NRI: Self-Supervised Object Detection and Visual Navigation

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- Learning visual representations for navigation and mapping
- Novel Out-of-Distribution Object Detection

Learning visual representations for navigation and mapping

Mapping and localization difficulties: data association, choice of models, global optimization, loop closure, scalability, followed by **planning and control**
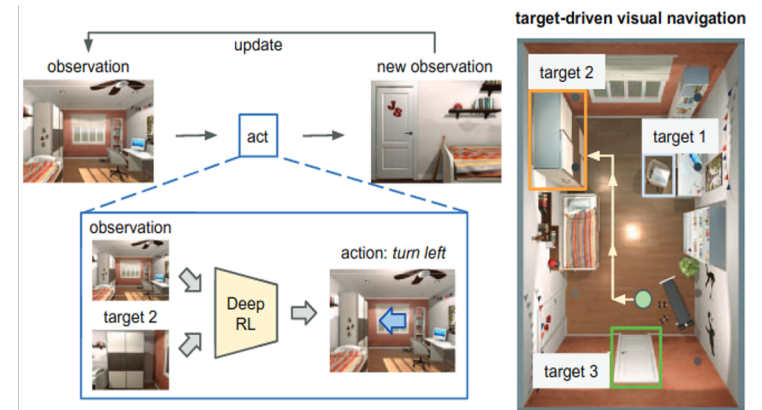
[Song SUN RGB-D et al.]   [Atanasov et al. ICRA'17]

End-to-end learning policies for goal or target driven navigation without a map   [Zhu al. ICRA'17]   [Das et al. CVPR'18]

Learning visual representations for navigation and mapping

Short range visual navigation

- Use learning to improve matching
- End-to-end visual servoing/homing
- Deep Q-learning framework with image error dense reward structure

- Goal specified as object detected by object detector
- Goal specified as desired view
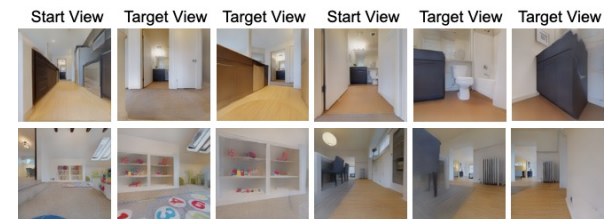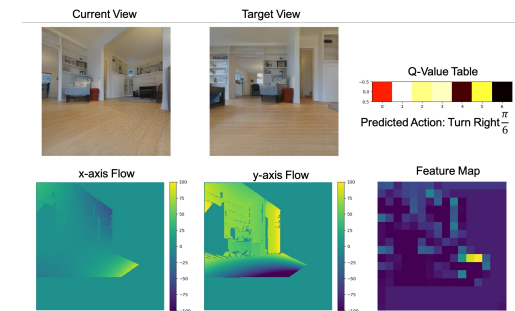
Y. Li, J. Kosecka. Learning View and Target Invariant Visual Servoing for Navigation, ICRA 2020

Learning visual representations for navigation and mapping

Mid-range target driven visual navigation

- Goal specified as semantic target category not in the FOV of the agent
- Learn a policy for finding the target using semantic features while simultaneously learning to localize and build 2D allocentric semantic map
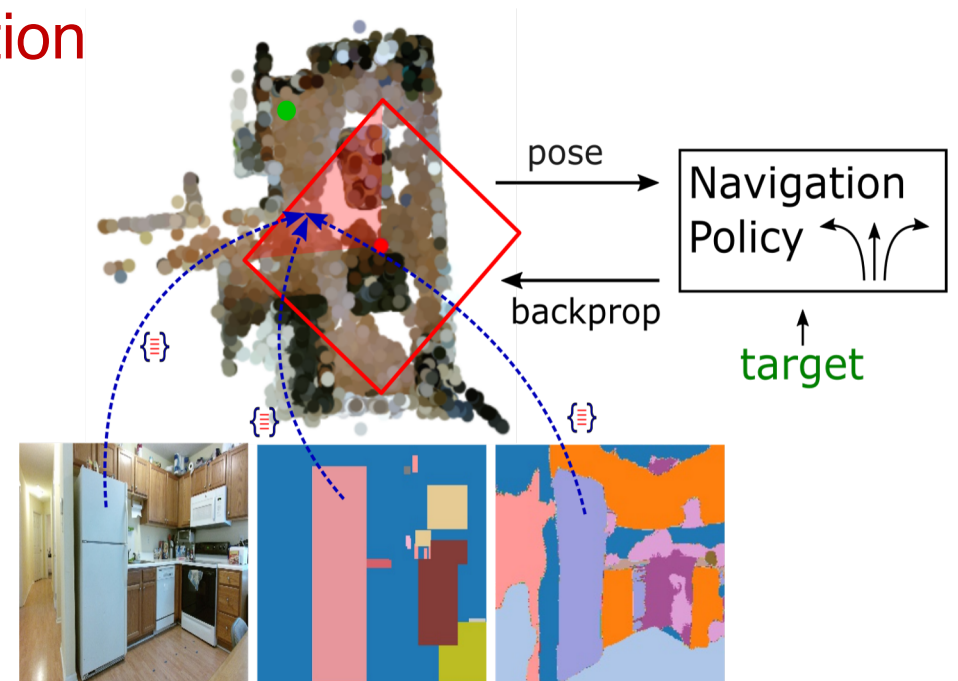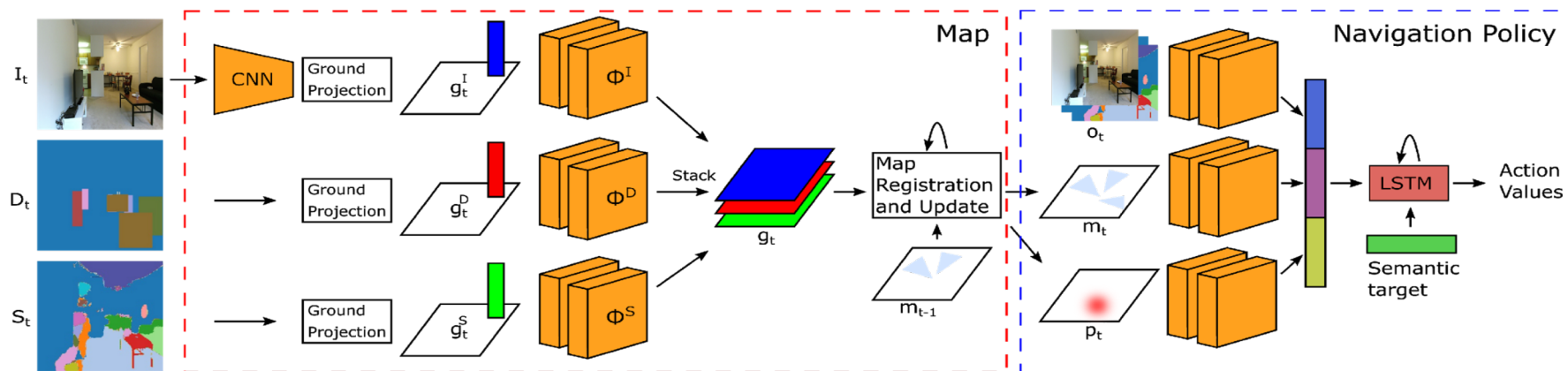

G. Georgiakis, Y. Li, J. Kosecka. Simultaneous Mapping and Target Driven Navigation, *arXiv* 2019

Learning visual representations for navigation and mapping

Mid-range target driven visual navigation

- Mapping module localizes the agent by registering observations in the map using distilled semantic and appearance information stored in the map and uses the build so far to find the target

G. Georgiakis, Y. Li, J. Kosecka. Simultaneous Mapping and Target Driven Navigation, *arXiv* 2019

Novel Out-of-Distribution Object Detection

- Detect the objects from different categories object detector or a semantic segmentation model in the training data.
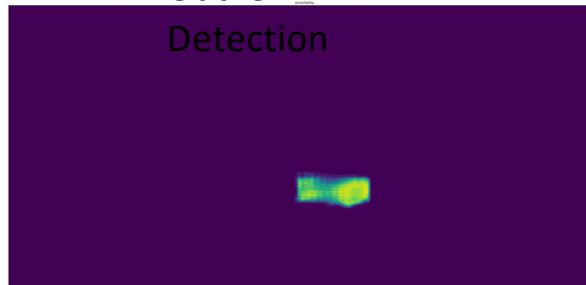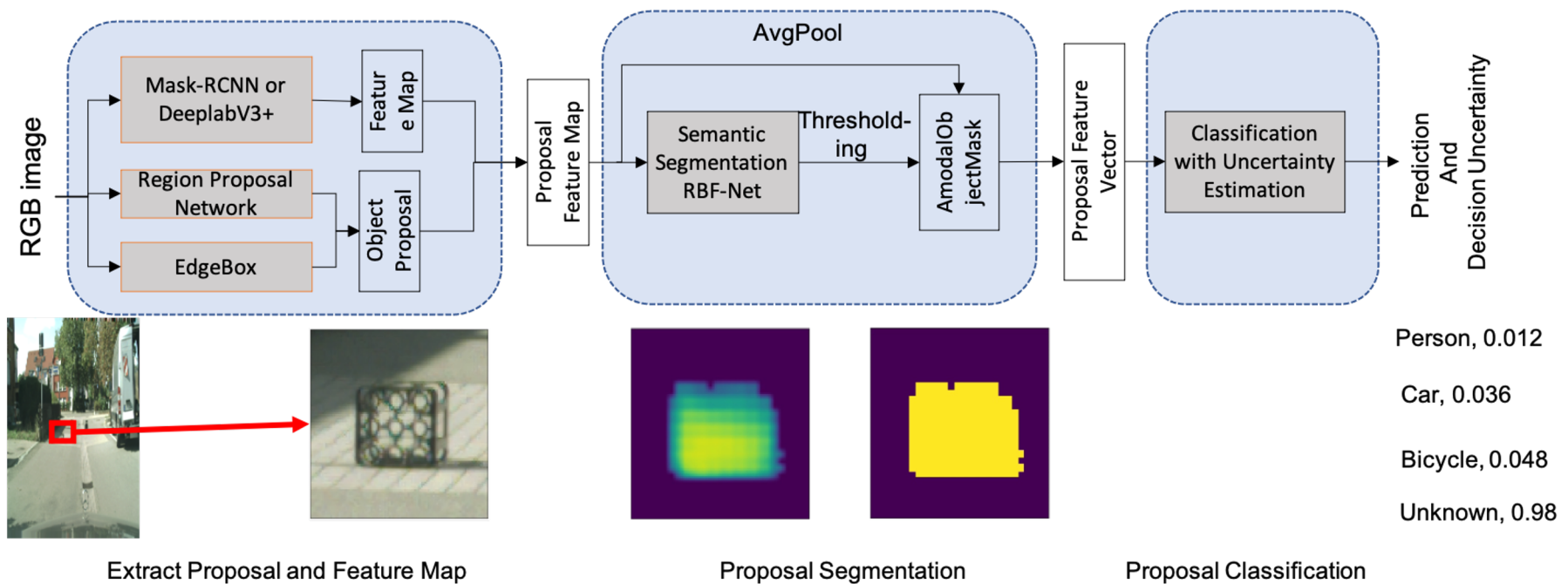- Unknow objects obstacles, self-supervised object discovery

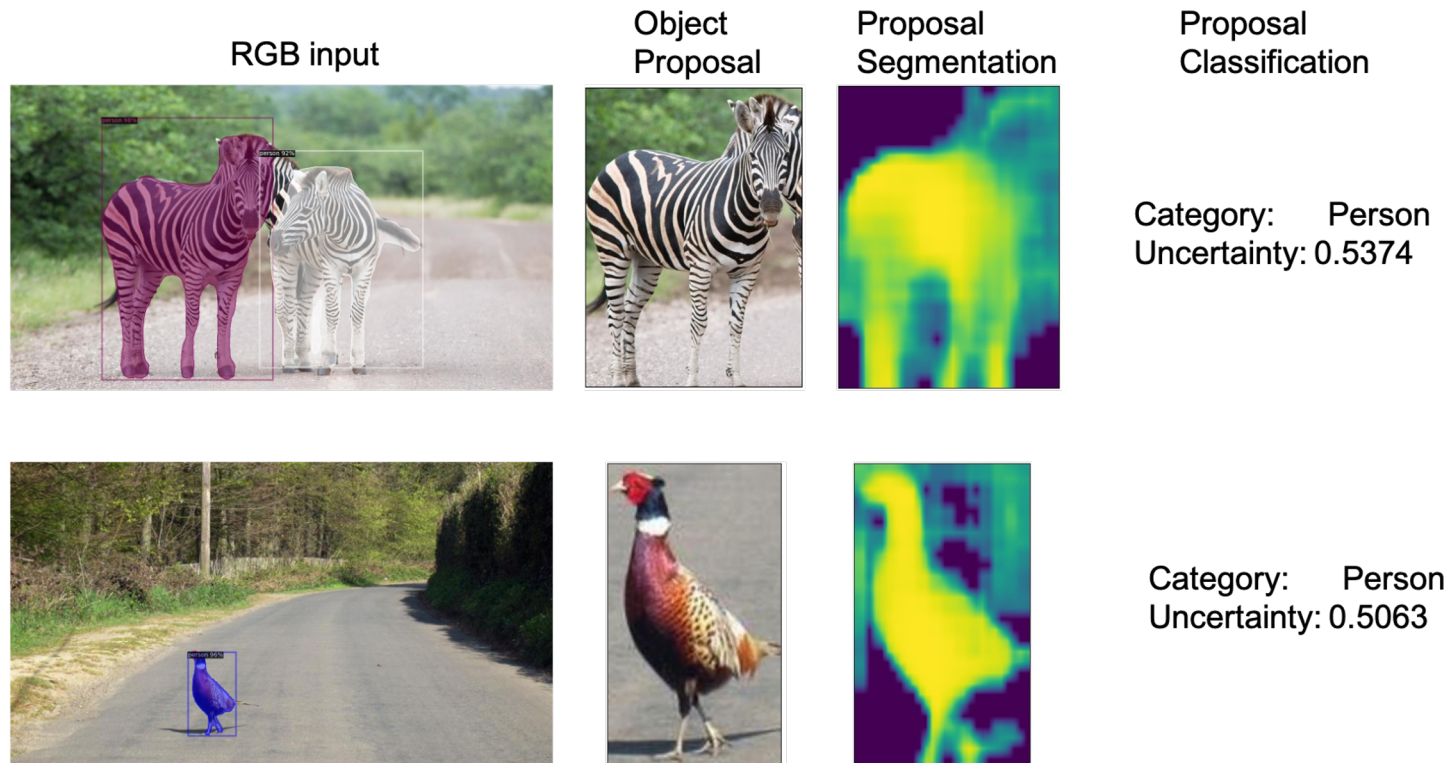RGB Input

Semantic

Outlier
Detection

Task: Novel Out-of-Distribution Object Detection

- Semantic segmentation on object proposals accompanied with uncertainty estimates
- Train a model that classifies object proposals with the help of both semantic segmentation and object detection features as unknown or known objects

Extract Proposal and Feature Map   Proposal Segmentation   Proposal Classification

Task: Novel Out-of-Distribution Object Detection

Improve faulty predictions of Mask-RCNN

RGB input	Object Proposal	Proposal Segmentation	Proposal Classification

Category: Person
Uncertainty: 0.5374

Category: Person
Uncertainty: 0.5063

Thank you !