Representative publications:

Liu, Shuying, and Weihong Deng. "Very deep convolutional neural network based image classification using small training sample size." *2015 3rd IAPR Asian conference on pattern recognition (ACPR)*. IEEE, 2015.

Representative citations:

1) Professor **Ruslan Salakhutdinov**, a leading international deep learning scholar and head of research at Apple, in his paper published in NeurIPS 2019, evaluates our method as being **especially optimised** for small datasets in the VGG16 version.

Deep Gamblers:
Learning to Abstain with Portfolio Theory

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exactly the experimental setting in [15] to allow for fair comparison. We use a version of VGG16 that is especially optimized for small datasets [27] with batchnorm and dropout. The baselines we

[27] Shuying Liu and Weihong Deng. Very deep convolutional neural network based image classification using small training sample size. In *2015 3rd IAPR Asian conference on pattern recognition (ACPR)*, pages 730–734. IEEE, 2015.

2) **Humberto Bustince**, IEEE Fellow and Professor at the Universidad Pública de Navarra, in his paper published in Neural Networks 2022, commented that our approach produces more **robust and optimal** structures that provide **impressive results** for image classification. impressive results for image classification.

Replacing pooling functions in Convolutional Neural Networks by linear combinations of increasing functions

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tasks. In this context, extensive research has been dedicated to developing new CNN designs: more heavily parameterized models have been proved to produce more robust and optimal architectures, offering impressive results for image classification (He, Zhang, Ren, & Sun, 2016; Liu & Deng, 2015); production environment constraints (e.g. smartphones or autonomous vehicles) have led to the development of more "compressed" but still competitive architectures (Howard et al., 2017; Huang, Liu, Van Der Maaten, & Weinberger, 2017; Tan & Le, 2019). Still,

Liu, S., & Deng, W. (2015). Very deep convolutional neural network based image classification using small training sample size. In *2015 3rd IAPR Asian conference on pattern recognition* (pp. 730–734).

3) **Su-In Lee**, Professor at the University of Washington, **Ran EI-Yaniv**, Professor at the Technion-Israel Institute of Technology, and **Maya R. Gupta**, Head of the Machine Learning R&D Group at the Google Research Institute, USA, in their papers published in Nature machine intelligence 2021, NIPS 2017, and NIPS 2018, respectively, the VGG-16 network is trained using the convolutional layer dropout method proposed by the applicant.

Improving performance of deep learning models with axiomatic attribution priors and expected gradients

Gabriel Erion[1,2,4], Joseph D. Janizek[1,2,4], Pascal Sturmfels[1,4], Scott M. Lundberg[1,3] and Su-In Lee[1]

Recent research has demonstrated that feature attribution methods for deep networks can themselves be incorporated into training; these attribution priors optimize for a model whose attributions have certain desirable properties—most frequently, that particular features are important or unimportant. These attribution priors are often based on attribution methods that are not guaranteed to satisfy desirable interpretability axioms, such as completeness and implementation invariance. Here we introduce attribution priors to optimize for higher-level properties of explanations, such as smoothness and sparsity, enabled by a fast new attribution method formulation called expected gradients that satisfies many important interpretability axioms. This improves model performance on many real-world tasks where previous attribution priors fail. Our experiments show that the gains from combining higher-level attribution priors with expected gradients attributions are consistent across image, gene expression and healthcare datasets. We believe that this work motivates and provides the necessary tools to support the widespread adoption of axiomatic attribution priors in many areas of applied machine learning. The implementations and our results have been made freely available to academic communities.

Image model experimental settings. We trained a VGG16 model from scratch modified for the CIFAR-10 dataset, containing 60,000 coloured 32×32-pixel images divided into 10 categories, as in ref. [50]. To train this network, we used

50. Liu, S. & Deng, W. Very deep convolutional neural network based image classification using small training sample size. In *2015 3rd IAPR Asian Conference on Pattern Recognition (ACPR)* 730–734 (IEEE, 2015).

Selective Classification for Deep Neural Networks

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We now consider CIFAR-10; see [14] for details. We used the VGG-16 architecture [17] and adapted it to the CIFAR-10 dataset by adding massive dropout, exactly as described in [15]. We used data

[15] Shuying Liu and Weihong Deng. Very deep convolutional neural network based image classification using small training sample size. In *Pattern Recognition (ACPR), 2015 3rd IAPR Asian Conference on*, pages 730–734. IEEE, 2015.

To Trust Or Not To Trust A Classifier

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We used a pretrained VGG-16 [51] architecture with adaptation to the CIFAR datasets based on [52].

[52] Shuying Liu and Weihong Deng. Very deep convolutional neural network based image classification using small training sample size. *2015 3rd IAPR Asian Conference on Pattern Recognition (ACPR)*, pages 730–734, 2015.