Evaluation

Your responses to this homework will be evaluated and rated taking into account the correctness of the answers and a number of criteria including the following:

1. *Knowledge of Machine Learning (25%)*
   - Fundamental understanding of machine learning/deep learning.
   - Demonstration of strong machine learning coding skills.
   - Performance / Accuracy of proposed solution.
   - Ability to independently complete the research, data processing, model engineering, etc.
2. *Knowledge of Web Development (45%)*
   - Good understanding of web application architecture.
   - Delivery of web applications with complete features.
   - Delivery of clear documentation and instructions.
   - Clean codes based on OOP (Object-oriented programming).
3. *Communication and Problem Solving skills (30%)*
   - Concise communication of key elements of the answers.
   - Ability to infer requirements and constraints not explicitly presented.
   - Creativity of the solution domain.

Assignments

Anomaly Detection on Image

With the MVTec Anomaly Detection Dataset, develop a web application that can upload a test **pill** image and tell whether that **pill** contains a defect or not. The application should contain an “Upload” button to allow end-user to upload an image file. After uploading is completed, a message is required to pop up to indicate whether the image contains a defect or not. See Figure 1 as example. (You are encouraged to create more creative UI and introduce more functionality, but make sure the basic feature is delivered.)

Download Data from:
https://www.mvtec.com/company/research/datasets/mvtec-ad/

Submit your source code and documents as a zip package.

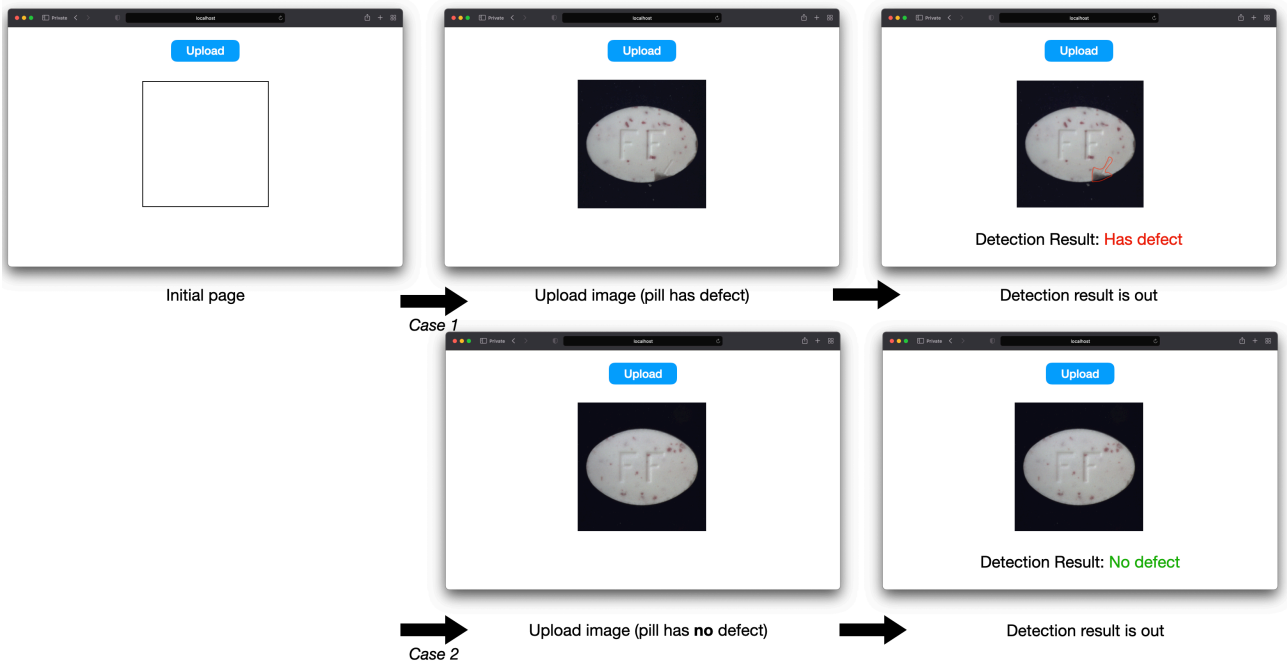

Figure 1

Requirements:

1. This assignment persuades all candidates to bring out an end-to-end solution utilizing Machine Learning / Deep Learning knowledge. Candidate needs to finish the homework independently and deliver following contents:
   - Source codes and all other necessary files for running the web application. (Please include a README for setup instruction.)
   - A pdf document explaining details on how the whole solution is achieved, including but not limited to, how model(s) or algorithm(s) are chosen and taught, metrics used for evaluation.
   - If the answer involves a training process for a certain model, please include the source code of training process.
2. The web application requires at least two features: **Uploading Image** and **Tell if a Defect exists on the image**.
   - For uploading image, end-user can upload common image types including png, jpg, bmp.
   - For detection, end-user can observe whether the defect exists in the image or not as minimum. If the position of the defect can be pointed out on the image, it will be considered as a bonus in the assessment.
   - Any other reasonable and creative features will be considered as a bonus in the assessment.

3. System Design:
   - Use a Javascript framework to build frontend UI, such as React.
   - Use python for model training and backend service.
   - There is no restriction on ML framework usage. But to increase the possibility that the application can be runnable during assessment, it is encouraged to use official packages.
4. Make sure the web application runnable on either Linux Ubuntu or MacOS.
5. Make sure the web application is delivered as a containerized solution.

Note

1. The MVTec Anomaly Detection Dataset contains altogether 15 categories. Please only focus on "**Pill**" category and download the relating tar file. After you unzip the file, you will figure out three folders including, *"train"*, *"test"*, *"ground_truth"*. Please make sure that your final application only have knowledge about data from *"train"* folder or augmented data generated from *"train"* folder. The constraint implies that when you are training any Machine Learning model, the images in "test" and "ground_truth" folders can never be used as training data.
2. You can take reference to any public research paper to figure out the your candidate model. Please remember to attach the link of paper in your pdf document. You are not allowed to use an existing production model in your web application. Please train the model by yourself and be honest. However, if you are using a deep learning model, it's acceptable to use a pre-trained backbone if your model needs to use, such as, VGG-16, ResNet, etc.