

Project Title: Automated Weapon Surveillance System using Deep Learning

Title of Journal: Weapon Detection in Real-Time CCTV Videos Using Deep Learning

Authors:

Muhammad Tahir Bhatti, Muhammad Gufran Khan (Senior Member, IEEE), Masood Aslam, Muhammad Junaid Fiaz

Published in: IEEE Access, Feb 12 2021

DOI: 10.1109/ACCESS.2021.3059170

Abstract:

The paper addresses the challenge of detecting weapons in real-time CCTV footage using deep learning. Despite advancements in algorithms, hardware, and cameras, real-time weapon detection remains difficult due to factors like angle variations, occlusions, and small object size. The authors developed a system using state-of-the-art open-source deep learning algorithms to detect weapons, focusing primarily on pistols. The research involved creating a custom dataset from various sources, including manual images, YouTube videos, and online repositories. The study compares several algorithms, concluding that YOLOv4 performed best with a mean average precision of 91.73% and an F1-score of 91%.

Methods:

Sliding Window/Classification, Region Proposal/Object Detection

The algorithms tested included VGG16, Inception-V3, Inception-ResnetV2, SSDMobileNetV1, Faster-RCNN Inception-ResnetV2 (FRIRv2), YOLOv3, and YOLOv4. Precision and recall were prioritized over accuracy for object detection.

Dataset:

A novel dataset of 8327 images was created, consisting of images taken with cameras, extracted from YouTube CCTV videos, GitHub repositories, and the Internet Movies Firearms Database (IMFDB). The dataset was preprocessed using OpenCV filters to enhance low brightness and resolution images.

Results:

YOLOv4 outperformed other models with an F1-score of 91% and a mean average precision of 91.73%. The system proved effective in real-time weapon detection even under challenging conditions.

Contributions:

- Development of a comprehensive real-time weapon detection system.
- Creation of a novel, extensive dataset for weapon detection.
- Introduction of confusion objects to reduce false positives and negatives.
- Evaluation of state-of-the-art deep learning models for weapon detection in real-time CCTV footage.

Conclusion:

The study successfully implemented a real-time weapon detection system using deep learning, significantly improving over previous methods. Future work will focus on enhancing the system's robustness and extending its application to other types of weapons.