Computer Vision and Pattern Recognition

CS 4243

Mini Project

S1-Y2023/24

NUS National University of Singapore | School of Computing

Mini Project Definition (CS4243-2023/1)

Mini Project

Motivation ….

Problem Statement

The police commissioner has given you a labeled image dataset.

Your task is to classify them between two classes:

0 $normal\ (no\ weapon\ is\ seen)$

1 $weapon\ (a\ weapon\ can\ be\ detected)$

i.e., Develop an algorithm to detect any possible dangers to help alert the relevant authorities.

Goals

1. **The mini project is worth 20% of overall module marks.**
2. **Details, Objectives**

Contents, Approach, Deployment	8%
Poster Quality	2%
Q&A	3%
Curiosity, Exploration	4%
Creativity	3%

3. **In general, higher *quality* work = higher marks!**
    1. More time spent doesn't necessarily mean higher marks (please manage your time)
    2. Higher accuracy doesn't necessarily mean higher marks (please follow the Project Philosophy)

Project Philosophy

This project is about:

1. Understanding of fundamental machine learning concepts. (Theory)
2. The practical skills required for a successful machine learning/ pattern recognition project. (Application)
3. Demonstration of understanding why it works and why it doesn't

This project is NOT about:

1. Usage of LARGE DEEP models
2. Overfitting and achieving high accuracy 99%
3. Hogging of computational resources (e.g GPU) and endless tuning
4. Writing ten lines of code with Keras and calling it "DeeP LeARninG“

Submission Details

- **You will Present your team's work using poster* format. No report/slides are required.**
- **You do not need to print the poster. Showing that on your laptop is enough.**
- **The presentation date/time will be announced later, however, it will be before the reading week.**
- **The contribution of EACH team member should be mentioned in the poster.**

*The poster is to limit/constrain the total time spent or the amount of work done for this mini project. The poster templates are provided at the end of this presentation.

Project specifics (Core expectations)

Students are expected to:

1. **Prepare** the given dataset. (E.g, data cleaning, visualization, pre-processing, data normalization, etc) *[This is important!!]*
2. **Minimally**, develop a vanilla baseline classifier to discriminate between the two classes above the baseline recognition rate of 50% from a random classifier (Why 50%?)
3. **Provide** improvements for the baseline method.
4. **Show** empirical observations. (Plot learning curves, recognition scores, numerical results)
5. **Present** your work CLEARLY and nicely.

Project Specifics (Open-ended theme)

- **By nature, the given dataset contains labeled images and it is a discriminative SUPERVISED learning problem**
- **However, it can be hosted as an Open-ended theme.**
  - No restrictions on approach. (You can regard it as image classification etc.)
  - No restrictions on which evaluation metric to use, but we prefer to see **the classification accuracy** and **Confusion matrix**.
  - No restrictions on backbone architecture.
  - No restrictions on using traditional computer vision or deep learning
  - No restrictions on optimizer (ADAM, SGD, ADAMax, LARS, etc..)
  - No restrictions ...

Project specifics (Open-ended theme)

- **What?**
  - Show the methods you chose to improve the baseline classification performance.
- **How?**
  - Explain how your method(s) works etc.
- **Why?**
  - Why you chose this approach, Why it works or why it does not work.

Project specifics (Open-ended theme)

(Why is it Open-ended?)

1. **Discourage hogging of GPU and training extremely large deep neural networks.**
2. **Newcomers have a chance to do well, likewise experienced players (smurfers) will have a chance to learn/try new things.**
3. **Encourage teams to explore the literature and exercise creativity.**

Bonus (Optional)

For advanced players only

Topics of interest include all aspects of computer vision and pattern recognition including, but not limited to:

Decision trees, SVM, Sensor fusion, RNN, GRU, LSTM, Transformers, RL, Unsupervised learning, Object detection, Segmentation, Self-SL, Semi-SL, FSL, ZSL, GANs, KD, VAE, Diffusion, Calibration, OOD detection, Curriculum learning, ... the list is endless...

*You may prepare/tailor the dataset for the methods mentioned above. (Step 1 of Core expectations)

Bonus (Optional)

Automatically awarded a max grade for the project if you:

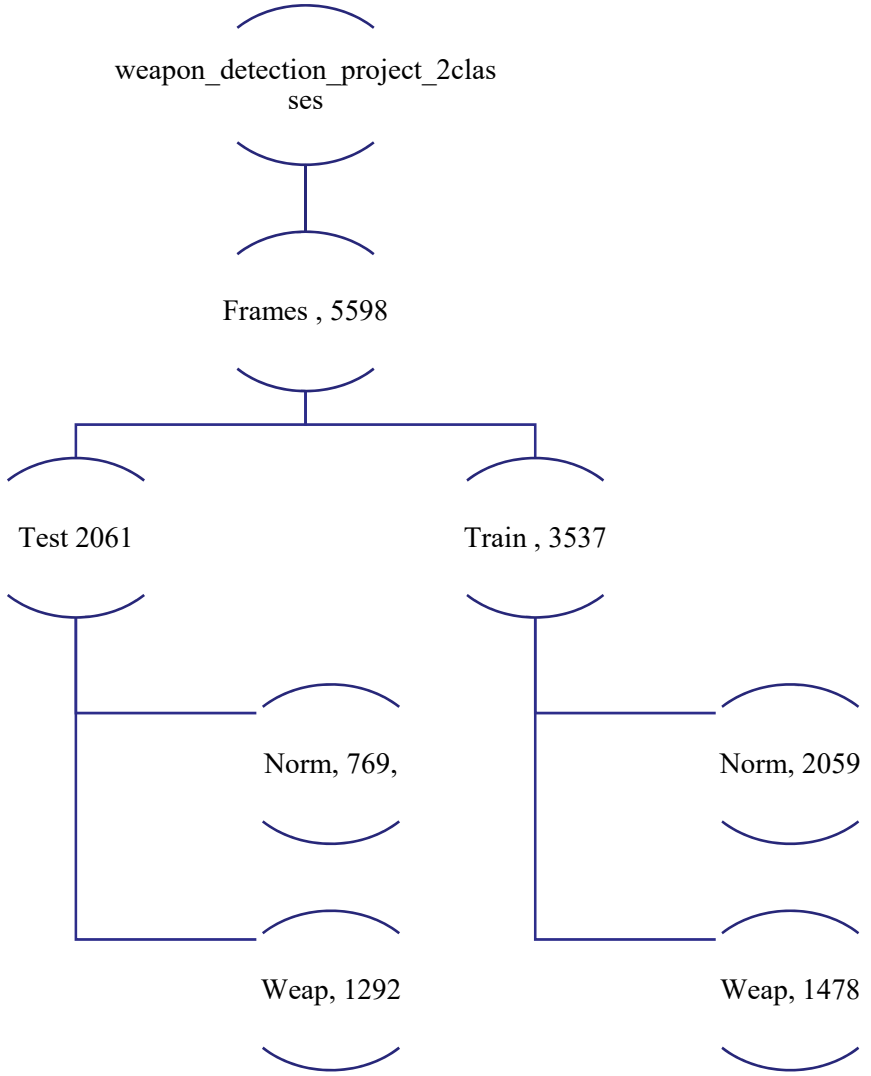
Deliver a novel method (that works) in any of the following:

- Evaluation metric
- Loss functions
- Architecture
- Optimizer
- Robustness against noise
- Fusion methods

And so on …

Dataset

- **Link to the dataset: https://drive.google.com/drive/folders/1qm0jkcNPWN3jBj7jQiZhndbKUsx4Ozfl?usp=sharing**
- **The directory name suggests what you'll find over there.**
- **We expect you to keep this setup.**



Finally …

- If you need high-performance computers to run your code, in particular, to train your model, we urge you to use public cloud services like Google Colab, unless you have a gamer laptop!
- If you want to use the existing methods as a baseline/or develop your system based on them, feel free to do so. But your main focus shall be to improve that.
- If you go for using an existing method or pre-trained model, please show that you tried to improve the overall performance. In the presentation, you shall explain the baseline method, the approaches you tried, and the comparison of the results.
- Please set up your team urgently. Link to shared Team declaration sheet: https://docs.google.com/spreadsheets/d/1lu1l365ki0lkU00qPE9BrAGoS76t6cKN/edit?usp=sharing&ouid=103312267246313924641&rtpof=true&sd=true

Poster Template

https://github.com/AKlushyn/NeurIPS/blob/master/poster-vhp-vae.pdf

https://github.com/reiinakano/neural-painters-pytorch/blob/master/neurips-poster.pdf

https://github.com/joshuaas/GBDSP-NeurIPS19/blob/master/conference_poster_2.pdf

References

1. https://arxiv.org/pdf/1905.03288
2. https://iopscience.iop.org/article/10.1088/1742-6596/1237/2/022026/pdf
3. https://globaljournals.org/GJCST_Volume19/2-Classification-of-Image-using-Convolutional.pdf

That's All ...

Good Luck