

## Editorial

# Editorial for the Special Issue on Deep Neural Networks

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Deep learning has been a popular research area in artificial intelligence with many applications in various fields, such as object detection and recognition, and multimedia data understanding, restoration, and synthesis. Moreover, deep learning has also played a critical role in data science, especially for analyzing big data relying on the extractions of high-level abstractions for data representations through a hierarchical learning process. In realizing deep learning frameworks, both supervised and unsupervised approaches for training deep neural networks have been empirically investigated and applied in different applications. However, there is still very limited understanding on why deep networks can work well and how to design efficient deep models in the viewpoints of software and hardware. Moreover, for embedding deep models into mobile applications, efficient representation or compression of model parameters for model storage is also highly required.

This special issue focuses on all aspects of deep learning in representation, interpretation, and applications, mainly extended from the special session on Recent Advances in Deep Learning with Multimedia Applications of the APSIPA ASC 2020 conference. This special issue has collected six excellent articles reviewed and highly recommended by the editors and reviewers.

The first one is “Robust deep convolutional neural network against image distortions,” authored by Liang-Yao Wang, Sau-Gee Chen and Feng-Tsun Chien. This paper addresses the problem on classification of distorted images, and presents a convolutional neural network-based architecture with a pre-processing unit in which only undistorted data are used for training. The second article is “Two-stage pyramidal convolutional neural networks for image colorization,” authored by Yu-Jen Wei, Tsu-Tsai Wei, Tien-Ying Kuo and Po-Chyi Su. This paper addresses the problem of image colorization and presents

a two-stage pyramidal convolutional neural network to solve this problem. The third article is “TGHop: an explainable, efficient, and lightweight method for texture generation,” authored by Xuejing Lei, Ganning Zhao, Kaitai Zhang and C.-C. Jay Kuo. This paper proposes an explainable, efficient, and lightweight method for texture generation, called TGHop (an acronym of Texture Generation PixelHop). TGHop has been shown to be lightweight, mathematically transparent, efficient in training and inference, and able to generate high-quality texture.

The fourth article is “Cross-layer knowledge distillation with KL divergence and offline ensemble for compressing deep neural network,” authored by Hsing-Hung Chou, Ching-Te Chiu and Yi-Ping Liao. This paper proposes an efficient compression method for compressing deep neural networks. The key is to present a cross-layer knowledge distillation framework with Kullback-Leibler divergence and offline ensemble. The fifth article is “Bridging gap between image pixels and semantics via supervision: a survey,” authored by Jiali Duan and C.-C. Jay Kuo. This paper addresses the problem that there exists a gap between low-level features and semantic meanings of images, called the semantic gap. Afterwards, the semantic gap problem is reviewed and a survey on recent efforts in bridging the gap is made in this paper. The sixth article is “Self-supervised intrinsic image decomposition network considering reflectance consistency,” authored by Yuma Kinoshita and Hitoshi Kiya. This paper presents an intrinsic image decomposition network considering reflectance consistency. The framework aims to decompose an image into illumination-invariant and illumination-variant components, referred to as “reflectance” and “shading,” respectively. The proposed network can be trained in a self-supervised manner and reliable results have been demonstrated.

Based on the papers published in this special issue, the issue brings the insight of deep neural networks in representation, interpretation, and applications in different aspects from theory to application. It is expected that it would be helpful for the readers to better understand how the deep models work and possibly design novel deep network architectures and applications.

#### **Guest Editors of the special issue:**

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