

# Monte Carlo DropBlock for Modelling Uncertainty in Object Detection

## Summery:

This paper addresses a critical limitation in deep learning-based object detection: the lack of uncertainty modeling, especially in out-of-distribution (OOD) scenarios common in real-world applications such as autonomous driving and healthcare. Traditional models like YOLO often make overconfident predictions without accounting for uncertainty. To tackle this, the authors propose **Monte Carlo DropBlock (MC-DropBlock)** — a novel inference technique that extends the DropBlock regularization method to both training and test phases in convolutional neural networks.

The approach models **epistemic uncertainty** by using DropBlock at inference time, which mimics Bayesian model averaging. The authors theoretically show that this process approximates Bayesian convolutional neural networks through variational inference. Additionally, **aleatoric uncertainty** is captured using a Gaussian likelihood that models the localization uncertainty in object detection.

The method was integrated into popular models such as YOLOv4, YOLOv5, and YOLACT, and evaluated through extensive experiments. The results demonstrated that MC-DropBlock improves **generalization, calibration, and uncertainty modeling** compared to standard DropBlock, MC-Dropout, and Gaussian YOLO models. Evaluations used mAP, Brier scores, and entropy on datasets like COCO, Pascal VOC, and CIFAR-10, with MC-DropBlock showing superior performance in both object detection and classification tasks.

Ultimately, the paper establishes MC-DropBlock as a computationally efficient and effective method for uncertainty estimation in vision tasks involving fully convolutional networks.

## Improvement:

We propose a dynamic DropBlock schedule where a higher drop probability is used during the early training phase to enhance regularization and improve generalization. As training progresses, the drop probability is gradually reduced to zero, enabling the model to fully utilize learned features for stable convergence.

**Link:** [Monte Carlo DropBlock for modeling uncertainty in object detection - ScienceDirect](#)