UNIVERSITI TEKNOLOGI MARA
College of Built Environment

Poster Book

IIIDBEEX 2023

20 JANUARY 2023

International Invention, Innovation & Design Exposition for Built Environment and Engineering 2023

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X-Ray Baggage Object Detection Using Neural Networks for Safety Purposes

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INTRODUCTION

- X-rays have been employed to assist in object detection for airport security purpose. X-ray machines usually scans the content of baggage used by travelers to detect if there are any anomalies contained.
- Images that are generated by the x-ray machines are carefully checked by officers onsite to ensure the travelers do have any prohibited items in their baggage. The entire inspection process usually takes 5-15 seconds, depending on the quality of the x-ray image produced as well as the years of expertise and knowledge of security officer.
- Convolutional Neural Network (CNN), and emerging concept comes under the umbrella of Artificial Intelligence and Deep Learning is the subject of interest that can increase the efficiency of object detection via X-Ray images whilst eliminating the discrepancies of human inspection.

ISSUES/ PROBLEM STATEMENT

The conventional way of x-ray baggage object detection has relatively low accuracy, i.e., only 50%, due to fatigue experienced by the airport security officers that perform checking the baggage. Sometimes, it is also difficult for officer to identify suspicious objects stored in baggage due to the poor quality images produced by X-ray machine.

OBJECTIVES

- To develop an innovative solution to address airport security issue by leveraging the benefits of deep learning method.
- To develop a threat object detection model using CNN.
- To analyze the effect of key parameters on the proposed framework and compared its performance with state-of-art methods.

METHODOLOGY

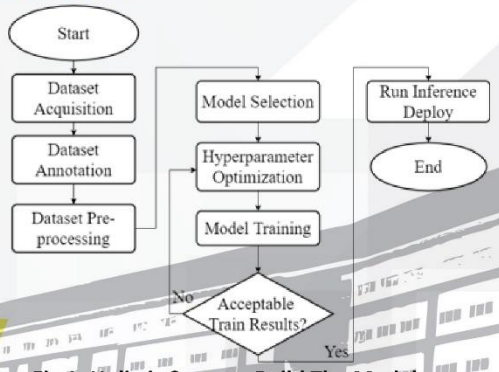


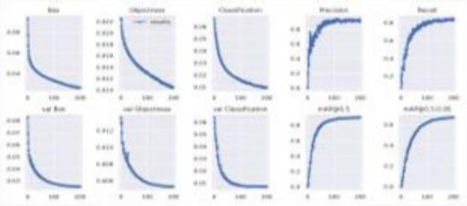
Fig 1: Holistic Steps to Build The Model

FINDINGS

Table 1: Comparison of Different Models

	Recall	Precision	F1- score	mAP@0.5	mAP@0.5:0.95
YOLOv5	***84.6***	***90.4***	***87.4***	***90.0***	***66.67***
YOLOv3	73.7	75.6	74.3	76.8	-
MobileNetSSD v2	38.0	44.0	40.8	28.1	-

Fig 2: Graph of Precision, Recall, mAP, and losses.



COMMERCIALIZATION

This project stands a chance to be commercialized, however for full scale commercialization it is important to use high-end computers to build the neural networks in order to get good performance metrics and speed.

RECOGNITIONS / CONFERENCES

- Gold Award Recipient at Thesis in 5 Minutes.
- Silver Award Recipient at InIIC Series 2/2022.
- Manuscript Accepted to be Published by Springer Singapore.
- Bronze Award at VIC 3/2022.
- Bronze Award at RICE 2023

NOVELTY

Hyperparameters are optimized by stochastic descent gradient. The proposed model uses the dense prediction, Cross Spatial Network, and Path Aggregate Network (PANet) for its head, backbone, and neck respectively.

CONCLUSION

The proposed model has mAP of 90.0%, precision of 90.4%, recall of 89.6%, and f1-score of 87.4%. The model can achieve at least 83.0% of accuracy level with the inference time of 0.008s, hence it is suitable for real-time application to address airport security issue.

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