Binary Weight Initialization Scheme with Normalized Outputs

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Advancements in neural networks have led to significant improvements in the accuracy and performance of deep learning models, revolutionizing various fields of study. However, the underlying theoretical explanations of how these models work and why they are effective are not always well-understood. Theoretical explanations are important in developing better architectures and algorithms, interpreting the behavior of neural networks, diagnosing problems, and evaluating and comparing different models. One potential way to discover some fundamental properties of neural networks is through pruning algorithms. Pruning reduces the size of neural networks by removing weights and nodes through different criteria, resulting in smaller, more efficient models that can be trained faster and require fewer computational resources. Previous studies on pruning algorithms suggest that preserving the polarity of weights in neural networks may play a significant role in neural network training, potentially even more so than the magnitudes of the weight. In this work, we introduce a binary weight initialization scheme with the objective of improving the performance of neural networks during training. Based on the paper "Deconstructing the Lottery Ticket Hypothesis" findings on weight polarity, we hypothesize that a neural network with our initialization scheme will have a similar accuracy compared to neural networks with Glorot initialization. This scheme initializes all weights to either 1, 0, or -1 to a proportion such that the output produced by each layer is normalized. By initializing them to the previous values, we can study more the effects of weight polarities in neural network training. We ran the test results with MNIST and CIFAR-10 and obtained an equal or just below equal performance to Glorot initialization in our models, signifying the importance of weight polarities but that initial weight magnitudes still play an important role in neural network training.

Keywords: pruning algorithms, neural networks, weight initialization schemes, weight polarity