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Integrating Noisy Label Learning and Confidence Estimation

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Training a neural network is challenging when the training dataset is contaminated by labelling errors, which are commonly referred to as label noise. This challenge often coexists with the challenge of predicting confidence, allowing one to flag low-confidence predictions for the main task. Existing techniques tackle one of the two challenges but not both, neglecting their interdependency. We establish a relationship between these challenges and propose a novel unified framework named Unsupervised Confidence Approximation (UCA) to address them concurrently. UCA trains a neural network simultaneously for its main task (e.g., image segmentation) and for confidence prediction, from noisy label datasets. Importantly, UCA can be trained without confidence labels and is thus prone to unsupervised training in this respect. UCA is generic as it can be used with any neural architecture designed for the main task. We evaluate UCA experimentally using the general CIFAR-10N dataset and the medical image datasets CheXpert and Gleason-2019. Incorporating UCA into existing networks enhances performance in both aspects of noisy label training and selective prediction. UCA-equipped networks are on par with the state-of-the-art in noisy label training when used in regular, full coverage mode. However, they have a risk-management facility, showing flawless risk-coverage curves with substantial performance gain over existing selective prediction methods.

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