CERTIFICATE

It is certified that **ANINDYA GHOSAL (Enrollment No.: 2020PSP3007)** has carried out their search work presented in this thesis entitled **“Bounding Box Refinement Agent For Overlapping Objects"** for the award of **Master of Technology** from Netaji Subhas University of Technology, New Delhi, under my supervision. The thesis embodies the results of original work, and studies are carried out by the student himself/herself (print only that is applicable)and the contents of the thesis do not form the basis for the award of any other degree to the candidate or to anybody else from this or any other University/Institution.

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BOUNDING BOX REFINEMENT AGENT FOR OVERLAPPING OBJECT

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ABSTRACT

With the advancement in the field of computer vision and neural networks, it feels like every day a new architecture with better performance than the previous architectures is being created. Massive networks with multiple layers and skip connections with a plethora of loss functions and approaches are being used. One of the most important areas of the use of convolutional neural networks is in the field of object detection. Now in a business use case when an object detection algorithm is used, all the compatible packages are installed and the functioning of the business is smooth. Now it is not possible for the organizations to scrap the framework they put in place every time a new detection algorithm is in the market.

So to save cost, effort, and time, the work in this literature is aimed at correcting incorrect bounding boxes. Incorrect bounding boxes in the context of this literature are the change in the target object of object detection. If the target object in a detection algorithm is changed, it is not possible to re-annotate the complete dataset and retrain the complete detection model. So the approach in this work aims at using the concept of reinforcement learning on a subset of data annotated separately. Using the agent trained on the subset of data, make it learn how to correct the bounding boxes and then used the agent to correct the changed target object detection over the complete dataset. An object detection algorithm is used to first detect target objects, then based on ground truth boxes the agent learns to correct the boxes on the training dataset, and the knowledge it learns is transferred for testing and correcting other bounding boxes.

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List of Symbols and Abbreviations

s_n	:	Given element from a collection of states
ω_n	:	Given element from a collection of observations
t	:	Given time step of the agent
a_t	:	Given element from a collection of actions
r_t	:	Given element from a collection of rewards
t+1	:	Time step after the current time step
S	:	Collection of all the states
A	:	Collection of all the actions
R	:	Collection of all the rewards
Ω	:	Collection of all the observations
T	:	Collection of all the state transition probabilities
γ	:	Discount Factor
$P[S_{t+1}\|S_t]$	:	Probability that the next state will be S_{t+1} given the previous state is S_t
$P[S_{t+1}=s' \| S_t = s]$	:	Transition probability
π (a | s)	:	Policy or function that maps states to actions
$Q^{\pi}(s, a)$	:	Q-Value of a state based on action, following policy π
$Q^{*}(s, a)$	:	Optimal Q-Value