Half Yearly Progress Report for Jul-Nov 2019

Name: Sadbhavana Babar

Registration No: CS18S029

Department: Computer Science and Engineering

Date of Joining: 09/07/2018

Specialization / Stream: Computer Vision

Area of Research work: Scene understanding, object detection and recognition

Category of Admission: Project

Guide: Prof. Sukhendu Das

Date of GTC meetings:

Description	Event	Date
1st GTC meeting	Research Scholar will have a Mid-Term Review meeting. GTC may recommend on continuation of HTRA.	1.5 years
2nd GTC meeting	Seminar	
3rd GTC meeting	Submission of Synopsis	1 month before thesis submission

Details of Course work

S.No	Course No.	Course Title	Sem/Year	Credits	Grade
Core Courses					
1.	CS6015	Linear Algebra and Random Processes	I (Jul-Nov 2018)	12	B
2.	CS6730	Probabilistic Graphical Models	II (Jan-May 2019)	12	A
3.	CS7015	Deep Learning	II (Jan-May 2019)	12	A

Elective Courses					
1.	CS5020	Non-Linear Optimization : Theory and Algorithms	I (Jul-Nov 2018)	12	C
2.	CS5691	Pattern Recognition and Machine Learning	I (Jul-Nov 2018)	15	C
3.	CS6350	Computer Vision	II (Jan-May 2019)	12	B
4.	CS6777	Optimization Methods for Computer Vision Applications	III (Jul-Nov 2019)	12	
Compulsory Courses / Optional Courses					
1.	ID6020	Introduction to Research (Institute Module)	I (Jul-Nov 2018)	0	P
2.	CS6021	Introduction to Research	I (Jul-Nov 2018)	0	P

Signature of Scholar   Signature of Guide

Contents

i) Title of Research Work : Scene Understanding for identification of covert geo-locations, in a scene, using a Hyper-classifier based Visual Intelligent System.

ii) Problem Definition / Research Objectives :

Object Detection and Recognition is one of the fundamental problems in Computer Vision which helps to understand visual scenes better. Depending on the kind of problem to be solved, there are two types of methods for Object Detection and Recognition - i) Single stage method : Here the main target is the speed with which the objects are detected in a scene. ii) Two stage methods : Here the target is the accuracy with which the algorithm is able to detect objects in a given scene. Its main purpose is to classify the objects into their correct classes and localize them accurately. So there is always a trade-off between speed and accuracy. Hence the goal is to design an algorithm which will be able to bridge this gap.

iii) Summary of Work Done before Review (From the date of admission till now)

- Dataset collection for the project : Collected indoor scenes in the form of images/videos shot inside the campus in various labs and corridors. We have collected around 200 videos approximately, with an average length of 35-40 seconds per video.
- Annotation of the dataset collected : Completed annotation of the VPOD (VP Lab Object Dataset) dataset.
- Created an in-house Handheld Object Dataset (HHOD) for the task of handheld object detection.
- Fine-tuned Yolov3, a real-time fast and accurate object detection algorithm on our in-house datasets both VPOD and HHOD.
- Course work : Completed seven courses, three in the first semester (Jul - Nov 2018), three in the second semester (Jan - May 2019) and one in the third semester (Jul - Nov 2019). In the first semester I took courses which would help me build my fundamentals to work in the field of machine learning. In Linear Algebra and Random Processes, I learnt about the importance of using different kinds of Matrices and their decompositions. I also learnt about different types of Probability Distributions which can be closely mapped onto some real world problems. In Non-Linear Optimization, I learnt about various techniques to solve different kind of optimization problems. I learnt about SVMs, logistic regression, gradient descent and its variants. In Pattern Recognition and Machine Learning, I learnt about Bayesian classifiers, GMMs, HMMs and their applications in solving problems related to speech and vision related tasks. I also learnt about non-parametric techniques to solve complex machine learning problems, and also dimensionality reduction methods like PCA, LDA. In the third semester, I studied about various methods in applications of optimization in computer vision which would help me in my research.
- Attended 11th Indian Conference on Computer Vision, Graphics and Image Processing (ICVGIP) 2018 held at IIIT Hyderabad from 18/12/2018 to 22/12/2018.
- Literature Review : Read research papers about recent advances in Object Detection and Recognition. Found out some unexplored areas in the field of object detection.

iv) Work Done During Review (Odd Semester : Jul-Nov 2019)

- Attended CVIT summer School 2019 at IIIT Hyderabad from 01/07/2019 to 07/07/2019. During the course of this period, I had an exposure about ongoing research in a plethora of tasks involved in the domain of Computer Vision.
- Created a Handheld Object Dataset (HHOD) for object detection task comprising of around ~7K images in training and ~2K images in testing. The

videos for the same were shot on high-resolution DSLR cameras as well as low resolution Sony handycams as well as USB cameras. The dataset comprises of about 12 classes. Presented this dataset and an online demo of the objects detected while holding them in hand, in the Indo-Japanese Smart City Symposium held in ICSR, IIT Madras on 30/10/2019.

- Fine-tuned Yolov3, a real-time fast and accurate object detection algorithm on our in-house datasets both VPOD and HHOD, for the Imprint TechEx 2019 held in IIT Delhi on 03/08/2019 and 04/08/2019. Also, comparison was done for this method with the state of the art methods for both high-end version as well as a light-weight version.

- Course work : Completed CS6777 course. This course gave deep insights about optimization in computer vision. The course seminars helped me in understanding classical as well as deep learning solutions for a real-world problem. Also the course term project assignment (TPA) was one of the building blocks towards my research. Performed experiments by modifying loss functions in the original architecture of CentreNet for the TPA.

- Attended IMPRINT Project Review Meeting II held at IIT Delhi from 31/10/2019 to 1/11/2019.

- Literature Review : Read papers about recent advances in Object Detection and Recognition and successfully implemented one of them on some standard datasets available for the same, like PASCAL VOC 2007, MS COCO, ImageNet VID, CityScapes. Also trying to implement codes and performing modifications to the existing architectures for bringing in novelty.

- Attended various seminars in and outside the department related to my field of research.

v) Issues affecting Research Progress, if any : None

vi) Future Plans, with proposed timeline :

- **Research work :** The problem of domain adaptation and knowledge distillation in object detection still remain unexplored. Future plan is to club these two techniques to design an object detection algorithm whose performance is at par with current methods available, both in terms of speed as well as accuracy and evaluate its performance standard benchmark datasets available for the same.

vii) Visible Research Output :

(a) Paper(s) Published in Journals : None

(b) Full Paper(s) Published in Conference Proceedings : None

(c) Seminars/Workshops/Conferences/Exchange Programmes attended and Papers Presented :

- Attended 11th Indian Conference on Computer Vision, Graphics and Image Processing (ICVGIP) 2018 held at IIIT Hyderabad from 18/12/2018 to 22/12/2018.
- Visited DRDO, CAIR in Bangalore for getting insight about the ongoing IMPRINT Project from 10/01/2019 to 11/01/2019.
- Attended CVIT Summer School 2019, IIIT Hyderabad from 1/7/2019 to 7/7/2019.
- Fine-tuned models of YOLOv3 on in-house datasets VPOD and HHOD presented at the IMPRINT TechEx Meeting held at IIT Delhi from 03/08/2019 and 04/08/2019.
- HHOD dataset presented at the Indo-Japanese Smart City Symposium, IIT Madras on 30/10/2019.
- Attended IMPRINT Project Review Meeting II held at IIT Delhi from 31/10/2019 to 01/11/2019.

(d) Awards/Honours, if any :
- Awarded cash prize for being in the top-20 performers in the CVIT Summer School, 2019 held at IIIT Hyderabad from 01/07/2019 to 07/07/2019.