Case Study: Task 2 – Object Detection

Data Analytics II

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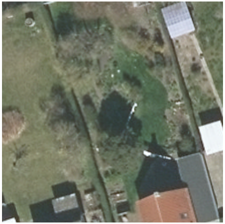
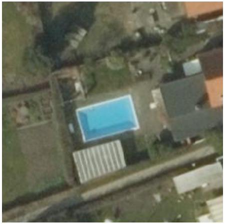
Motivation

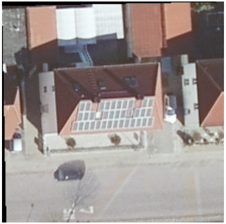
An insurance company is looking for these types of objects in danish front yards:



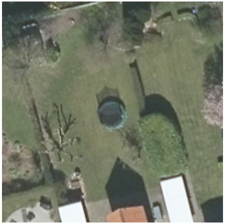
(a) Pond



(b) Pool



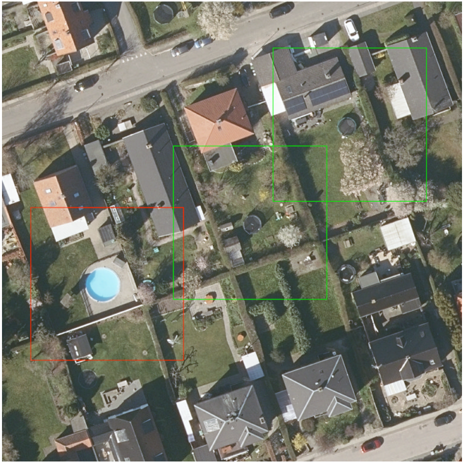
(c) Solar



(d) Trampoline

Your general task is to help the insurance company in finding and labeling these objects. To do so, train a Convolutional Neural Network (CNN) on a supervised learning task for object classification, first.

Motivation



Second, apply your trained CNN on an object detection task to find and mark all *ponds, pools, solar panels, and trampolines* on new satellite images.

Datasets

- There will be four different datasets:
  1. Training set: contains small patches (256×256) of objects from the four different categories with an additional background class.
  2. Unlabeled training set: contains 20 large satellite images with a resolution of $8,000 \times 8,000$.
  3. *Public* test set: contains a few large satellite images and in-addition ground-truth data. *(will be released later)*
  4. *Hidden* test set: unknown data. We will use this data set to evaluate your performance.

Tasks

1. Open a Google Colab account. For the following tasks, you should have access to a GPU!
2. Split the dataset into a training and validation set. Train CNNs on the provided training dataset. You can use a simple, classification task for now.
3. Try out different architectures, hyperparameters, and also different pre-trained models.
4. Now, you are supposed to apply your model to the test set. First, you have to implement the *sliding window* approach in combination with *non-max suppression*.

   Note: Instead of choosing the *non-max suppression*, you can choose a different approach or come up with your own.
5. After you have found your best performing setup, apply your model to the *unlabeled data set*. You can check for plausibility by visually inspecting the output or choose to reuse the predictions for increasing the number of training observations.

Submission

1. For submission, you are supposed to create a script that produces an output `csv`-file for every test image, automatically.
2. The `csv`-files should contain five columns:
   (1) `class_label`
   (2) `y_upper_left`
   (3) `x_upper_left`
   (4) `y_lower_right`
   (5) `x_lower_right`
   Note: these are the pixel-wise coordinates of the upper-left and lower-right corners of the predicted bounding box (the upper-left corner of the image is $(0, 0)$).
   All bounding boxes should have a size of 256×256.
3. We will use *Intersection over Union* (IoU) to measure your performance on the hidden test set. *For this, we will provide further information at a later time.*
4. Deadline for Task 2: 11th July, 11:59pm

Deliveries

1. *URL* to your Google Colab project which contains
   1. `Readme`-File which documents your project
   2. `create_predictions` file which takes a path as input, (1) loads all test data within that folder, (2) loads your best model, (3) applies your model on all test data, and (4) writes the predictions in a `csv`-file for each test file
   3. All your code for training, testing, etc.

   Note: We will provide you with a public test set and a notebook with evaluates your predictions on the public test set.

2. `zip`-file of you project which contains **only the final model** used for the predictions

3. A poster (A1-size) as `pdf`-file.

   Note: We will have a poster session. You do NOT have to print the poster. Instead, we will do that for you :-)

Good Luck!