YOLO with Integrated Multi-Scale Domain Adaptation

A report submitted in partial fulfillment of the requirements for the award of a degree of

Bachelor of Technology

in

Computer Science and Engineering

by

G. Yashwanth

(21EG505827)

G. Sampath Reddy

(21EG505829)

S. Teja Reddy

(21EG505859)

Under the Guidance of

Mrs. B. Ujwala,

Asst. Professor, Department of CSE

Department of Computer Science and Engineering

ANURAG UNIVERSITY

Venkatapur (V), Ghatkesar (M), Medchal (D)., T.S-500088

(2023-2024)

DECLARATION

We hereby declare that the report entitled **"YOLO with Integrated Multi-Scale Domain Adaptation"** submitted for the award of the degree of **Bachelor of Technology (B. Tech)** in Computer Science and Engineering is a record of an original work done by us and the report has not formed the basis for the award of any degree, diploma, associateship or fellowship of similar other titles. It has not been submitted to any other University or Institution for the award of any degree or diploma.

G. Yashwanth
21EG505827

G. Sampath Reddy
21EG505829

S. Teja Reddy
21EG505859

Place:
Date:

ANURAG UNIVERSITY | SCHOOL OF ENGINEERING

CERTIFICATE

This is to certify that the report entitled **"YOLO with Integrated Multiscale Domain Adaptation"** is being submitted by **Mr. G. Yashwanth** bearing the Hall Ticket number **21EG505827**, **Mr. G. Sampath Reddy** bearing the Hall Ticket number **21EG505829**, **Mr. S. Teja Reddy** bearing the Hall Ticket number **21EG505859** in partial fulfillment for the award of the Bachelor of Technology in Computer Science and Engineering to the Anurag University is a record of bonafide work carried out by them under my guidance and supervision for the academic year 2023 to 2024.

The results embodied in this report have not been submitted to any other University or Institute for the award of any other degree or diploma.

Signature of Supervisor
Mrs. B. Ujwala
Assistant Professor
Department of CSE

Signature of Dean
Dr. G. Vishnu Murthy
Dean, CSE

External Examiner

ACKNOWLEDGEMENT

We would like to express our sincere thanks and deep sense of gratitude to project supervisor **Mrs. B. Ujwala,** Assistant Professor, Dept of CSE for her constant encouragement and inspiring guidance without which this project could not have been completed. Her critical reviews and constructive comments improved our grasp of the subject and steered to the fruitful completion of the work. Her patience, guidance and encouragement made this project possible.

We would like to express our special thanks to **Dr. V. Vijaya Kumar**, Dean School of Engineering, Anurag University, for his encouragement and timely support in our B. Tech program.

We would like to acknowledge our sincere gratitude for the support extended by **Dr. G. Vishnu Murthy**, Dean, Dept. of CSE, Anurag University. We also express our deep sense of gratitude to **Dr. V V S S S Balaram**, Academic Coordinator, **Dr. Pallam Ravi**, Project Coordinator and Project Review Committee members, whose research expertise and commitment to the highest standards continuously motivated us during the crucial stage of our project work.

G. Yashwanth
(21EG505827)

G. Sampath Reddy
(21EG505829)

S. Teja Reddy
(21EG505859)

ABSTRACT

Domain adaptation is crucial for mitigating the domain shift problem encountered by many deep learning applications, stemming from differences in the distributions of training and real-world testing data. In response, we present a pioneering Multi-Scale Domain Adaptive YOLO (MSDAYOLO) framework. MS-DAYOLO integrates multiple domain adaptation paths and corresponding domain classifiers across various scales of the YOLOv4 object detector. Furthermore, we introduce three innovative deep learning architectures for a Domain Adaptation Network (DAN) aimed at generating domain-invariant features: Progressive Feature Reduction (PFR), Unified Classifier (UC), and an integrated architecture. Through comprehensive training and testing on established datasets, our experiments demonstrate substantial enhancements in object detection performance when utilizing YOLOv4 with the proposed MS-DAYOLO architectures, particularly in autonomous driving scenarios. Additionally, MS-DAYOLO exhibits a remarkable real-time speed improvement compared to Faster R-CNN solutions, while maintaining comparable object detection accuracy.

Keywords: Domain adaptation, Domain shift, MultiScale Domain Adaptive YOLO (MSDAYOLO), YOLOv4, Object detection, Domain Adaptation Network (DAN), Progressive Feature Reduction (PFR), Unified Classifier (UC), Faster R-CNN.

CONTENTS

LIST OF FIGURES