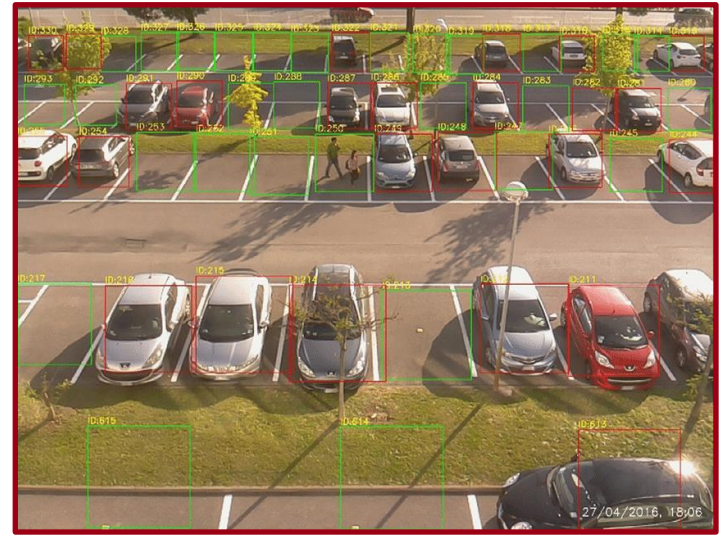




FINAL PROJECT: HOW'S THE WEATHER TODAY FIND A PARKING PLACE!

COMPUTER VISION 2023-24

CV 2023-24: FINAL PROJECTS



Two options:

1. *Weather Classification*
2. *Detection of Free Parking Spaces*

PROJECT 1: WEATHER CLASSIFICATION



- Classify the weather conditions in the provided images
- Analyze each image and assign it to one of the 4 possible weather classes
- Both “traditional” and machine learning based approaches can be used

THE DATASETS: MULTI-CLASS WEATHER DATASET (MWD)



Class	Cloudy	Sunshine	Rainy	Sunrise
Samples	300	235	215	357

- You can get the data from https://drive.google.com/open?id=1zJtLsAtdDXKBgBpupqw4YhUH0TyB-GBP&usp=drive_fs
- Provides 1125 images divided into 4 classes as in the table
- You can use the training set to train ML classifiers
- Relatively easy, a good accuracy can be reached
- The data has been divided into 75% for training and 25% for testing

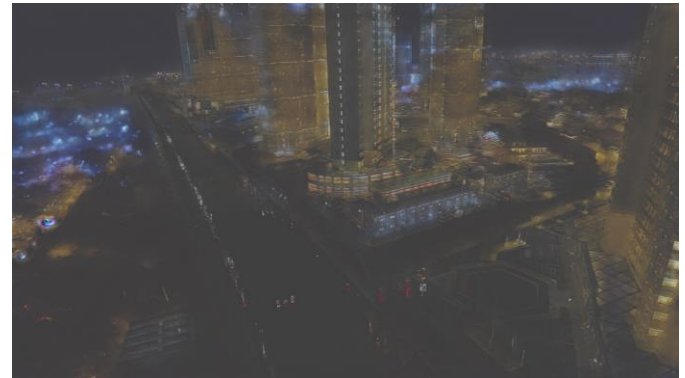
THE DATASETS: ACDC



Class	Clear	Fog	Night	Rain	Snow
Samples	300	300	300	300	300

- You can get from https://drive.google.com/file/d/1zLieQfvP_6C3pkt0FKC1kmMKtXv2Nimt/view?usp=sharing
- Provides 1500 images divided into 5 classes as in the table
- Acquired in an autonomous driving setting
- A bit more challenging but more data available
- The data has been divided into 2/3 for training and 1/3 for testing

THE DATASETS: UAVID



Class	Clear	Fog	Night	Rain
Samples	30	30	30	30

- You can get from <https://drive.google.com/file/d/1zKCUXF7wltISTpxd9pW3MLHG6egICvYN/view?usp=sharing>
- Provides 120 images divided into 4 classes as in the table
- Aerial imagery, the sky is less visible!
- Relatively easy, but small amount of data available, avoid overfitting!
- The data has been divided into 2/3 for training and 1/3 for testing

THE DATASETS: SYNDRONE



Class	Clear	Fog	Night	Rain
Samples	300	300	300	300

- You can get from
- https://drive.google.com/file/d/1zOevapl-HyJo_-fDnBqK2Viy1_9o4L0E/view?usp=sharing
- Provides 1200 images divided into 4 classes as in the table
- Aerial imagery but bigger than UAVID
- Same classes as UAVID, you can test transfer by training on one and test on the other
- Relatively easy, a good accuracy can be reached
- The data has been divided into 400 for test and 800 for training

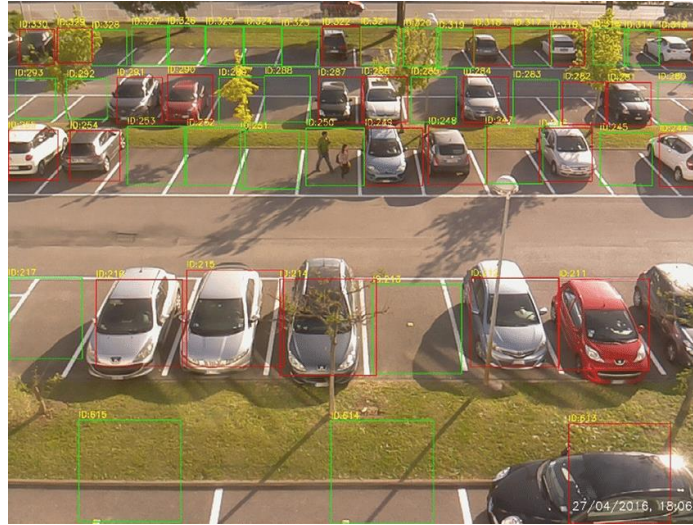
WEATHER CLASSIFIER

1. Download the datasets and extract the information you need for the target task
2. The datasets are divided into train and test sets
 - The training set is useful if you use ML-based approaches
3. *Task:* classify the weather
 - No notebook or template is provided, start from scratch
 - You can use both plain python code (.py) or jupyter

Possible approaches:

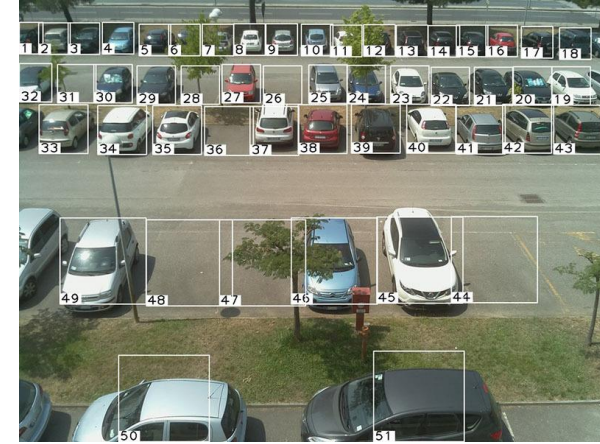
- Analyse image statistics (e.g., average brightness, colors...)
- Analyse histogram of the image
- Feed histogram/statistics to ML classifiers, e.g., SVM or Random Forests
- Deep learning classifier: use a CNN or any other approach
- Use semantic segmentation to locate the sky and analyze its color
- Look for structures like raindrops or the sun

PROJECT 2: PARKING SLOT DETECTOR

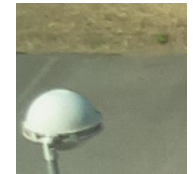


- Find free parking slots in the provided images
- Analyse each slot's region and detect if it contains a car
- Both “traditional” and machine learning based approaches can be used

THE DATASETS: CNRPARK



Subset	Cams	Collection Period	Weather	Frames	Patches
CNRPark	2	July 2015 (2 days)	☀	242	12,584
CNR-EXT	9	Nov. 2015 - Feb. 2016 (23 days)	☀ ☁ ☔	4,081	144,965



- Download from <http://cnrpark.it/>
- Provides both the full images and the single slot patches
- You can use the patches to train binary classifiers based on ML techniques
- Some patches are very difficult due to occlusions, do not expect to classify all
- The .csv files contains the location of the slots
- Files CNRpark+EXT.csv and the .txt files contain the ground truth

THE DATASETS: PKLOT



Parking1a



Parking1b



Parking2

- Download from <https://web.inf.ufpr.br/vri/databases/parking-lot-database/>
- Provides both the full images and the single slot patches
- You can use the patches to train binary classifiers based on ML
- It considers larger parking lots with more slots that can be also rotated in different ways
- The slot positions and the ground truth are inside the .xml files
- Have a look at OpenCV FileStorage to open .xml files

PARKING SLOT DETECTOR

1. Download the datasets and extract the information you need for the target task
2. The datasets are divided into train and test sets
 - The training set is useful if you use ML-based approaches
3. *Task:* find which parking slots are free and which are occupied
 - No notebook or template is provided, start from scratch
 - You can use both plain python code (.py) or jupyter

Possible approaches:

- Run edge/corner/feature detector into the slot and analyse found features
- Analyse image statistics into the slot
- Extract features (e.g. SIFT, ORB) , then use ML classifiers, e.g., SVM or Random Forests
- Deep learning classifier: segment the slots, normalize them to a common size and orientation and then feed to a DL classifier (e.g., a 3-4 layer CNN)
- Deep learning object detector (e.g., look for cars or motorbikes)

GENERAL NOTES

- You can choose your preferred strategy, any idea different from the proposed ones is welcome
- Develop the approach in **Python**
- In case of Deep Learning based approaches you can use DL frameworks like Pytorch (suggested) or Tensorflow/Keras
- ***Avoid directly cutting and pasting material from the web***
 - In particular the cnrpark webpage provides a deep network already trained for the task, do not use it
- **If for any reason you use material from the web for side activity (e.g., load xml, visualization, pre-available deep nets...) declare it**
 - Not declared material from the internet will result in a big penalty
- You need to deliver the **code**, the **report** (mandatory for the final project) and some **output results**