# RESEARCH PROJECT REPORT

**Project 73**

**Identifying intruders on scooters entering carparks**

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**ABSTRACT**

This project addresses the growing security concern of e-scooter riders entering carparks to commit offenses by developing an accurate and efficient detection system. With the rising popularity of e-scooters, there is an urgent need for automated surveillance solutions that can identify potential intruders in real-time. Our research focuses on enhancing e-scooter detection accuracy while balancing real-world constraints such as limited compute resources and the need for rapid detection.

We investigate the effectiveness of fine-tuning various pre-trained deep learning models for e-scooter detection. We hypothesize that leveraging models originally trained on humans will boost detection accuracy, reduce training times, and address the key problem of a lack of e-scooter data. The models that were fine tuned were originally trained to detect humans, cars, motorcycles, and more — progressively becoming less domain relevant to observe any advantages. Our research also addresses the challenge of occlusion, which is common in crowded urban environments. [ADWAIT INSERT HERE]

Key findings reveal that fine-tuned models originally trained on [specific domain] data perform best for e-scooter detection, achieving a mean Average Precision (mAP) of [X%] on our test set. Our occlusion handling methods improved detection accuracy by [Y%] in scenarios with partial obstruction. We also identify important trade-offs between model size, inference speed, and detection accuracy, crucial for real-time applications.

This research contributes to the field of object detection by demonstrating effective transfer learning strategies for a niche application and addressing the specific challenges of e-scooter detection in security contexts. Our findings have important implications for the development of smart surveillance systems in urban environments, offering a balance between accuracy and computational efficiency.

## DECLARATION

**Student**

I hereby declare that:

1. This report is the result of the final year project work carried out by my project partner (see cover page) and I under the guidance of our supervisor (see cover page) in the 2024 academic year at the Department of Electrical, Computer and Software Engineering, Faculty of Engineering, University of Auckland.
2. This report is not the outcome of work done previously.
3. This report is not the outcome of work done in collaboration, except that with a potential project sponsor (if any) as stated in the text.
4. This report is not the same as any report, thesis, conference article or journal paper, or any other publication or unpublished work in any format.

In the case of a continuing project, please state clearly what has been developed during the project and what was available from previous year(s):

Signature:

Date:

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# Acknowledgements

Thank important people here. Be sure to thank your mum.

# Glossary of Terms

Term Definition

# Abbreviations

AOA Angle of attack

# Introduction

Some text [[1](#_bookmark4)].

## Subsection

Some text.

### Subsubsection

Another text.

# Next Section

Some text.

# References

[1] M. J. Balas, Y. J. Lee, and L. Kendall, “Disturbance tracking control theory with application to horizontal axis wind turbines,” in *Proceedings of the 1998 ASME Wind Energy Symposium*, Reno, Nevada, 12-15 January 1998, pp. 95–99.

# Appendix A The First Appendix

**Program A1** Some MATLAB script

1. % SaveExperiment. m: This file prompts the user to save the data
2. % and plots the results.

3 %

1. % This file is meant to be run autoamtically after lab experiment is
2. % finished .

6 %

7 % Hazim Namik Date created : 14 /4 /2019

8

9 clc;

10

1. % prompting the user to specify a file name and a location
2. [ fileName , filePath ] = uiputfile(’\*. mat’,’ Save file name ’);
3. % Checking if the user clicked cancel
4. if(~( ischar( fileName)&& ischar( filePath )))
5. disp (’ Canceled . No data was saved .’);
6. return
7. end
8. % Saving the file at the specified location
9. save ([ filePath , fileName],’ ActualPump Usage ’, ’ ActualError ’, ’ Tank HeightAll ’, ’ Sim Pump Usage ’, ’ Sim Error ’);

# Appendix B Second Appendix