2024 Autumn
Introduction to Machine Learning
Homework 4 Announcement

Release Date: 2024/11/26 15:00

Homework 4

- Deadline: 23:59, Dec. 17th (Tue), 2024
- **Kaggle and Report** (70%): Participat in the **Kaggle competition** and write reports**.**
    - Competition (50%): Get good score.
    - Report (20%): Description and implementation related to your method.
- **Handwritten Questions** (30%): Answer questions about deep learning.
    - Answer the questions in the report.
    - You **must use the template** and in **digital-typed** (**no handwritten scan**)
    - In English

Links

- Questions and Report template
- Link to Kaggle

Face Emotion Image Classification

- 7 facial emotion categories
  - Angry / Disgust / Fear / Happy / Neutral / Sad / Surprise
- 48 x 48 pixel, grayscale image

Happy

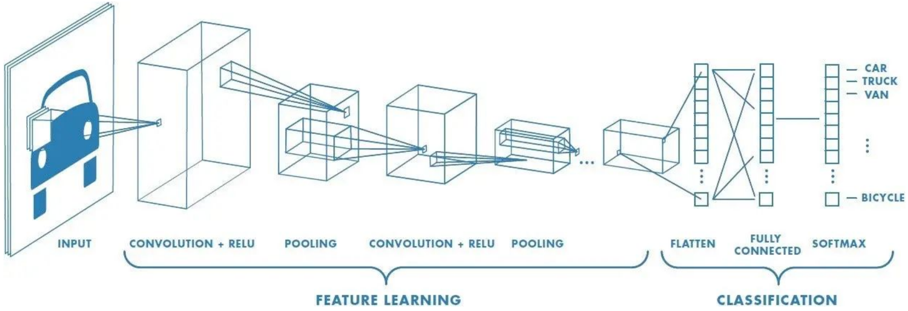
Angry

Sad

Neutral

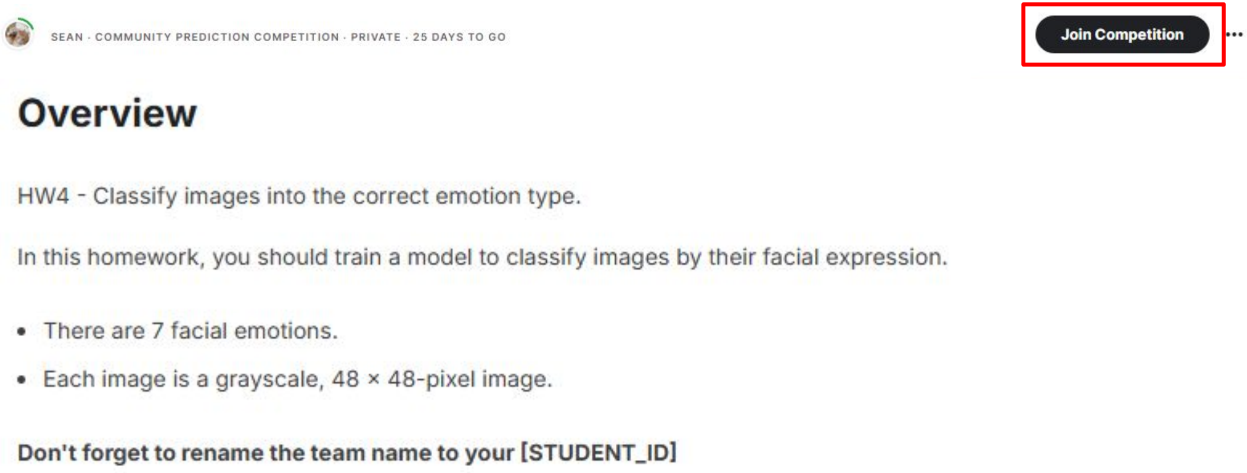
Hint

- Convolution Neural Network
- Transfer Learning



Join the Competition

- Link



SEAN · COMMUNITY PREDICTION COMPETITION · PRIVATE · 25 DAYS TO GO
Join Competition

Overview

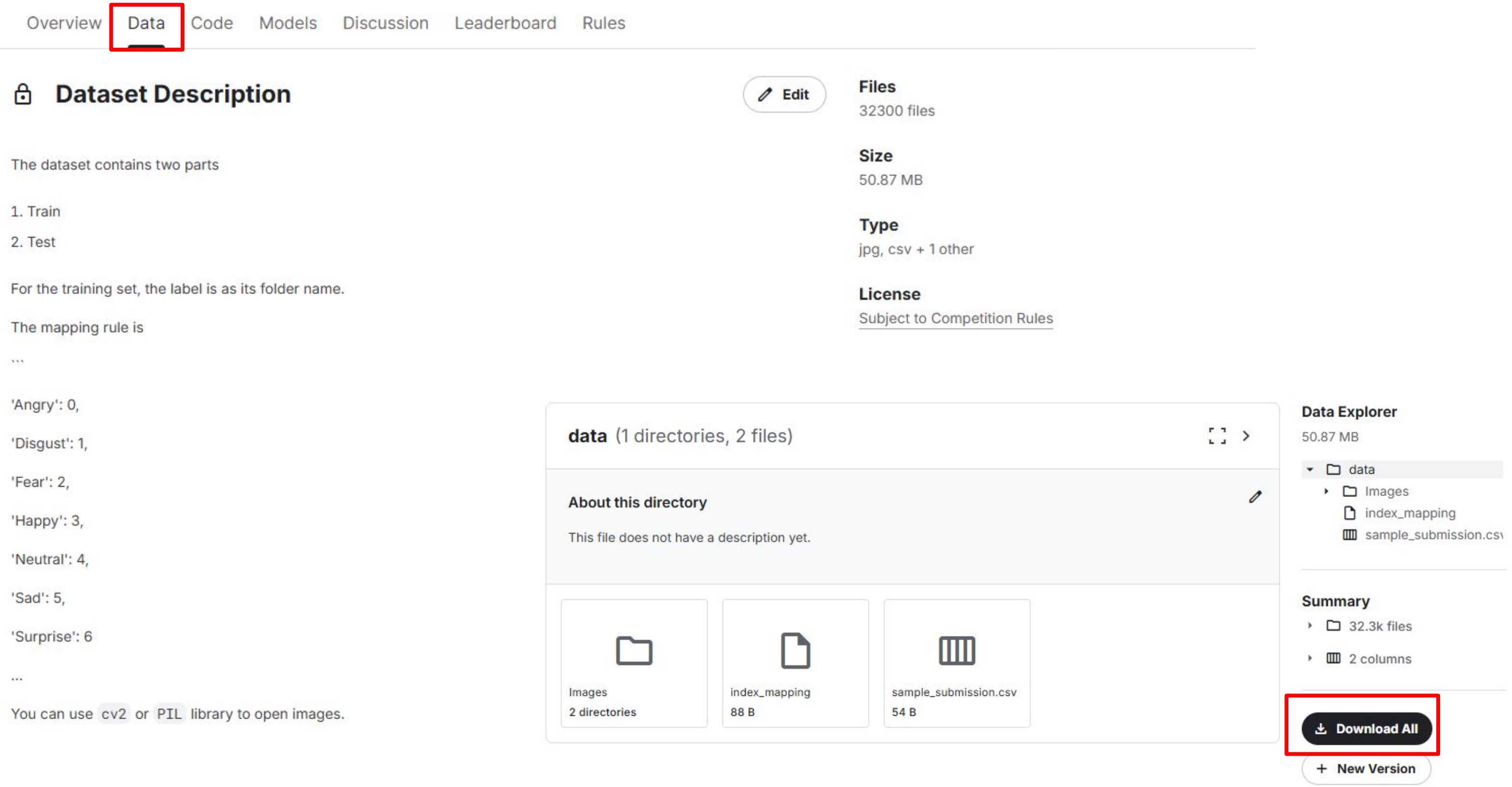
HW4 - Classify images into the correct emotion type.

In this homework, you should train a model to classify images by their facial expression.

- There are 7 facial emotions.
- Each image is a grayscale, 48 × 48-pixel image.

Don't forget to rename the team name to your [STUDENT_ID]

Download the Dataset



Dataset Description

The dataset contains two parts

1. Train
2. Test

For the training set, the label is as its folder name.

The mapping rule is

```
'Angry': 0,

'Disgust': 1,

'Fear': 2,

'Happy': 3,

'Neutral': 4,

'Sad': 5,

'Surprise': 6
```

You can use `cv2` or `PIL` library to open images.

Files
32300 files

Size
50.87 MB

Type
jpg, csv + 1 other

License
Subject to Competition Rules

data (1 directories, 2 files)

About this directory

This file does not have a description yet.

Images	index_mapping	sample_submission.csv
2 directories	88 B	54 B

Data Explorer
50.87 MB

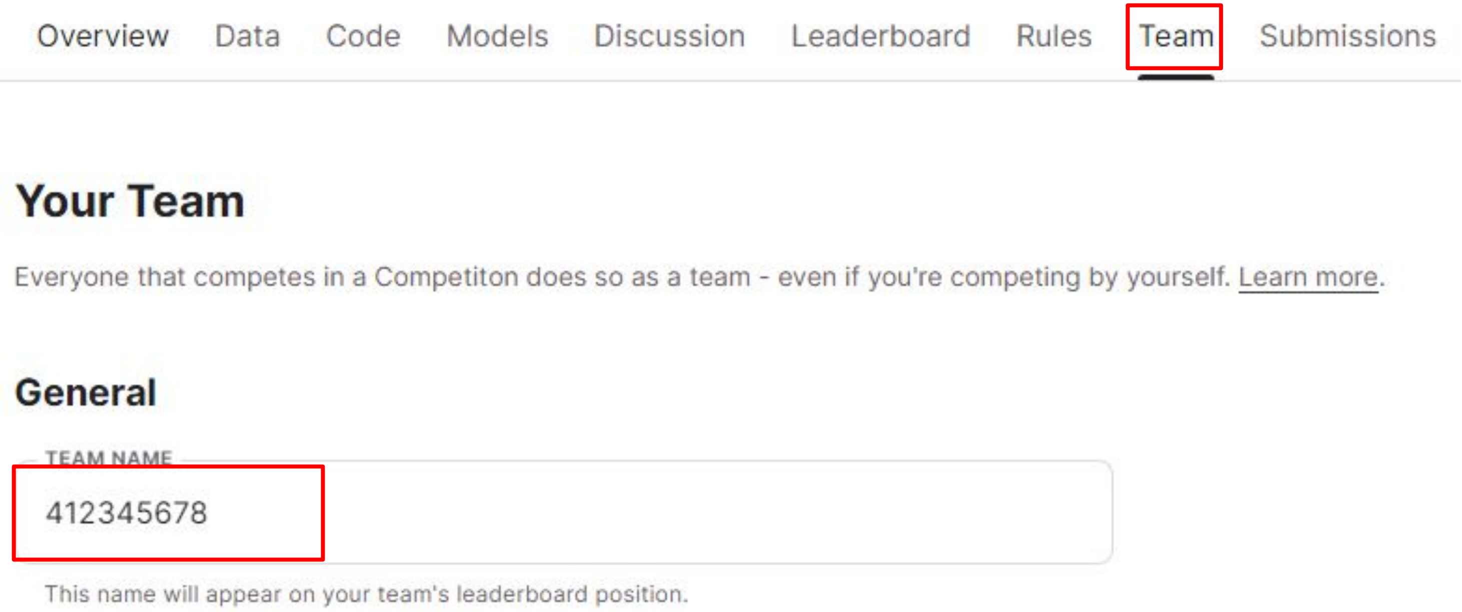
- data
  - Images
  - index_mapping
  - sample_submission.csv

Summary

- 32.3k files
- 2 columns

Set the Team Name

- You must set your team name as your **student ID**.



Your Team

Everyone that competes in a Competiton does so as a team - even if you're competing by yourself. Learn more.

General

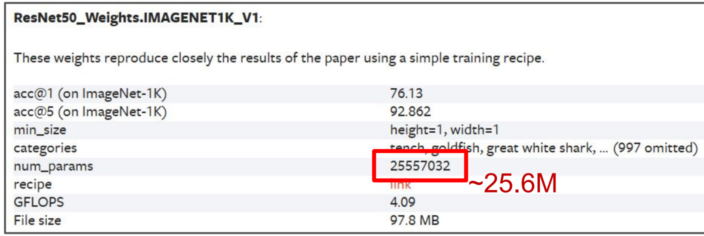
TEAM NAME

412345678

This name will appear on your team's leaderboard position.

Competition Rules

- You are allowed to use any open-source resources/libraries but you must specify them in the report.
  - model architecture (ex: ResNet, ViT, etc.)
  - pre-trained weights (ex: ImageNet)



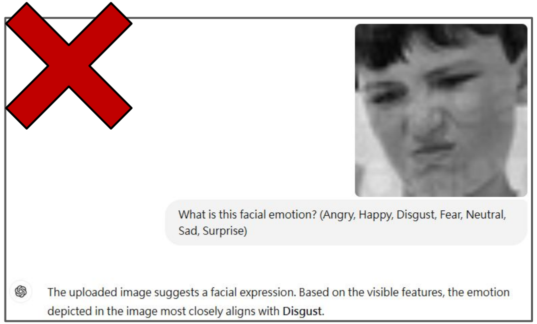
ResNet50_Weights.IMAGENET1K_V1:

These weights reproduce closely the results of the paper using a simple training recipe.

acc@1 (on ImageNet-1K)	76.13
acc@5 (on ImageNet-1K)	92.862
min_size	height=1, width=1
categories	tench, goldfish, great white shark, ... (997 omitted)
num_params	25557032
recipe	link
GFLOPS	4.09
File size	97.8 MB

~25.6M

- Your model size (parameters) have to **<u>less than 100M</u>**.
- You cannot use any external data.
- You have to train (finetune) your model by yourself!



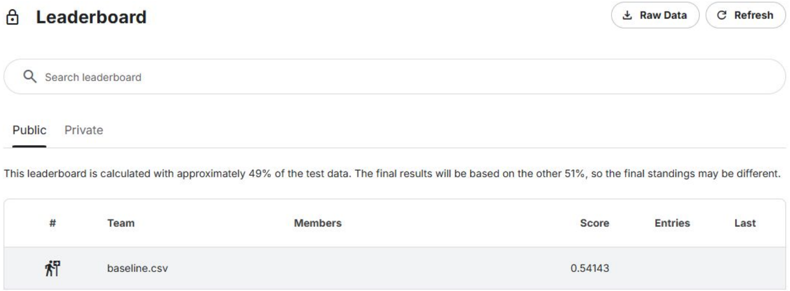
What is this facial emotion? (Angry, Happy, Disgust, Fear, Neutral, Sad, Surprise)

The uploaded image suggests a facial expression. Based on the visible features, the emotion depicted in the image most closely aligns with **Disgust**.

Violation of the above three rules will result in <u>0 pts</u> for this part.

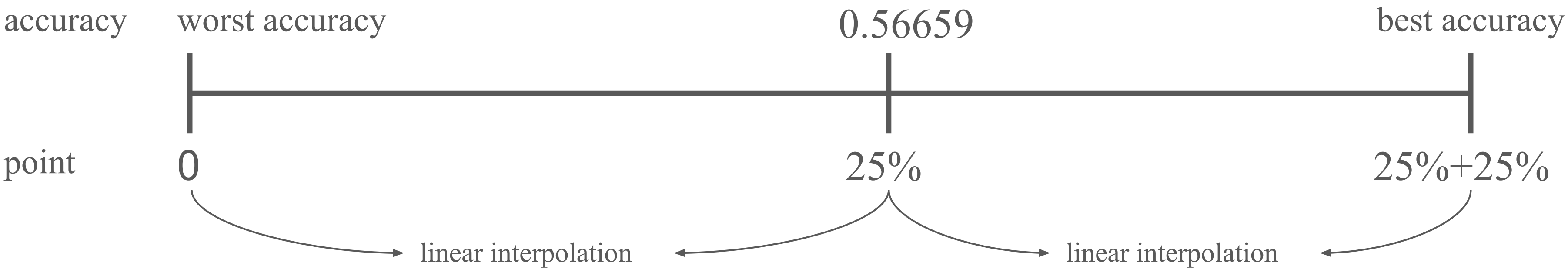
Grading Criteria – Performance (50%)

- Public leaderboard
  - For you as a reference (similar distribution to the private)
- Private leaderboard
  - (25%) Baseline: **accuracy >= 0.56659**
  - (25%) Compete with your classmates



This leaderboard is calculated with approximately 49% of the test data. The final results will be based on the other 51%, so the final standings may be different.

#	Team	Members	Score	Entries	Last
	baseline.csv		0.54143		



accuracy worst accuracy 0.56659 best accuracy

point 0 25% 25%+25%

linear interpolation linear interpolation

Grading Criteria – Report (20%)

- Implementation details (10%)
  - Model architecture & hyperparameters (5%)
  - Training strategy (5%)

- Experimental results (10%)
  - Evaluation metrics and learning curve (5%)
  - Ablation Study (5%)
    - To prevent submission counts that affect final rank, you can run ablations on individual validation set split from training set by yourself.

Numpy & PyTorch

- Numpy Tutorial: Link
- PyTorch Tutorial: Link
    - Free to use any modules and functions

Environment

- Python version: 3.9 or higher
- If you have a GPU
  - Conda
  - Miniconda
  - virtualenv
  - …
- If you don’t have a GPU
  - Google Colab

Handwritten Questions (30%)

2-1 **(10%)** Explain the support vector in SVM and the slack variable in Soft-margin SVM. Please provide a precise and concise answer. (each in two sentences)

2-2 **(10%)** In training an SVM, how do the parameter C and the hyperparameters of the kernel function (e.g., γ for the RBF kernel) affect the model's performance? Please explain their roles and describe how to choose these parameters to achieve good performance.

Handwritten Questions (30%)

2-3 **(10%)** SVM is often more accurate than Logistic Regression. Please compare SVM and Logistic Regression in handling outliers.

Report

- Please follow the report template format. (-5pts if not use the template)
- Link

Submission

- Compress your **code** and **report** into a **.zip file** and submit it to E3.
- Report should be written in English. (-5 pts if not English)
- <STUDENT ID>_HW4.zip
    - [YOUR CODE] (Make sure it is well-organized and can be executed)
        - Training code, Inference code, README, etc. (README should contains how to setup your env and run the code)
        - Model weights: <STUDENT ID>_weight.txt (which contains a link to your google drive & ensure the permission is granted)
    - <STUDENT ID>_HW4.**pdf** (NO .doc, .docx or others format)
- Don't put the data (e.g. train.csv / test.csv) and model weights into submission file
    - -10 pts if you put the wrong things into zip file

Kaggle Submission Reproduction

- Your inference script should be able to reproduce your kaggle submission.
  - Build and load the model (with the model weights you provide) and then generate your kaggle submission file.

- For python file (inference.py)
  - It will be checked on our lab’s servers. (NVidia 1080Ti, cuda 11.3)
  - Please provide a **environment setup instruction** which can help us quickly rebuild your environment and accurately reproduce your results.

- For jupyter notebook file (inference.ipynb)
  - It will be checked on Google Colab.
  - Please include the necessary **pip install instructions** in the first cell.

Other rules

- **Late Policy**: No Delay allowed this time. (delayed, a.k.a. submission closed)
    - **You will get 0 pts on HW4**

- **No Plagiarism**: You should complete the assignment by yourself. Students engaged in plagiarism will be penalized heavily. Super serious penalty.
    - 0pt for the assignment or failed this course, etc
    - Report to academic integrity office

AI-Assistant

- Not recommended but no forbidden
- Copy-and-Paste answers from the AI-Assiant will be seen as Plagiarism
    - However, you can have your own answer first then rephrase it by AI-Assiant.
- Some questions might be parts of final exam, make sure you understand the concept

FAQs

- If you have other questions, ask on **E3 forum** first! We will reply as soon as possible.
    - Also, feel free to write email to TAs (And remember to cc all TAs).

Have Fun!

Machine learning students at the beginning of a project vs. Machine learning students at the end of a project