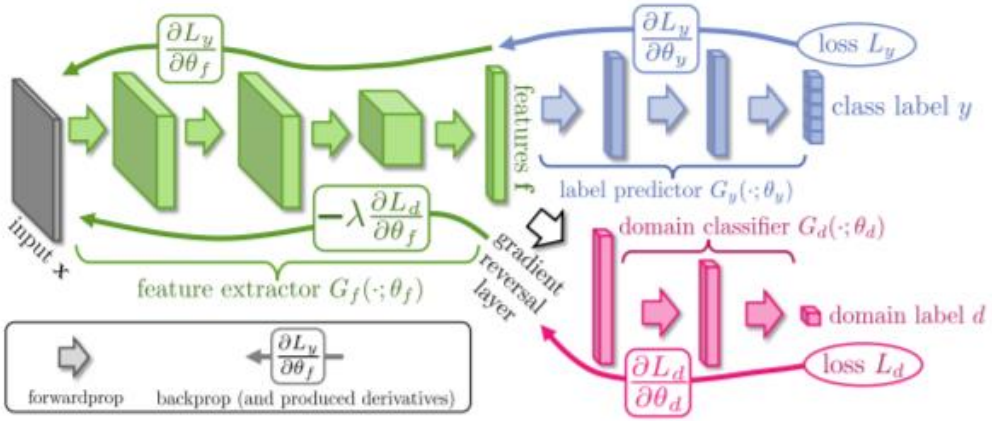
Multi-Source Domain Adaptation

Final Project #1

Deep Learning for Computer Vision (107-2)

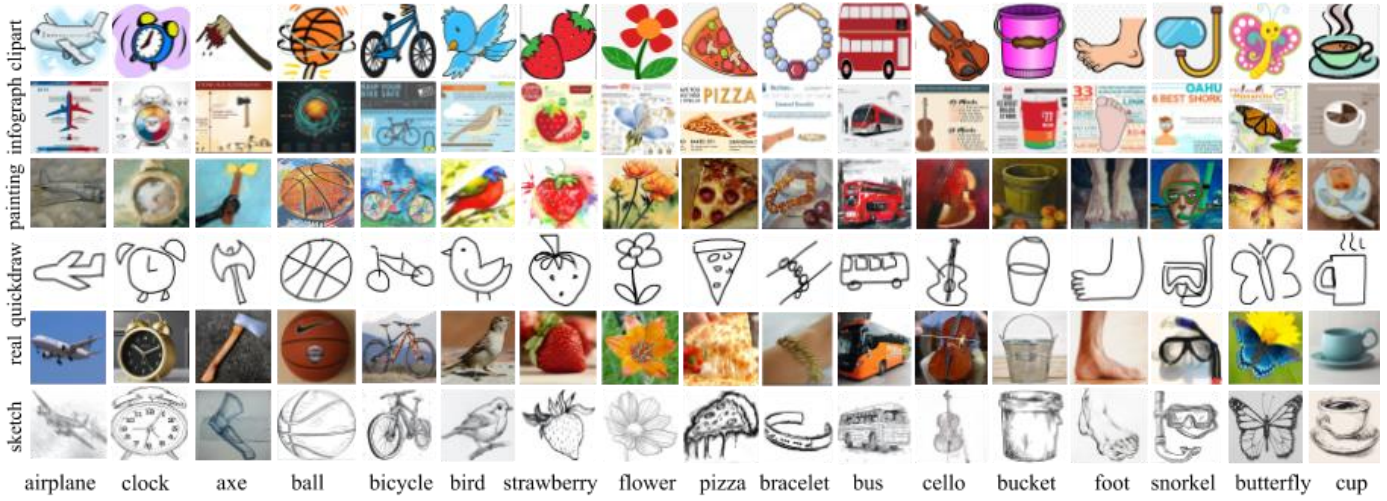
Introduction

- Recall what you did in HW3…
  - Classification on digits in different *domains*
    - MNIST-M, USPS, SVHN…
  - No data labels in the *target* domain (unsupervised)
  - Adaptation to the target domain by exploiting information from the *source* domain



Introduction

- Domain Adaptation
  - From one domain to another (e.g. USPS → SVHN)
- **Multi-Source** Domain Adaptation
  - A more practical scenario where training data are collected from multiple sources



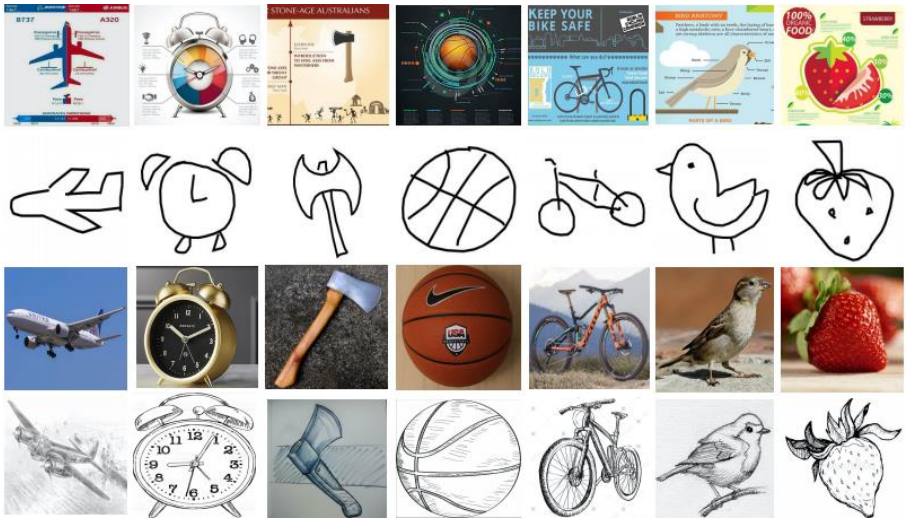
Dataset (Overview)

- For this challenge, we use the **DomainNet** dataset

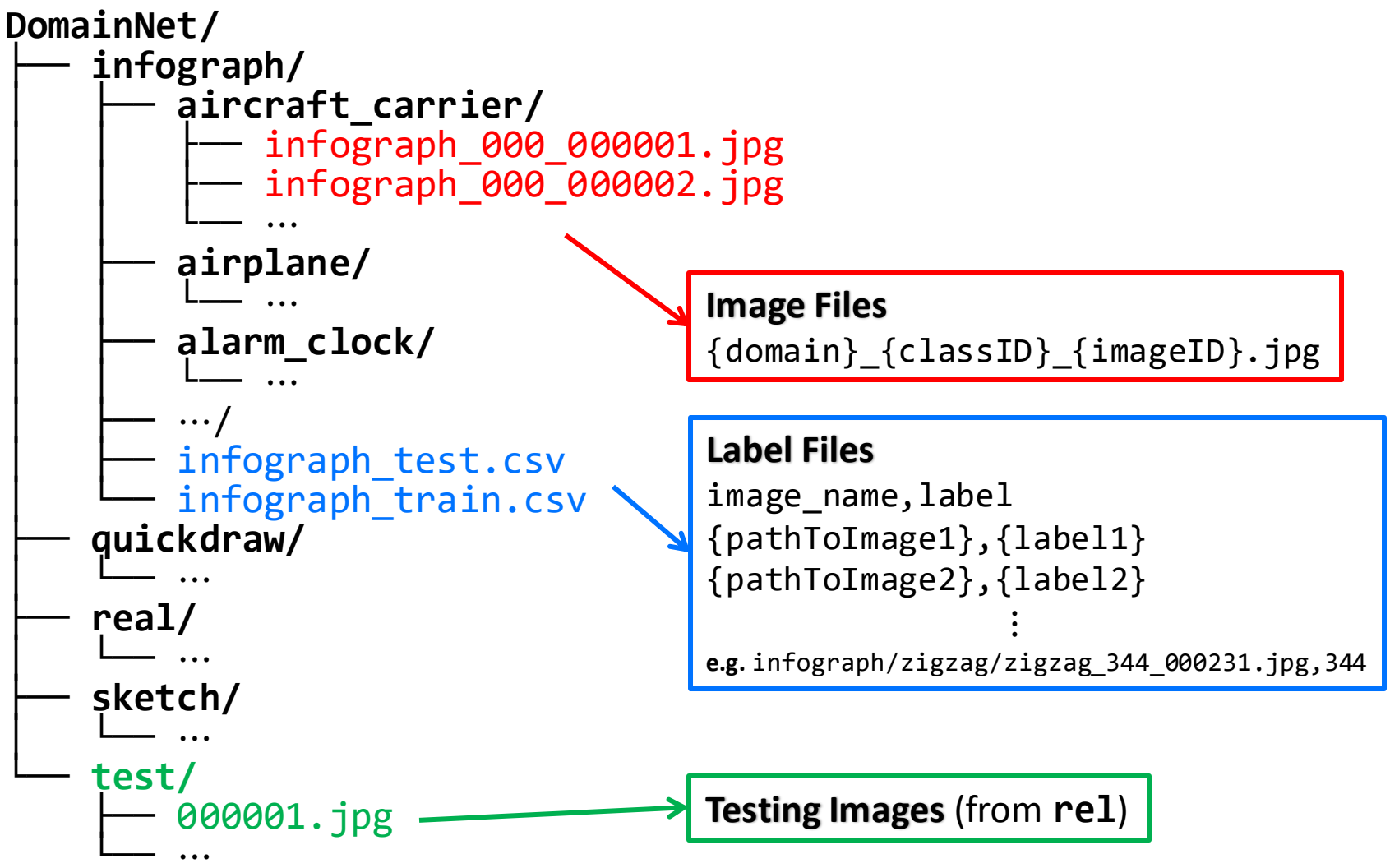
  https://drive.google.com/file/d/1S8zc21EthjpCg7ckslAD4PfovWyErQ0p/view?usp=sharing

- We consider **3 source domains** and **1 target domain**, where each domain consists of 345 image classes

  1. Infograph (`inf`)
  2. Quickdraw (`qdr`)
  3. Real (`rel`)
  4. Sketch (`skt`)



Dataset (Structure)



Dataset (Remarks)

- Each image may be of different sizes
  - You may have to come up with a method to resize/crop the images for data preprocessing
- Image format will be of `.jpg`
- Class labels range from `0` to `344`
- You may NOT use other custom datasets for training
- The dataset will include
  - Training images from all 4 domains
  - Training labels from all 4 domains
  - Testing images from all 4 domains
  - Testing labels from **`inf`**, **`qdr`**, **`skt`** (**`rel`** is withheld)

Task

- You will need to perform all 4 adaptations below

#	Source Domains	Target Domain
1	`inf + qdr + rel`	`skt`
2	`inf + rel + skt`	`qdr`
3	`qdr + rel + skt`	`inf`
4	`inf + qdr + skt`	`rel`

← Kaggle competition

- **IMPORTANT**: Note that during training, only the following data should be accessible
  - Source domain images + labels
  - Target domain images ~~+ labels~~

Evaluation

- Evaluation is straightforward
  - **Accuracy** = $\frac{(\#\text{ of correctly classified images})}{(\#\text{ of total images})} \times 100\%$
  - The accuracy is only evaluated over the **target domain**
  - You need to write your own evaluation script
- You should include the following table in your final presentation (i.e. poster)

Domain Adaptation	inf+qdr+rel →skt	inf+rel+skt →qdr	qdr+rel+skt →inf	inf+qdr+skt →rel
Accuracy	%	%	%	%

You can obtain this score by uploading your results to Kaggle

Evaluation

- Kaggle Link

  https://www.kaggle.com/t/51ef0ecd72554974b15163285ba19576

  - The team leader should create a team on Kaggle with the same team name as in GitHub Classroom
  - It is **strictly prohibited** for members in the same team to create multiple teams on Kaggle
  - You can upload your submissions at most 5 times per day (reset at 08:00 AM (GMT+8) every day)

- The predicted results you upload to Kaggle should be a .csv file with the following format
  - `{pathToImage},{label}`

```
image_name,label
test/000001.jpg,81
test/000002.jpg,99
        ⋮
test/052762.jpg,325
test/052763.jpg,299
```

Presentation & Grading

- **Presentation Date/Time**
  - **108/6/25 (Tue.) 13:30 – 17:00**
  - If you cannot participate, you need to let me/TAs/your team members know in advance.
- **Final 35%** (Bonus up to 1%+3%+3%)
  - **Code / Kaggle 10%**: Kaggle for references, final accuracy evaluated by TAs
    - Early baseline: bonus 1% (due 6/15 Sat. 01:00)
    - TA baseline
      Public: Weak 5% / Strong 5%; Private: bonus up to 3% (due 6/24 Mon. 02:00)
  - **Approach & Presentation 25%**
    - Novelty and technical contribution 10%
    - Completeness of experiments 10% (e.g., comparisons to baseline and recent models, ablation studies, visualization, etc.)
    - Presentation (Oral + Poster) 5% + bonus up to 3% (top 3 teams voted by class)
- You need to upload your code to GitHub and provide your own README files, so that TAs will be able to reproduce your results.
- If TAs cannot reproduce your results, 0/20 points will be given unless minor errors (i.e., no credits for the approach part).

Presentation & Grading

- **Baseline Scores**

Domain Adaptation	inf+qdr+rel →skt	inf+rel+skt →qdr	qdr+rel+skt →inf	inf+qdr+skt →rel
Weak	23.1 %	11.8 %	8.2 %	**41.8 %**
Strong	33.7 %	13.3 %	13.0 %	**53.1 %**

- **Intra-Group Evaluation** (for teams with 2+ members)
  - Every student will rate each member in his/her team. (e.g., 1~5)
  - Every student will specify the contributions of each member in the team.
  - (*Optional*)
    Students can provide additional remarks on the team members if necessary. The comments will not be released to other team members and will be accessible to the instructor and TAs only.

Packages

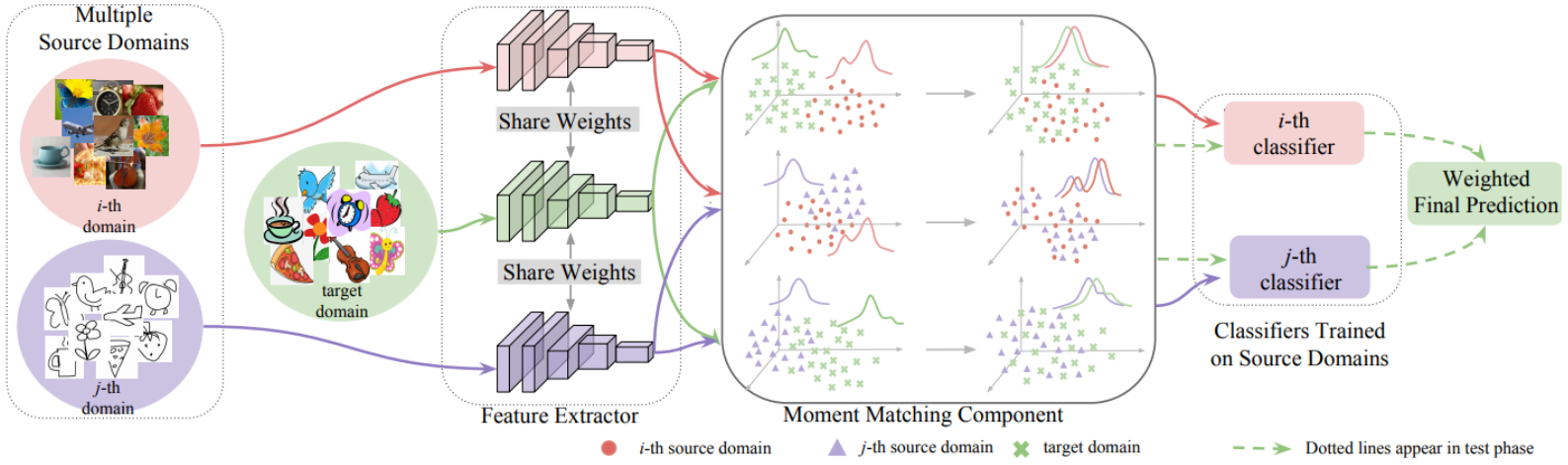
- List of allowed packages
  - `python`: 3.5+
  - `tensorflow`: 1.13
  - `keras`: 2.2+
  - `torch`: 1.0
  - `h5py`: 2.9.0
  - `numpy`: 1.16.2
  - `pandas`: 0.24.0
  - `torchvision`: 0.2.2
  - `tensorboard`: 1.13.1
  - `scipy`: 1.3.0 (`scipy.misc.imread` is deprecated in this version)
  - `cv2`, `matplotlib`, `skimage`, `sklearn`, `Pillow`, `imageio`
  - The Python Standard Library
- **E-mail or ask TAs first if you want to import other packages.**

Related Papers

- Moment Matching for Multi-Source Domain Adaptation. arXiv 2019
- Adversarial Multiple Source Domain Adaptation. NeurIPS 2018
- Multi-Domain Adversarial Learning. ICLR 2019
- Multi-Source Domain Adaptation with Mixture of Experts. EMNLP 2018
- Deep Cocktail Network: Multi-source Unsupervised Domain Adaptation with Category Shift. CVPR 2018

Related Papers

- Multi-Source Domain Adaptation
  - Some existing methods…



Peng, Xingchao, et al. "Moment Matching for Multi-Source Domain Adaptation." *arXiv preprint arXiv:1812.01754* (2018).

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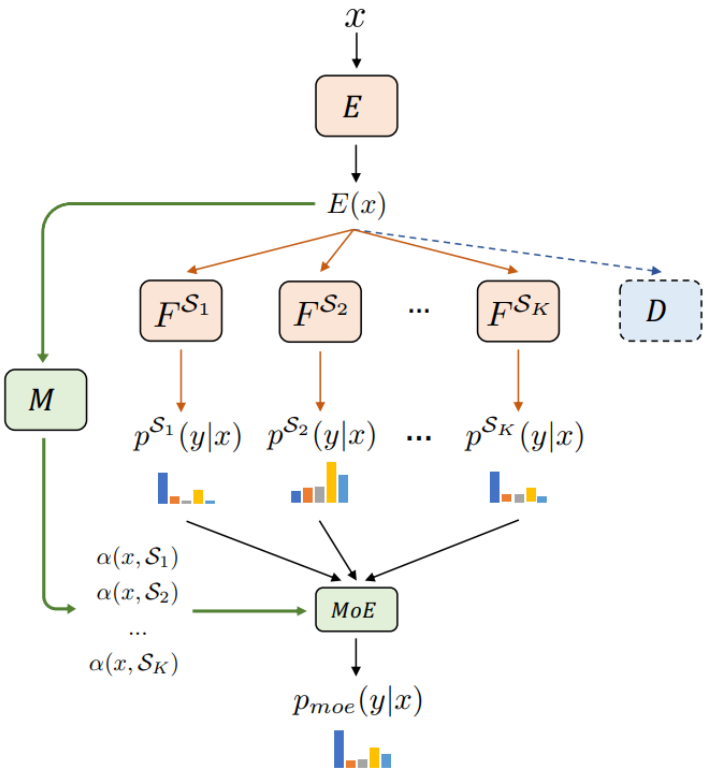

Guo, Jiang, Darsh J. Shah, and Regina Barzilay. "Multi-Source Domain Adaptation with Mixture of Experts." *arXiv preprint arXiv:1809.02256* (2018).

Contact TAs

- 楊福恩：Tue. 13:00 ~ 15:00 @ BL527
- 李元顥：Wed. 13:30 ~ 15:30 @ BL527
- 劉彥廷：Wed. 15:30 ~ 17:30 @ BL527
- 郭冠軒：Thu. 14:00 ~ 16:00 @ BL527

- If you have any questions, please leave a comment in the Facebook group or send an email to TA's email account.