# Special Issue on
# Learning with Less Labels in Computer Vision

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## 1 SPECIAL ISSUE TITLE

Learning with Less Labels in Computer Vision

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## 3 ABSTRACT AND MOTIVATION

The past several years have witnessed an explosion of interest in and a dizzyingly fast development of machine learning, a subfield of artificial intelligence. Foremost among these approaches are Deep Neural Networks (DNNs) that can learn powerful feature representations with multiple levels of abstraction directly from data when large amounts of labeled data is available. One of the core computer vision areas, namely, object classification achieved a significant breakthrough result with a deep convolutional neural network and the large scale ImageNet dataset, which is arguably what reignited the field of artificial neural networks and triggered the recent revolution in Artificial Intelligence (AI). Nowadays, artificial intelligence has spread over almost all fields of science and technology. Yet, computer vision remains in the heart of these advances when it comes to visual data analysis, offering the biggest big data and enabling advanced AI solutions to be developed.

Undoubtedly, DNNs have shown remarkable success in many computer vision tasks, such as recognizing/localizing/segmenting faces, persons, objects, scenes, actions and gestures, and recognizing human expressions, emotions, as well as object relations and interactions in images or videos. Despite a wide range of impressive results, current DNN based methods typically depend on massive amounts of accurately annotated training data to achieve high performance, and are brittle in that their performance can degrade severely with small changes in their operating environment. Generally, collecting large scale training datasets is time-consuming, costly, and in many applications even infeasible, as for certain fields only very limited or no examples at all can be gathered (such as visual inspection or medical domain), although for some computer vision tasks large amounts of unlabeled data may be relatively easy to collect, *e.g.*, from the web or via synthesis. Nevertheless, labeling and vetting massive amounts of real-world training data is certainly difficult, expensive, or time-consuming, as it requires the painstaking efforts of experienced human annotators or experts, and in many cases prohibitively costly or impossible due to some reason, such as privacy, safety or ethic issues (*e.g.*, endangered species, drug discovery, medical diagnostics and industrial inspection).

DNNs lack the ability of learning from limited exemplars and fast generalizing to new tasks. However, real-word computer vision applications often require models that are able to (a) learn with few annotated samples, and (b) continually adapt to new data without forgetting prior knowledge. By contrast, humans can learn from just one or a handful of examples (*i.e.,* few shot learning), can do very long-term learning, and can form abstract models of a situation and manipulate these models to achieve extreme generalization. As a result, one of the next big challenges in computer vision is to develop learning approaches that are capable of addressing the important shortcomings of existing methods in this regard. Therefore, in order to address the current inefficiency of machine learning, there is pressing need to research methods, (1) to drastically reduce requirements for labeled training data, (2) to significantly reduce the amount of data necessary to adapt models to new environments, and (3) to even use as little labeled training data as people need.

Numerous attempting efforts have appeared in top conferences (including CVPR, ICCV, ECCV, NeurIPS and ICLR) and top journals (including TPAMI and IJCV). Nevertheless, there has been yet no special issue in prestigious journals to systematically collect mature research and to boost future work in this area. The aim of this special issue is to fill this gap by stimulating researchers from different fields (in particular, computer vision and machine learning) to present high-quality research work and to provide a cross-fertilization ground for stimulating discussions on the next steps in this important research area. In this special issue, we welcome contributions of novel work in the area of visual learning with less labels via techniques including self-supervised learning, semisupervised learning, weakly supervised learning, few-shot learning, zero-shot learning, meta-learning, continual learning, and domain adaptation, as well as applications in computer vision tasks such as image classification, object detection, semantic segmentation, instance segmentation, and many others.

## 4  TOPICS OF INTEREST

This special issue focuses on learning with less labels for computer vision tasks and the topics of interest include (but are not limited to) the following areas:

- Self-supervised learning methods
- New methods for few-/zero-shot learning
- Meta-learning methods
- Life-long/continual/incremental learning methods
- Novel domain adaptation methods
- Semisupervised learning methods
- Weakly supervised learning methods

## 5  PROPOSED DATES

- Paper Submission: April 15, 2021.
- First Notification: July 15, 2021.
- Revisions of Submissions: October 15, 2021.
- Final Decisions: December 15, 2021.
- Final manuscript due: January 15, 2022.

## 6  EXPECTED NUMBER OF SUBMISSIONS

We expect about 60 submissions from all around the world.

## 7  BIOGRAPHY OF GUEST EDITORS

### 7.1  Li Liu

Li Liu received her Ph.D. degree in information and communication engineering from the National University of Defense Technology, China, in 2012. She joined the faculty at the National University of Defense Technology in 2012. During her PhD study, she spent more than two years as a Visiting Student at the University of Waterloo, Canada, from 2008 to 2010. From 2015 to 2016, she spent ten months visiting the Multimedia Laboratory at the Chinese University of Hong Kong. From 2016 to 2018, she was a senior researcher of the CMVS at the University of Oulu, Finland, where she is currently an Assistant Professor. Dr. Liu was cochair of nine International Workshops of several major venues including CVPR, ICCV and ECCV. She served as the leading guest editor of the special issues for IEEE TPAMI and IJCV. She also served as Area Chair for ICME2020 and ACCV2020. She currently serves as Associate Editor of Pattern Recognition Letters and the Visual Computer Journal. Her current research interests include computer vision, pattern recognition and machine learning. Her papers have currently over 2700 citations in Google Scholar. She is a senior member of the IEEE.

### 7.2  Timothy Hospedales

Timothy Hospedales is a Professor at University of Edinburgh, Principal Scientist at Samsung AI Research Centre, Cambridge, where he leads the machine learning and data intelligence group, and Alan Turing Institute Fellow. He is an Associate Editor of IEEE TPAMI, and has served as Area Chair of several major venues including CVPR, ICCV, ECCV, AAAI, IJCAI, and program chair of BMVC 2018. His research interests include data efficient machine learning and generalization especially via meta-learning and neuro-symbolic approaches, with applications in computer vision and beyond. He has published numerous papers on few shot learning, multitask learning, domain adaptation, domain generalization, meta-learning, and so on. His work has won prizes or nominations at ICML, BMVC, ICPR and ICML AutoML. He has coorganized relevant tutorials at ACM Multimedia and ECCV.

### 7.3  Yann LeCun

Yann LeCun is VP and Chief AI Scientist at Facebook and Silver Professor at NYU affiliated with the Courant Institute and the Center for Data Science. He was the founding Director of Facebook AI Research and of the NYU Center for Data Science. He received an EE Diploma from ESIEE (Paris) in 1983, a PhD in Computer Science from Sorbonne Université (Paris) in 1987. After a postdoc at the University of Toronto, he joined AT&T Bell Laboratories. He became head of the Image Processing Research Department at AT&T Labs-Research in 1996, and joined NYU in 2003 after a short tenure at the NEC Research Institute. In late 2013, LeCun became Director of AI Research at Facebook, while

remaining on the NYU Faculty part-time. He was visiting professor at Collège de France in 2016. His research interests include machine learning and artificial intelligence, with applications to computer vision, natural language understanding, robotics, and computational neuroscience. He is best known for his work in deep learning and the invention of the convolutional network method which is widely used for image, video and speech recognition. He is a member of the US National Academy of Engineering, a Chevalier de la Légion d' Honneur, a fellow of AAAI, the recipient of the 2014 IEEE Neural Network Pioneer Award, the 2015 IEEE Pattern Analysis and Machine Intelligence Distinguished Researcher Award, the 2016 Lovie Award for Lifetime Achievement, the University of Pennsylvania Pender Award, and honorary doctorates from IPN, Mexico and EPFL. He is the recipient of the 2018 ACM Turing Award (with Geoffrey Hinton and Yoshua Bengio) for "conceptual and engineering breakthroughs that have made deep neural networks a critical component of computing".

### 7.4 Mingsheng Long

Mingsheng Long is an Associate Professor in the School of Software, Tsinghua University. He received the B.E. degree in Electrical Engineering and the Ph.D. degree in Computer Science from Tsinghua University in 2008 and 2014 respectively. He was a visiting researcher in the AMP Lab and SAIL Lab at UC Berkeley. He has published over 50 papers in major conferences and journals including TPAMI, ICML, NeurIPS, and CVPR. He is serving as an Area Chair of NeurIPS and ICLR, as an SPC member of IJCAI and AAAI, and as PC members of ICML, CVPR, and ICCV. His research spans machine learning theories and algorithms, with persistent dedication to enabling adaptive machine learning in nonstationary environment, including representation learning, predictive learning, transfer learning, domain adaptation, multitask learning and learning to learn.

### 7.5 Jiebo Luo

Jiebo Luo is a Professor of Computer Science at the University of Rochester which he joined in 2011 after a prolific career of fifteen years at Kodak Research Laboratories. He has authored over 400 technical papers and holds over 90 U.S. patents. His research interests include computer vision, NLP, machine learning, data mining, computational social science, and digital health. He has been involved in numerous technical conferences, including serving as the program co-chair of ACM Multimedia 2010, IEEE CVPR 2012, ACM ICMR 2016, and IEEE ICIP 2017, as well as the general co-chair of ACM Multimedia 2018. He has served on the editorial boards of the IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI), IEEE Transactions on Multimedia (TMM), IEEE Transactions on Circuits and Systems for Video Technology (TCSVT), IEEE Transactions on Big Data (TBD), ACM Transactions on Intelligent Systems and Technology (TIST), Pattern Recognition, Knowledge and Information Systems (KAIS), Machine Vision and Applications, and Journal of Electronic Imaging. He is the current Editor-in-Chief of the IEEE Transactions on Multimedia. Professor Luo is a Fellow of ACM, AAAI, IEEE, SPIE, and IAPR.

### 7.6 Wanli Ouyang

Wanli Ouyang received the Ph.D. degree in the Department of Electronic Engineering, the Chinese University of Hong Kong. He is now a senior lecturer at the University of Sydney. His research interests include image processing, computer vision and pattern recognition. He received the best reviewer award of ICCV. He serves as the guest editor for IJCV, demo chair for ICCV 2019, and Area Chair of ICPR2020, ICPR2018. He has been the reviewer of many top journals and conferences such as IEEE TPAMI, TIP, IJCV, SIGGRAPH, CVPR, and ICCV. He is a senior member of the IEEE.

### 7.7 Matti Pietikäinen

Matti Pietikäinen received the doctor of science degree in technology from the University of Oulu, Finland. He is now emeritus professor with the Center for Machine Vision and Signal Analysis, University of Oulu. From 1980 to 1981 and from 1984 to 1985, he visited the Computer Vision Laboratory, University of Maryland. He has made fundamental contributions, e.g., to Local Binary Pattern (LBP) methodology, texture-based image and video analysis, and facial image analysis. He has authored more than 350 refereed papers in international journals, books, and conferences. His papers have nearly 65,000 citations in Google Scholar (h-index 90). He has been Associate Editor of IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI), Pattern Recognition, IEEE Transactions on Forensics and Security, Image and Vision Computing, and IEEE Transactions on Biometrics, Behavior and Identity Science journals. He has also been Guest Editor for a special session of TPAMI and a special issue of International Journal of Computer Vision. He was president of the Pattern Recognition Society of Finland from 1989 to 1992, and was named its honorary member in 2014. From 1989 to 2007, he served as member of the Governing Board of International Association for Pattern Recognition (IAPR), and became one of the founding fellows of the IAPR in 1994. In 2014, his research on LBP-based face description was awarded the Koenderink Prize for fundamental contributions in computer vision. He was the recipient of the IAPR King-Sun Fu Prize 2018 for fundamental contributions to texture analysis and facial image analysis. In 2018, he was named a highly cited researcher by Clarivate Analytics, by producing multiple highly cited papers in 2006-2016 that rank in the top 1 percent by citation for his field in web of science. He is a fellow of the IEEE for contributions to texture and facial image analysis for machine vision.

### 7.8 Tinne Tuytelaars

Tinne Tuytelaars is a Professor at KU Leuven Belgium. She received a Master of Electrical Engineering from the KU Leuven, Belgium in 1996. She has been one of the program chairs for ECCV 2014 and one of the general chairs of CVPR 2016. She served as Associate Editor in Chief of IEEE

Transactions on Pattern Analysis and Machine Intelligence, and is a Member of the Editorial Board of Computer Vision and Image Understanding. She served as General cochair of CVPR2016, Program cochair of ECCV2014 and CVPR2021, and Area Chair for ECCV(2008, 2010, 2012, 2018), CVPR (2009, 2011, 2013), ICCV (2011, 2013) and BMVC (2017). She received the Koenderink Award at ECCV 2016 for fundamental contributions in computer vision that stood the test of time, and the CVIU Most Cited Paper Award in 2011. Her research interests are object recognition, action recognition, multimodal analysis and image representations.

# 8 SELECTED PUBLICATIONS OF GUEST EDITORS ON THE SPECIAL ISSUE TOPIC

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