

# Mitigating the Impact of Object Overlapping on YOLOv4 Object Detection

Shahrzad Sayyafzadeh, Idongesit Mkpang-Ruffin, Chutima Boonthum-Denecke  
Florida A&M University, Department of Computer and Information Sciences  
Hampton University, Department of Computer Science

## Abstract

Object detection algorithms like You Only Look Once (YOLOv4) can face challenges when multiple objects overlap within the same grid cell. In this scenario, accurately detecting and classifying each object becomes difficult. Data augmentation techniques can address this issue and improve the accuracy of YOLOv4. More diverse training data can be created by artificially generating images with non-overlapping objects through random shifting, rotating, resizing, color jittering, and flipping. This improves the robustness of the model and helps it better handle real-world images with diverse object configurations. Data augmentation and post-processing can help address overlapping objects in YOLOv4, improving accuracy and performance in object detection tasks. The network was trained to recognize 80 object classes and achieved a 99% prediction rate and 54% confidence rate.

## Method

- I. Darknet is a pre-trained model for object detection in computer vision.
- II. Prediction confidence rate is a key metric used to evaluate the performance of darknet and other pre-trained models.
- III. By analyzing a histogram of detected objects with their corresponding prediction confidence rates, developers can gain insights into the performance of the object detection model.
- IV. The histogram shows that most detected objects fall into the higher confidence rate bins, indicating that the model has correctly identified these objects with a high degree of confidence.
- V. The methodology for implementing the Kalman filter for a YOLOv4 object detection model involves obtaining the frequency and impulse responses and applying the Kalman filter to estimate the state of the system based on the observed data.

## Conclusion

- I. Accurately detecting and classifying overlapping objects can be addressed by utilizing data augmentation techniques such as random shifting, rotating, resizing, color jittering, and flipping, which improve the model's accuracy.
- II. Generating more diverse training data with non-overlapping objects enhances the model's robustness and ability to handle various object configurations in real-world images. By combining data augmentation and post-processing techniques, the accuracy and performance of YOLOv4 in object detection tasks can be significantly improved.