Homework 1 - Face Detection
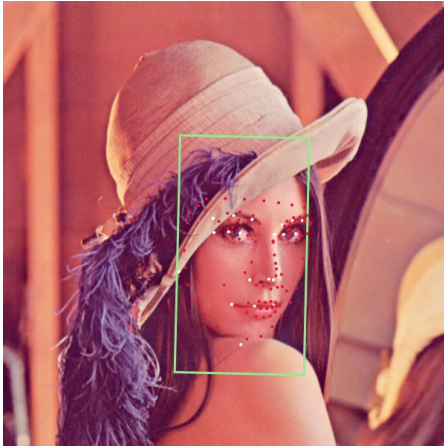
Due Date: 3/18(Mon.) 23:59

Face detection

The process of detecting faces in images.

The process involves **1) localization** and **2) recognition** of faces.

This HW focuses on **face recognition**!

The goal of this homework

1) Learn how to prepare a dataset for machine learning
2) Get a taste of a complete supervised learning process
3) Implement Viola-Jones face detection, especially **Adaboost algorithm for feature selection**
4) Learn the limitations of Viola-Jones face detection

Implementation

The codebase includes most parts of the Viola-Jones face detection algorithm.

- Check Appendix A for Files description.
- Please read the comments before you implement the functions.
- Please finish codes between # Begin your code and # End your code.

```python
def load_data_small():
    """
    This function loads images form the path: 'data/data_small' and return the training
    and testing dataset. The dataset is a list of tuples where the first element is the
    numpy array of shape (m, n) representing the image the second element is its
    classification (1 or 0).

    Parameters:
        None

    Returns:
        dataset: The first and second element represents the training and testing dataset respectively
    """
    # Begin your code (Part 1)
    raise NotImplementedError("To be implemented")
    # End your code (Part 1)

    return dataset
```

Part 1: Load and prepare your dataset

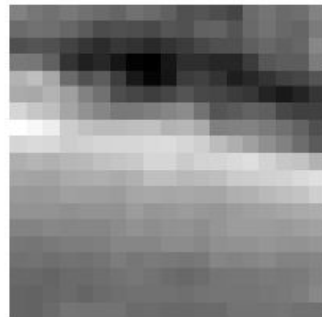Please convert images into a list of tuples.

- The first element is a numpy array that stores an image. The shape of the numpy array is 19*19.
- The second element is its **Label** (1 or 0).

● Note that there are two different datasets you need to load.

● Check Appendix A for Dataset description.

Part 2: Implement Adaboost algorithm

Please make sure you understand the concept of the
Viola-Jones/Adaboost algorithm and examples discussed in class.

Part 3: Additional experiments

Please change the parameter T in the Adaboost algorithm.
- Test the parameter T between 1 to 10.
- Compare the corresponding detection performance.

Accuracy for each Iteration
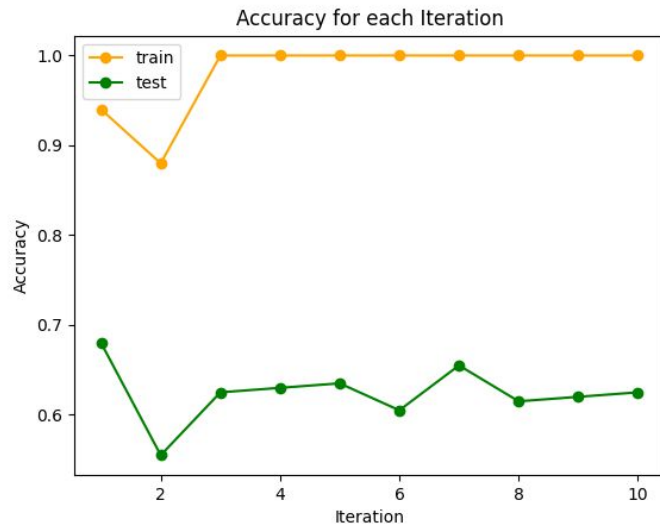
Part 4: Detect face

Detect faces we assigned.

- Read detectData.txt to understand the input format.
- Use clf.classify() function to detect faces.
- Display face detection results. If the classification is "Face," draw a green box on an image. Otherwise, draw a red box on an image.

Part 5: Test classifier on your own images

Please choose your own images with faces.
-   Create a text file with the same format as in detectData.txt.
-   Detect faces (same as Part 4)

Part 6: Implement another classifier (Bonus)

You can implement the "selectBest" function in adaboost.py with another method.

- Compare detection results with results obtained from Part 2 and Part 3.

Report

Follow the instructions described in **spec** and **report template**.
- Screenshot of your code and explain it in detail.
- Screenshots of the results and tell your analysis.
- Compare the result using different classifiers trained on different datasets.
- Answer the questions.
- The report should be written in **English**.
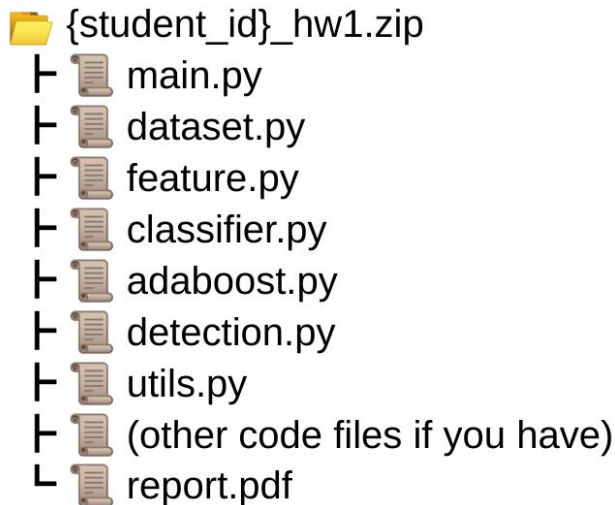- Please save the report as a **.pdf** file. (font size: 12)

Submission

Please directory compress all your code files and report (.pdf) into {STUDENT ID}_hw1.zip and **submit it to the New E3 System.**

Please do not upload the dataset !!!

Wrong submission format leads to -10 point

Late submission leads to -20 points per day

📁 {student_id}_hw1.zip
├ 📜 main.py
├ 📜 dataset.py
├ 📜 feature.py
├ 📜 classifier.py
├ 📜 adaboost.py
├ 📜 detection.py
├ 📜 utils.py
├ 📜 (other code files if you have)
└ 📜 report.pdf

QA page

If you have any questions about this homework, please ask them in the following Notion page. We will answer them as soon as possible. Additionally, we encourage you to answer other students' questions if you have any idea😄

https://lopsided-soursop-bec.notion.site/HW1-Question-Sheet-16273fe7d8214421 89b5c5a43187b185?pvs=4

Please check out the spec for more details!