmo Gu*, **Sanghyuk Chun***, Wonjae Kim, Yoohoon Kang, Sangdoon Yun, “*Language-only Training of Zero-shot Composed Image Retrieval*”, arXiv preprint arXiv:2312.01998

Taekyung Kim*, **Sanghyuk Chun**, Byeongho Heo, Dongyoon Han*, “*Longer-range Contextualized Masked Image Models*”, arXiv preprint arXiv:2310.13593

Seulki Park, Daeho Um, Hajung Yoon, **Sanghyuk Chun**, Sangdoon Yun, Jin Young Choi, “*RoCOCO: Robust Benchmark MS-COCO to Stress-test Robustness of Image-Text Matching Models*”, arXiv preprint arXiv:2304.10727

Geonmo Gu*, **Sanghyuk Chun***, Wonjae Kim, HeeJae Jun, Yoocheon Kang, Sangdoon Yun, “*CompoDiff: Versatile Composed Image Retrieval With Latent Diffusion*”, arXiv preprint arXiv:2303.11916

Byungsoo Ko, Han-Gyu Kim, Byeongho Heo, Sangdoon Yun, **Sanghyuk Chun**, Geonmo Gu, Wonjae Kim, “*Group Generalized Mean Pooling for Vision Transformer*”, arXiv preprint arXiv:2212.04114.

Jaehui Hwang, Dongyoon Han, Byeongho Heo, Song Park, **Sanghyuk Chun***, Jong-Seok Lee*, “*Similarity of Neural Architectures Based on Input Gradient Transferability*”, arXiv preprint arXiv:2210.11407.

Hwanjun Song, Deqing Sun, **Sanghyuk Chun**, Varun Jampani, Dongyoon Han, Byeongho Heo, Wonjae Kim, Ming-Hsuan Yang, “*An Extendable, Efficient and Effective Transformer-based Object Detector*”, arXiv preprint arXiv:2204.07962.

Sanghyuk Chun, Song Park, “*StyleAugment: Learning Texture De-biased Representations by Style Augmentation without Pre-defined Textures*”, arXiv preprint arXiv:2108.10549.

YoungJoon Yoo, **Sanghyuk Chun**, Sangdoon Yun, Jung-Woo Ha, Jaejun Yoo, “*Neural Approximation of Auto-Regressive Process through Confidence Guided Sampling*”, arXiv preprint arXiv:1910.06705.

Minz Won, **Sanghyuk Chun**, Xavier Serra, “*Toward Interpretable Music Tagging with Self-attention*”, arXiv preprint arXiv:1906.04972.

JangHyun Kim*, Jaejun Yoo*, **Sanghyuk Chun**, Adrian Kim, Jung-woo Ha, “*Multi-Domain Processing via Hybrid Denoising Networks for Speech Enhancement*”, arXiv preprint arXiv:1812.08914

Research Presentations

“**Probabilistic Image-Text Representations**”, HUST AI Summer School on “Modern Machine Learning: Foundations and Applications” (2023).

“**CompoDiff: Versatile Composed Image Retrieval With Latent Diffusion**”, Yonsei University (2023).

“**Probabilistic Image-Text Representations**”, Sogang University (2023).

“**ECCV Caption: Correcting False Negatives by Collecting Machine-and-Human-verified Image-Caption Associations for MS-COCO**”, NAVER and Sogang University (2022).

“**Towards Reliable Machine Learning: Challenges, Examples, Solutions**”, UNIST AIGS (2022).

“**Shortcut learning in Machine Learning: Challenges, Analysis, Solutions**”, FAccT 2022 Tutorial (2022).

“**Towards Reliable Machine Learning**”, SNU, AI773: Special Topics in Artificial Intelligence (2022).

“**Towards Reliable Machine Learning**”, KAIST, AI599: Special Topics in Machine Learning : Deep Learning and Real-world Applications (2022).

“**Shortcut learning in Machine Learning: Challenges, Examples, Solutions**”, POSTECH AI Research (PAIR) ML Winter Seminar (2022).

“**Realistic challenges and limitations of AI**”, University of Seoul (2021).

“**Mitigating dataset biases in Real-world ML applications**”, NAVER (2021).

“**Limits and Challenges in Deep Learning Optimizers**”, UNIST (2021).

“**Towards better cross-modal learning by Probabilistic embedding and AdamP optimizer**”, Computer Vision Centre (CVC), UAB (2021).

“**AdamP: Slowing Down the Slowdown for Momentum Optimizers on Scale-invariant Weights**”, KSIAM (2021).

“Towards Few-shot Font Generation”, Seoul University and NAVER (2021).
“Probabilistic Embeddings for Cross-Modal Retrieval”, NAVER (2020).
“Reliable Machine Learning in NAVER AI”, Yonsei University (2020).
“Toward Reliable Machine Learning”, Omnious and Nota (2020).
“Reliable Machine Learning”, NAVER interactive sessions at CVPR 2020.
“Neural Architectures for Music Representation Learning”, NAVER (2020).
“Learning generalizable representations with CutMix and ReBias”, NAVER Labs Europe (2019).
“An empirical evaluation on the generalization ability of regularization methods”,
ICML 2019 Expo Workshop: Recent Work on Machine Learning at NAVER (2019).
“Recent works on deep learning robustness in Clova AI Research”,
ICLR 2019 Expo Talk Representation Learning to Rich AI Services in NAVER and LINE (2019).
“Recommendation system in the real world”, Deepest Summer School (2018).

Academic Activities

Journal Action Editor Transactions on Machine Learning Research (TMLR).
Conference Area Chair NeurIPS 2023 Dataset and Benchmark (D&B) track.
Reviewer (Conference) CVPR 2020 (*outstanding reviewer award*), ACCV 2020, NeurIPS 2020, WACV 2021, AAAI 2021, ICLR 2021, CVPR 2021 (*outstanding reviewer award*), ICML 2021, ICCV 2021, NeurIPS 2021, CVPR 2022 (*outstanding reviewer award*), ICLR 2022, ICML 2022, ECCV 2022, NeurIPS 2022, ICLR 2023, CHI 2023, CVPR 2023, ICCV 2023, NeurIPS 2023 (*top reviewer award*), ICLR 2024, CVPR 2024.
Reviewer (Journal) IEEE Transactions on Image Processing (TIP), International Journal of Computer Vision (IJCV), Transactions on Pattern Analysis and Machine Intelligence (TPMAI), Transactions on Machine Learning Research (TMLR) (*nominated as TMLR Expert Reviewers*).
Organizer NeurIPS 2021 Workshop on ImageNet: Past, Present, and Future.
ICLR 2022 ML in Korea Social (Main), ICLR 2021 ML in Korea Social (Technical chair).
FAccT 2022 Tutorial: “Shortcut learning in Machine Learning: Challenges, Analysis, Solutions”

Awards

- Top reviewer award (NeurIPS 2023)
- TMLR Expert Reviewer (2023)
- Outstanding reviewer award (CVPR 2022)
- Outstanding reviewer award (CVPR 2021)
- Outstanding reviewer award (CVPR 2020)
- Best paper runner-up award (AI for Content Creation Workshop at CVPR 2020)

Work & Research Experiences

NAVER Feb 2018 - Now
Lead Research Scientist at NAVER AI Lab / Leader of ML Research Seongnam, Korea

- Have led the ML Research team, a research-oriented team of 5-10 people (Since Feb 2022).

- Have participated in research projects targeted to major ML-related conferences such as ICML, NeurIPS, ICLR, CVPR, ICCV, ECCV, AAAI and ICASSP (23 conference papers, 8 workshop papers, 2 journal papers, and 10+ preprints). Please see the full paper list for the details.
- Have supervised research internship students. Academic papers have been presented in top-tier conferences and workshops, *e.g.*, ICLR WS'19, ICML WS'19, ICASSP'20, CVPR'20, ICML'20, AAAI'21, CVPR WS'21, ICCV'21, NeurIPS'21, ICLR'22, CVPR'22, ICML'22, NeurIPS'22, ICLR'23, CVPR WS'23.
- Served as a technical leader at NAVER AI Lab (2020-2021).
- Worked as the main developer for the personalized handwritten Korean font generation project. See <https://clova.ai/handwriting/list.html> for the full list of generated fonts.
- Worked as the main developer for a cross-domain emoji recommender system, which recommends emojis similar to the given human face. The whole production pipeline (including the data tagging system, the face detector system, the tag-based recommender system, and the serving API and demo) was covered.

Kakao corp.

Feb 2016 - Jan 2018

Research Engineer at ART (Advanced Recommendation Technology)

Seongnam, Korea

- Main developer of a large-scale real-time recommender system (Toros) for various services in Kakao.
 - Textual domain:** Daum News similar article recommendation, Brunch (blog service) similar post recommendation, Daum Cafe (community service) hit item recommendation.
 - Visual domain:** Daum Webtoon and Kakao Page (webcomic service) similar item recommendation, related video recommendation for a news article (cross-domain recommendation).
 - Musical domain:** Personalized and similar music recommendation for Kakao Mini (smart speaker), Melon (the biggest music streaming service in Korea) and Kakao Music.
 - Online to offline:** Kakao Hairshop personalized shop and style recommendation.
- Researches and tech transfers on machine learning based recommender systems; Content-based representation modeling for textual, visual, and musical domain, collaborative filtering (matrix factorization), hyperparameter optimization (bandit-based and Bayesian optimization), user embedding, user clustering (online clustering), and ranking system based on multi-armed bandit (online ranking system).
- Main developer of the personalized item push notification system for Daum news and webcomic services. The system can be interpretable to a personalized item recommendation with content-based user modeling. More details can be found in “A Study on Intelligent Personalized Push Notification with User History”.
- Main developer of a large-scale text-based auto-tagging system for Daum Shopping, which has a web-scale data size (billion-scale items), an unbalanced label distribution, and noisy labels.

M.S. researcher

Mar 2014 - Feb 2016

Algorithmic Intelligence Lab in KAIST

Deajeon, Korea

- Researched an efficient algorithm and initialization for a robust PCA and K-means based clustering including theoretical guarantees for the local convergence property and the perfect clustering condition for the proposed initialization method (Master's thesis).
- Designed a robust algorithm for ECG Authentication in noisy environments using machine learning techniques (by low-rank approximation) with SAMSUNG Electronics.
- Participated in many internal study groups on convex optimization, randomized algorithm, Markov Chain Monte Carlo Methods, probabilistic graphical models, and other machine learning methods.

Internship experiences

- Research internship at NAVER Labs Korea (Aug. 2015 - Dec. 2015).
- Research internship at Algorithmic Intelligence Lab in KAIST (Fall 2013).
- Research internship at Networked and Distributed Computing System Lab in KAIST (Summer 2013). During the internship, I developed the index system described in Section 4 of [USENIX'15] **FloSIS: A Highly Scalable Network Flow Capture System for Fast Retrieval and Storage Efficiency**.
- Software engineering internship at IUM-SOCIUS (Jun. 2012 - Jan. 2013).

Language Proficiency

- Korean (Native proficiency)
- English (Full professional proficiency, C1 ~ C2)
- Japanese (Limited working proficiency, B1 ~ B2)
- French (Elementary proficiency, A1)

Education

M.S. in Electrical Engineering from **Korea Advanced Institute of Science and Technology (KAIST)**.
(Advisor: Jinwoo Shin) (Mar. 2014 - Feb. 2016)

Thesis: **Scalable Iterative Algorithm for Robust Subspace Clustering: Convergence and Initialization.**

B.S. in Electrical Engineering and Management Science (double major) from **Korea Advanced Institute of Science and Technology (KAIST)**. (Mar. 2009 - Feb. 2014)