Sanghyuk Chun

Lead Research Scientist at NAVER AI Lab

sanghyuk.chun@gmail.com https://sanghyukchun.github.io/home

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Research Interests

Expanding machine knowledge with insufficient human supervision. Existing machine learning models cannot understand the problem itself. This causes many realistic problems, such as discrimination by machines, poor generalizability to unseen (or minor) corruptions / environments / groups. Current state-of-the-art machines only do "predict", rather than "logical reasoning". Our model should not learn undesirable shortcut features, or should be robust to unseen corruptions or significant distribution shifts. Also we need to make a machine not discriminative to certain demographic groups. We expect a model says "I don't know" when they get unexpected inputs. At least, we expect a model can explain why it makes a such decision, and how it can be fixed (e.g., More data collection? More annotations? Filtering?). My research focuses on expanding machine knowledge from "just prediction" to "logical reasoning". Unfortunately, in many cases, the existing evaluation protocol or metrics are not reliable to measure how machines learn proper knowledge. I also have worked with fair evaluation benchmarks and metrics to mitigate this issue.

Selected Publications

* *indicates equal contribution.*

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.

Byeongho Heo*, **Sanghyuk Chun***, Seong Joon Oh, Dongyoon Han, Sangdoo 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.

Hyojin Bahng, **Sanghyuk Chun**, Sangdoo 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, **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.

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.

Sangdoo 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, Sangdoo 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)

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* *indicates equal contribution.*

See also at my 🎓 Google Scholar

[27] Chanwoo Park*, Sangdoo 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 MS-COCO"*, 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, Sangdoo 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, Sangdoo 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, Sangdoo 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] Sangdoo 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, Sangdoo 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**, Sangdoo 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] Sangdoo 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, Sangdoo 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 and Preprints)

* *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).

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"*, *Submitted to* IEEE Transactions on Pattern Analysis and Machine Intelligence **(PAMI)** (Under review).

Academic Papers (Preprints)

* *indicates equal contribution.*

Byungsoo Ko, Han-Gyu Kim, Byeongho Heo, Sangdoo 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.

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**, Sangdoo 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

"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

Reviewer 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.

Organizer NeurIPS 2021 Workshop on ImageNet: Past, Present, and Future.
ICLR 2022 ML in Korea Social.
FAccT 2022 Tutorial: "Shortcut learning in Machine Learning: Challenges, Analysis, Solutions"

Awards

- 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 participated in research projects targeted to major ML-related conferences such as ICML, NeurIPS, ICLR, AAAI, CVPR, ICCV, ECCV and ICASSP (21 conference papers, 6 workshop papers, 2 journal papers, and 5 preprints). 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.
- 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)
- Japanese (Limited working proficiency)
- French (Elementary proficiency)

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)