Pravendra Singh

Assistant Professor, Department of CSE
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Research Interests: Model Compression, Few-Shot Learning, Zero-Shot Learning, Continual Learning, Deep Learning, Computer Vision.

Education

2016–2020 **Doctor of Philosophy (Ph.D.) in Computer Science and Engineering**, *Indian Institute of Technology, Kanpur, India*, CPI 9.33/10.
Supervisor: Prof. Vinay P. Namboodiri

2011–2013 **Masters of Technology (M.Tech.) in Geoinformatics**, *Indian Institute of Technology, Kanpur, India*, CPI 8.94/10.
Supervisor: Prof. Onkar Dikshit

2006–2010 **Bachelor of Technology (B.Tech. Honours) in Computer Science and Engineering**, *AKGEC, Ghaziabad affiliated to UPTU, Lucknow*, Percentage 77.1/100.

Journal Publication

IJCV-19 **Pravendra Singh**, Vinay Kumar Verma, Piyush Rai, Vinay P. Namboodiri,"HetConv: Beyond Homogeneous Convolution Kernels for Deep CNNs", International Journal of Computer Vision (**IJCV-2019**). [Impact Factor: 11.541 (2017), Q1]

IVC-19 **Pravendra Singh***, Vinay Sameer Raja Kadi*, Vinay P. Namboodiri,"FALF ConvNets: Fatuous Auxiliary Loss based Filter-pruning for Efficient Deep CNNs", Image and Vision Computing (**IMAVIS-2019**). [Impact Factor: 3.103 (2019), Q1]

JSTSP-20 **Pravendra Singh**, Vinay Kumar Verma, Piyush Rai, Vinay P. Namboodiri,"Acceleration of Deep Convolutional Neural Networks using Adaptive Filter Pruning", IEEE Journal of Selected Topics in Signal Processing (**JSTSP-2020**). [Impact Factor: 6.688 (2018), Q1]

IVC-20 **Pravendra Singh**, Prem Raj, Vinay P. Namboodiri, "EDS Pooling Layer", Image and Vision Computing (**IMAVIS-2020**). [Impact Factor: 3.103 (2019), Q1]

IVC-20 Pratik Mazumder, **Pravendra Singh**, Vinay P. Namboodiri, "GIFSL - Grafting based Improved Few-Shot Learning", Image and Vision Computing (**IMAVIS-2020**). [Impact Factor: 3.103 (2019), Q1]

NEUCOM-21 **Pravendra Singh***, Pratik Mazumder*, Mohammed Asad Karim*, Vinay P. Namboodiri, "Calibrating Feature Maps for Deep CNNs", Neurocomputing (**NEUCOM-2021**). [Impact Factor: 4.438 (2019), Q1]

SIVP-21 Munender Varshney, **Pravendra Singh**, "Optimizing nonlinear activation function for convolutional neural networks", Signal, Image and Video Processing (**SIVP-2021**). [Impact Factor: 1.794 (2019), Q2]

Conference Publication

CVPR-19 **Pravendra Singh**, Vinay Kumar Verma, Piyush Rai, Vinay P. Namboodiri, "HetConv: Heterogeneous Kernel-Based Convolutions for Deep CNNs", IEEE/CVF Conference on Computer Vision and Pattern Recognition (**CVPR-2019**), Long Beach, USA. [Core Rank: A* (2020), h5-index - 299 (2020)]

IJCAI-19 **Pravendra Singh**, Vinay Kumar Verma, Piyush Rai, Vinay P. Namboodiri, "Play and Prune: Adaptive Filter Pruning for Deep Model Compression", International Joint Conference on Artificial Intelligence (**IJCAI-2019**), Macao, China. [Core Rank: A* (2020), h5-index - 95 (2020)]

WACV-19 **Pravendra Singh**, Vinay Sameer Raja Kadi, Nikhil Verma, Vinay P. Namboodiri, "Stability Based Filter Pruning for Accelerating Deep CNNs", IEEE Winter Conference on Applications of Computer Vision (**WACV-2019**), Hawaii, USA. [Core Rank: A (2020), h5-index - 54 (2020)]

WACV-19 **Pravendra Singh**, Manikandan R, Neeraj Matiyali, Vinay P. Namboodiri, "Multi-layer Pruning Framework for Compressing Single Shot MultiBox Detector", IEEE Winter Conference on Applications of Computer Vision (**WACV-2019**), Hawaii, USA. [Core Rank: A (2020), h5-index - 54 (2020)]

NIPS-20 **Pravendra Singh***, Vinay Kumar Verma*, Pratik Mazumder, Lawrence Carin, Piyush Rai, "Calibrating CNNs for Lifelong Learning", Conference on Neural Information Processing Systems **(NeurIPS-2020)**, Virtual Conference. [Core Rank: A* (2020), h5-index - 198 (2020)]

CVPR-W-20 Rajat, Munender Varshney, **Pravendra Singh**, Vinay P. Namboodiri, "Minimizing Supervision in Multi-label Categorization", IEEE/CVF Conference on Computer Vision and Pattern Recognition - Workshop Proceedings (**CVPR-W-2020**), Seattle, Washington, USA (shifted online). [h5-index - 73 (2020)]

ICASSP-20 **Pravendra Singh***, Pratik Mazumder*, Vinay P. Namboodiri, "CPWC: Contextual Point Wise Convolution for Object Recognition", IEEE International Conference on Acoustics, Speech and Signal Processing **(ICASSP-2020)**, Barcelona, Spain (shifted online). [h5-index - 86 (2020)]

WACV-20 **Pravendra Singh**, Pratik Mazumder, Vinay P. Namboodiri, "Accuracy Booster: Performance Boosting using Feature Map Re-calibration", IEEE/CVF Winter Conference on Applications of Computer Vision (**WACV-2020**), Colorado, USA. [Core Rank: A (2020), h5-index - 54 (2020)]

WACV-20 **Pravendra Singh**, Munender Kumar, Vinay P. Namboodiri, "Cooperative Initialization based Deep Neural Network Training", IEEE/CVF Winter Conference on Applications of Computer Vision (**WACV-2020**), Colorado, USA. [Core Rank: A (2020), h5-index - 54 (2020)]

WACV-20 **Pravendra Singh***, Vinay Kumar Verma*, Piyush Rai, Vinay P. Namboodiri, "Leveraging Filter Correlations for Deep Model Compression", IEEE/CVF Winter Conference on Applications of Computer Vision (**WACV-2020**), Colorado, USA. [Core Rank: A (2020), h5-index - 54 (2020)]

WACV-20 Vinay Kumar Verma, **Pravendra Singh**, Vinay P. Namboodiri, Piyush Rai, "A "Network Pruning Network" Approach to Deep Model Compression", IEEE/CVF Winter Conference on Applications of Computer Vision (**WACV-2020**), Colorado, USA. [Core Rank: A (2020), h5-index - 54 (2020)]

IJCNN-20 **Pravendra Singh**, Pratik Mazumder, Vinay P. Namboodiri, "Passive Batch Injection Training Technique: Boosting Network Performance by Injecting Mini-Batches from a different Data Distribution", IEEE International Joint Conference on Neural Networks **(IJCNN-2020)**, Glasgow, Scotland, UK (shifted online). [Core Rank: A (2020), h5-index - 46 (2020)]

IJCNN-20 **Pravendra Singh**, Vinay P. Namboodiri, "SkipConv: Skip Convolution for Computationally Efficient Deep CNNs", IEEE International Joint Conference on Neural Networks **(IJCNN-2020)**, Glasgow, Scotland, UK (shifted online). [Core Rank: A (2020), h5-index - 46 (2020)]

WACV-21 Pratik Mazumder, **Pravendra Singh**, Vinay P. Namboodiri, "Improving Few-Shot Learning using Composite Rotation based Auxiliary Task", IEEE/CVF Winter Conference on Applications of Computer Vision (**WACV-2021**), Hawaii, USA (shifted online). [Core Rank: A (2020), h5-index - 54 (2020)]

WACV-21 Pratik Mazumder, **Pravendra Singh**, Kranti Kumar Parida, Vinay P. Namboodiri, "AVGZSLNet: Audio-Visual Generalized Zero-Shot Learning by Reconstructing Label Features from Multi-Modal Embeddings", IEEE/CVF Winter Conference on Applications of Computer Vision (**WACV-2021**), Hawaii, USA (shifted online). [Core Rank: A (2020), h5-index - 54 (2020)]

WACV-21 Pratik Mazumder, **Pravendra Singh**, Vinay P. Namboodiri, "RNNP: A Robust Few-Shot Learning Approach", IEEE/CVF Winter Conference on Applications of Computer Vision (**WACV-2021**), Hawaii, USA (shifted online). [Core Rank: A (2020), h5-index - 54 (2020)]

AAAI-21 **Pravendra Singh***, Pratik Mazumder*, Piyush Rai, "Few-Shot Lifelong Learning", AAAI Conference on Artificial Intelligence (**AAAI-21**), Virtual Conference. [Core Rank: A* (2020), h5-index - 126 (2020)]

CVPR-21 **Pravendra Singh***, Pratik Mazumder*, Piyush Rai, Vinay P. Namboodiri, "Rectification-based Knowledge Retention for Continual Learning", IEEE/CVF Conference on Computer Vision and Pattern Recognition (**CVPR-2021**), Virtual Conference. [Core Rank: A* (2020), h5-index - 299 (2020)]

IJCAI-21 Mohammed Asad Karim, Vinay Kumar Verma, **Pravendra Singh**, Vinay P. Namboodiri, Piyush Rai, "Knowledge Consolidation based Class Incremental Online Learning with Limited Data", International Joint Conference on Artificial Intelligence (**IJCAI-2021**), Virtual Conference. [Core Rank: A* (2020), h5-index - 95 (2020)]

PhD Thesis Work

Title **Efficient methods for deep learning**.
Supervisors: Prof. Vinay P. Namboodiri (IIT Kanpur)

Description While convolutional neural networks (CNNs) have achieved remarkable performance on various supervised and unsupervised learning tasks, they typically consist of a massive number of parameters and massive computations. This results in significant memory requirements as well as a computational burden. Consequently, there is a growing need for efficient methods in deep learning to reduce parameters and computations. In this context, we first work on model compression methods, which reduces computations/parameters of deep CNNs without hurting model accuracy. Next, we work on efficient architectures that use efficient convolutions to reduce the model size and complexity. Last, we work on methods that increase deep CNNs accuracy without significantly increasing computations/parameters.

Masters Thesis

Title **Feature based automatic image registration**.
Supervisor: Prof. Onkar Dikshit (IIT Kanpur)

Description Image registration is a pre-processing step for several remote sensing applications, which is used for aligning multiple images. In this, we have proposed an automatic image registration approach using feature extraction through SURF (Speeded Up Robust Features), MSER (Maximally Stable Extremal Regions), and Harris and Stephens corner detector. SURF and MSER features are beneficial because they are invariant to zoom, noise, scale, rotation, and illumination. The analysis is conducted for various image transformations such as image rotation, scaling, image compression, noise addition, histogram equalization, contrast stretching, blur, and change in illumination.

Awards/Grants

2020 Best Student Paper Award Finalist for paper “Passive Batch Injection Training Technique” at IEEE International Joint Conference on Neural Networks (IJCNN) 2020.

2020 Awarded Microsoft Research Travel Grant to present our work at WACV 2020.

2019 Awarded Google Research Travel Grant to present our work at CVPR 2019.

2019 Awarded Microsoft Research Travel Grant and IJCAI Travel Grant to present our work at IJCAI 2019.

2019 Received Student Volunteer Award from IJCAI 2019.

2016 Qualified Graduate Aptitude Test in Engineering (GATE-16 CSE) with AIR-322 (99.7 Percentile).

2010 Certificate of merit for good performance in sessional examination (B.Tech. 2009-10).

2009 Certificate of merit for good performance in sessional examination (B.Tech. 2008-09).

Industrial Projects

2019 **IIT Kanpur - Samsung Project**, *Project Title: Efficient Activity Recognition*, Designation: Senior Student Research Associate.
Principal Investigator: Prof. Vinay P. Namboodiri

2018 **IIT Kanpur - Hitachi Project**, *Project Title: In-Vehicle Vision Application (self-driving vehicles)*, Designation: Senior Student Research Associate.
Principal Investigator: Prof. Vinay P. Namboodiri

Professional Service

2019 Invited to participate in Amazon Research Days at Bangalore

2019 Invited talk at NCVPRIPG 2019: "HetConv: Beyond Homogeneous Convolution Kernels for Deep CNNs"

Conference Served as a reviewer for CVPR, ICCV, AAAI, ICRA, BMVC, WACV, ICVGIP, NCVPRIPG conferences

Journal Served as a reviewer for IEEE Transactions on Neural Networks and Learning Systems, Neurocomputing, Computer Vision and Image Understanding, Neural Computation, IEEE Computational Intelligence Magazine, IET Computer Vision, Electronics Letters, IEEE Transactions on Circuits and Systems for Video Technology journals

Technical skills

Deep learning Pytorch, Torch, Tensorflow

Language Python, C, C++, MATLAB