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Determining the accessibility of parking spaces in unfavorable conditions

FINAL PROJECT OF INTRO2CV

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PLAN

INTRODUCTION

- Looking for a parking spot is a *common* and often *stressful activity;* it takes *a large amount of time*.
- Have to pay a high amount in parking fines.
- Imbalance between parking demand and availability because of the *growth of automobile ownership.*
- Consumes around one million barrels of oil every day and contributes to *air pollution.*

⇒ PROJECT: **locate vacant parking spaces** in parking lots based on bird's-eye view photographs acquired by cameras in unfavorable conditions.

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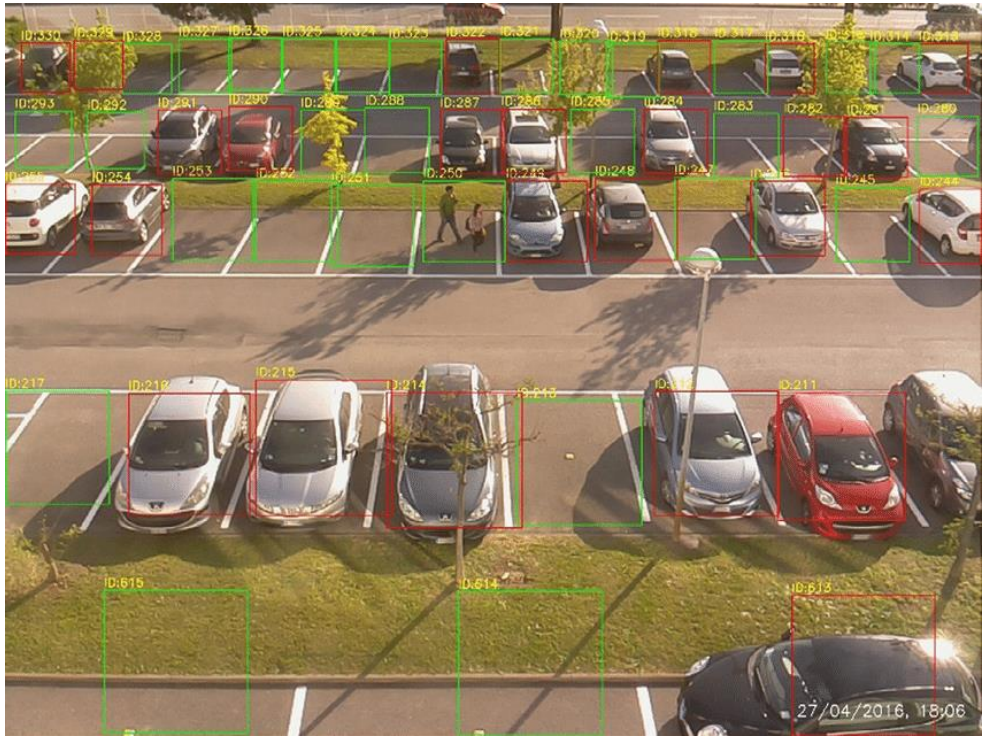
What is the expected value?

- Graphical display of available parking spaces
- Center coordinates
- Occupation status

PROBLEM DESCRIPTION



Ideal case:

- There are parking markings
- The images of the cars are not distorted in any way

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But what about real life?

Real case:

- There are **no** parking markings
- Cars are **covered** with snow

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Proposed methods

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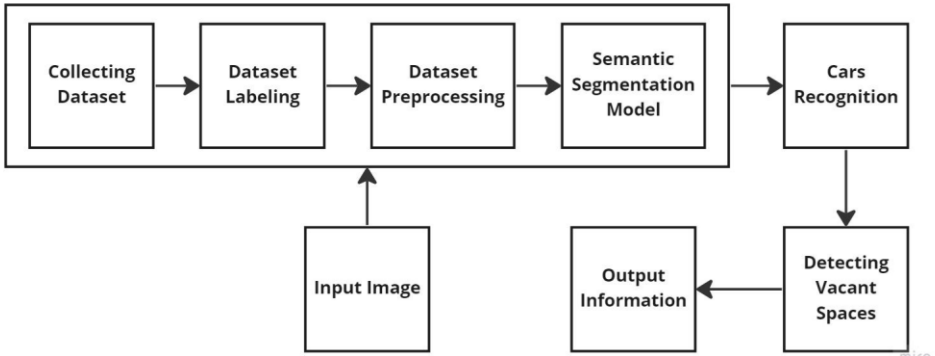
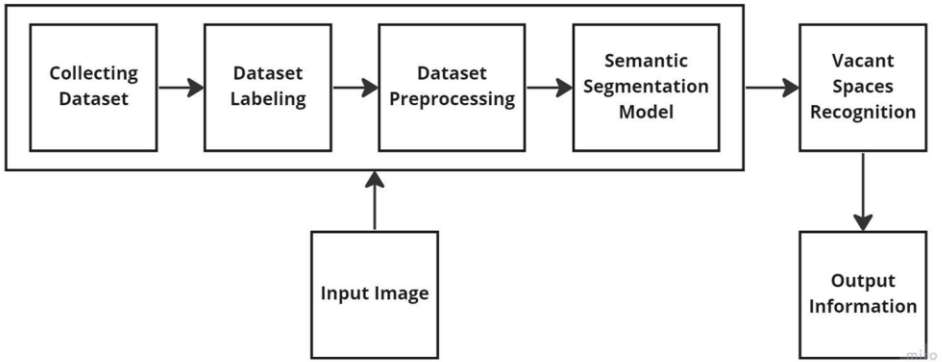


First method



Second method

Dataset - 1 DESCRIPTION

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Dataset - 2 DESCRIPTION

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COMPUTER VISION PIPELINE

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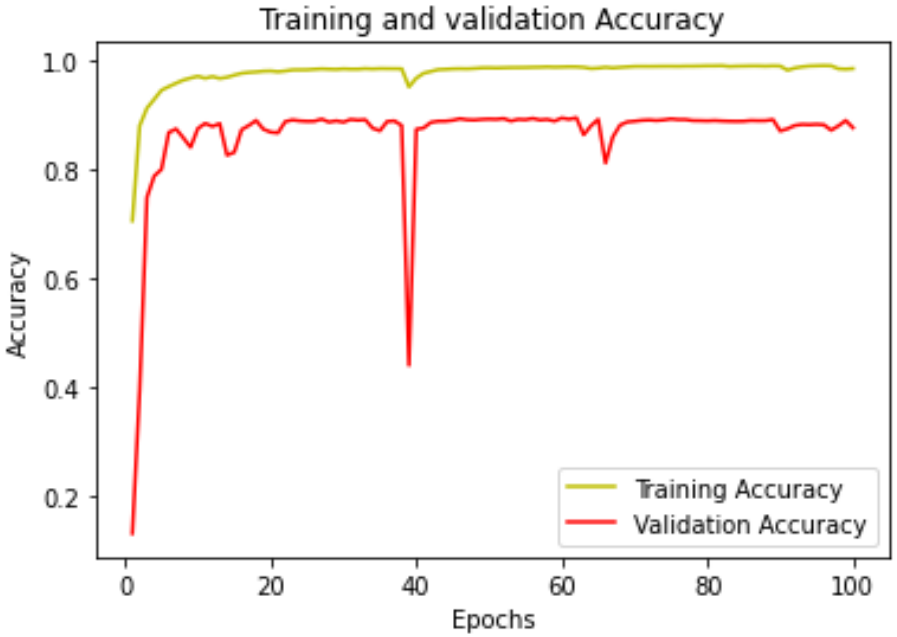
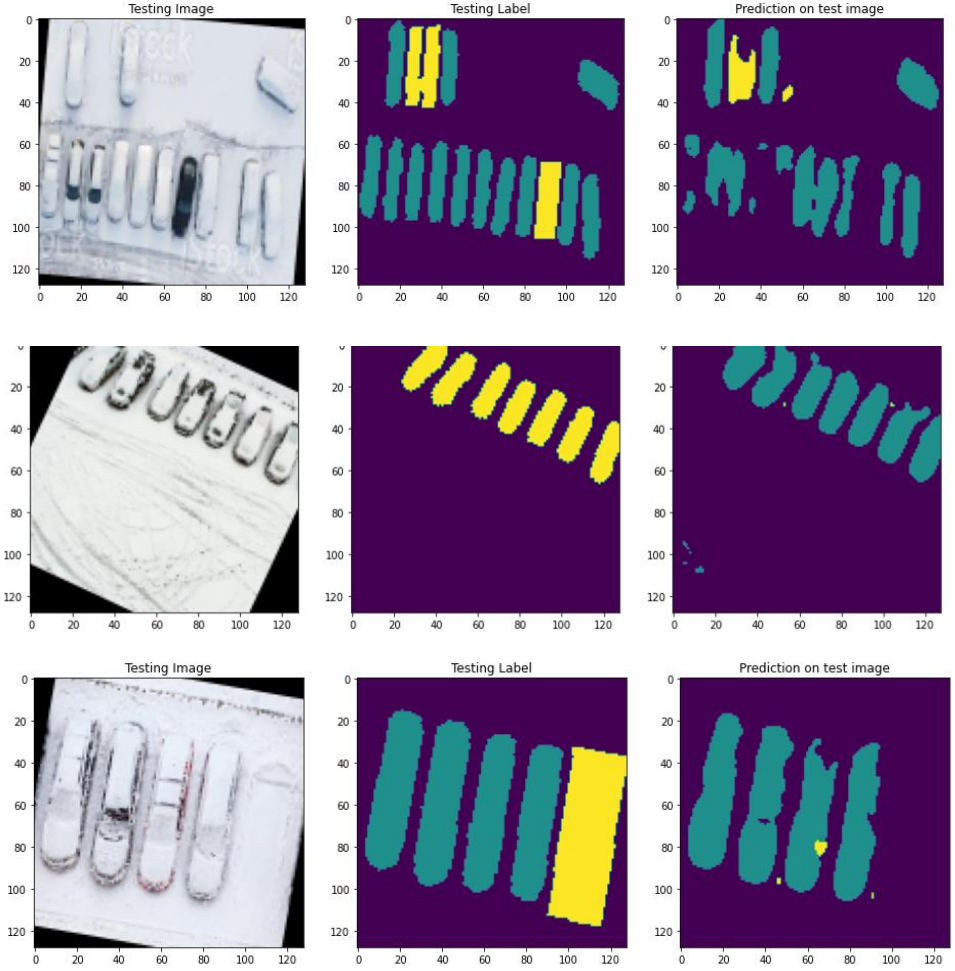
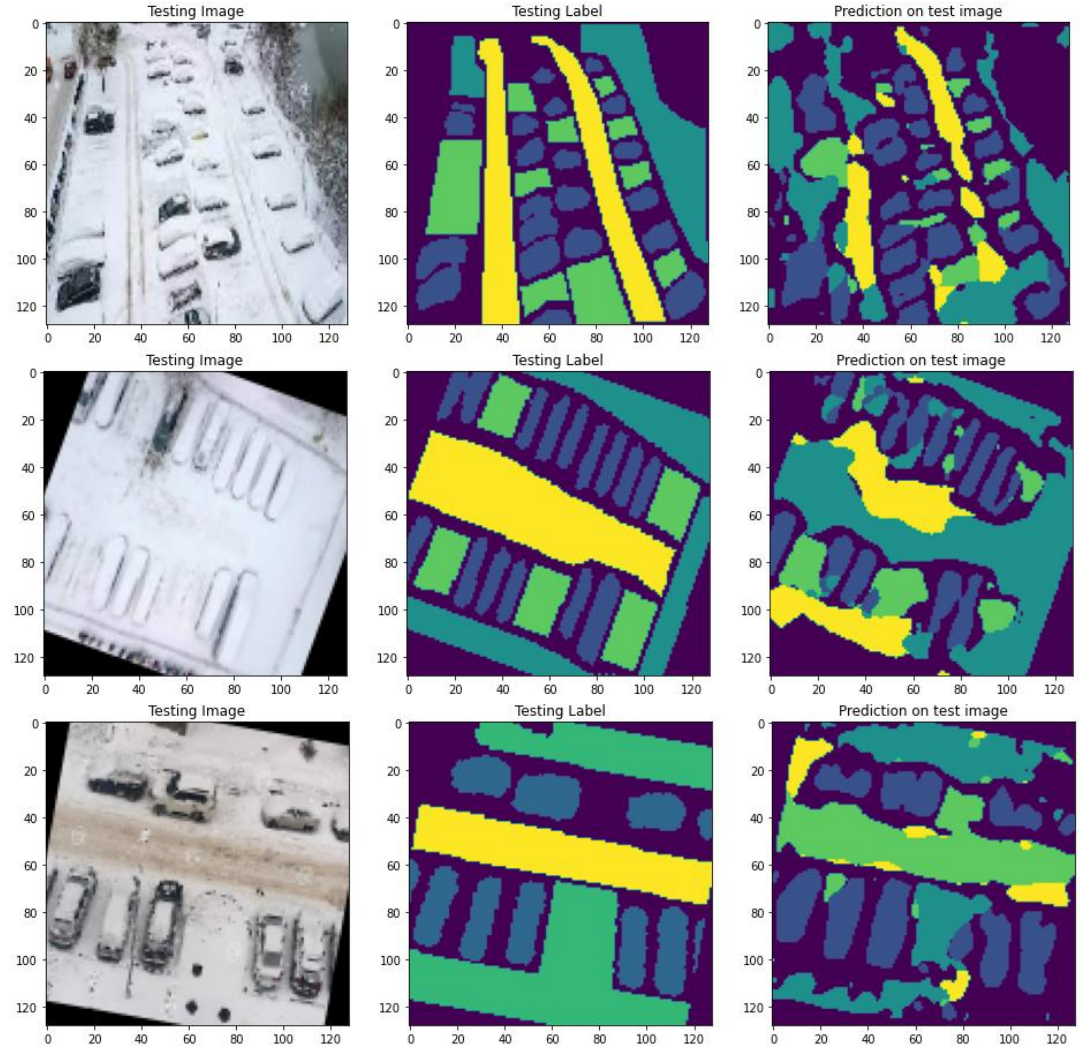
1. Manually collect images for train dataset (22 images)
2. Train resnet34 model for semantic segmentation (cars, parking, road, mud)
3. Apply morphological operations to labeled image
4. Using the contours, draw a rectangle for each “car area” that borders it
5. Retreating from the car at equal distances to the side, check whether the space is free or occupied

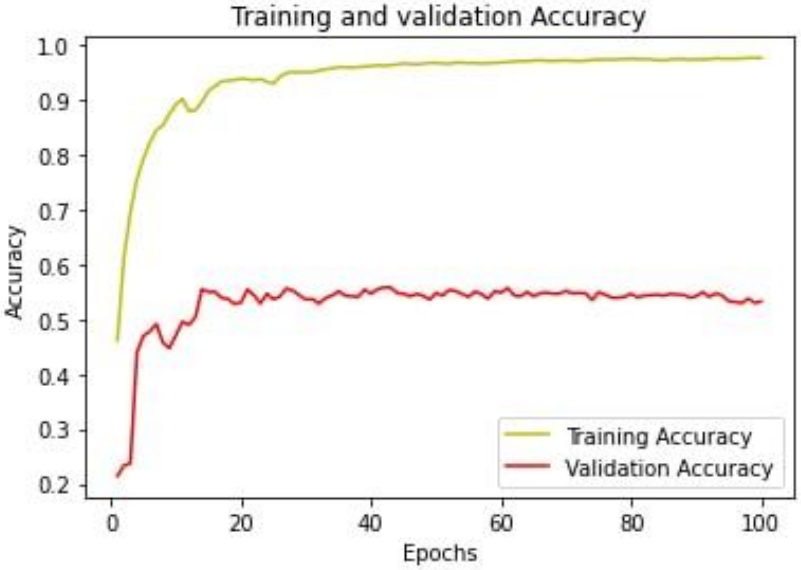
METHOD on Dataset-2







METHOD on Dataset-1



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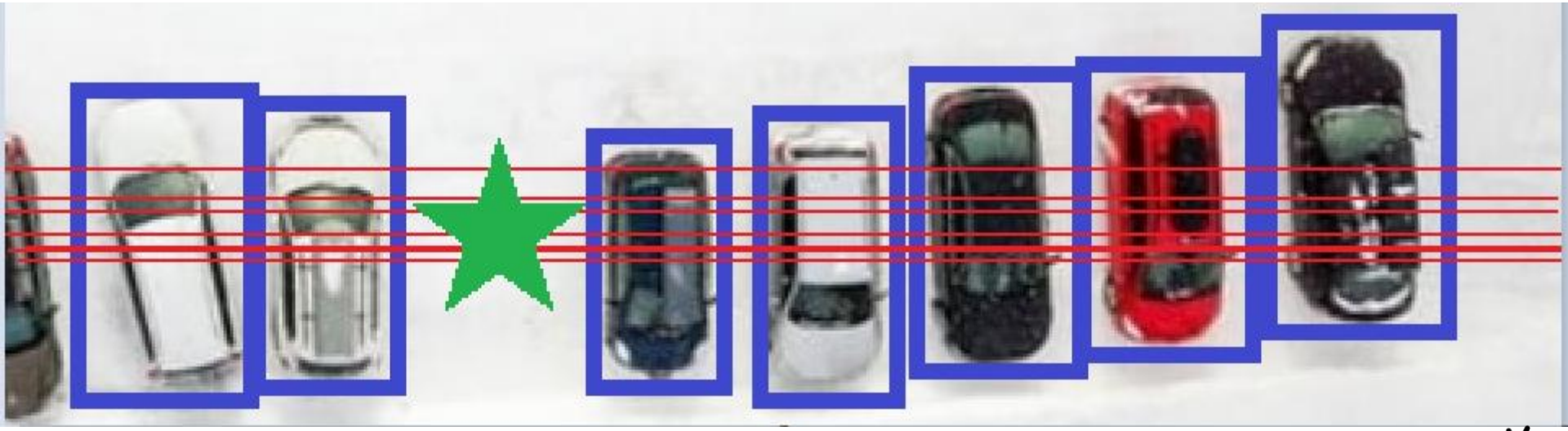
How does algorithm look?



RESULTS

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To test the algorithm, we used a test dataset consisting of 6 images.

TPR	FPR	Mean error
0,54	0,14	0,6

Estimate quality metrics

RESULTS: GOOD EXAMPLES

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RESULTS: BAD EXAMPLES

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False negative

False positive

CONCLUSION

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1. Using **semantic segmentation** to detect **parking spaces** as a class is **unreasonable,** because in winter conditions in most cases a free parking space (covered with snow) is no different from a road (covered with snow) or an environment (covered with snow).
2. A common sense approach is to use **semantic segmentation** to detect **snow-covered cars** and work with that information.
3. In such non-trivial tasks, the **data** set must be collected **manually**, and its size must be **large** and cover all **commonality.**


Thank you!

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References

Semantic segmentation model

Dataset Labeling