A New Loss Function for Deep Learning and Bayesian Regularisation

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Abstract

Estimation has long been a central topic in Statistics. In recent years, learning has become the dominant approach in AI for tackling problems involving unstructured data. A critical component in both Statistics and Deep Learning is the choice of loss function and performance metrics used for training and evaluating models.

Loss functions play a vital role in developing effective statistical methods (such as least-squares estimation) and achieving success in deep learning applications, including computer vision, network security, and natural language processing—fields in which various security risks have also emerged. Robust loss functions are essential for handling outliers in Statistics and adversarial examples in Deep Learning. However, most existing robust loss functions fail to address asymmetry, which often arises from skewed or imbalanced data distributions.

This talk introduces a novel Huberised-type asymmetric loss function and its corresponding probability distribution, which is shown to follow a scale-mixture of normals. We then propose a new Bayesian Huberised regularisation method for robust regression. This line of research also holds promise for the development of new Bayesian network models.