Link to Github repo: https://github.com/alyssahuang02/CS197-Pset4

Exercise 1

Added import wandb lines at the top

```
import wandb
wandb.login()
```

Initializing project and config information for wandb

```
wandb.init(
            # Set the project where this run will be logged
            project="cs197-pset4",
            # Track hyperparameters and run metadata
            config=config_dict)
```

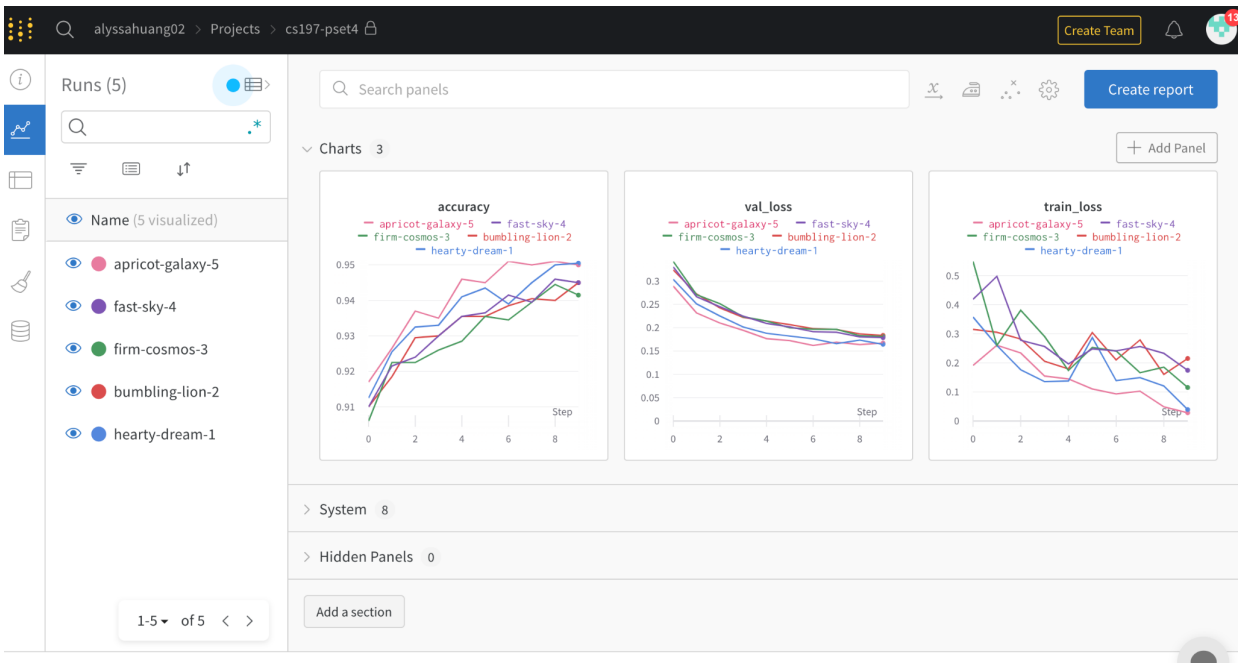
Logging train loss, val loss, and accuracy for wandb

```
wandb.log({"train_loss": train_loss, "val_loss": val_loss, "accuracy": accuracy})
```

Finishing the wandb run

```
wandb.finish()
```

Here are the charts in wandb:



Exercise 2

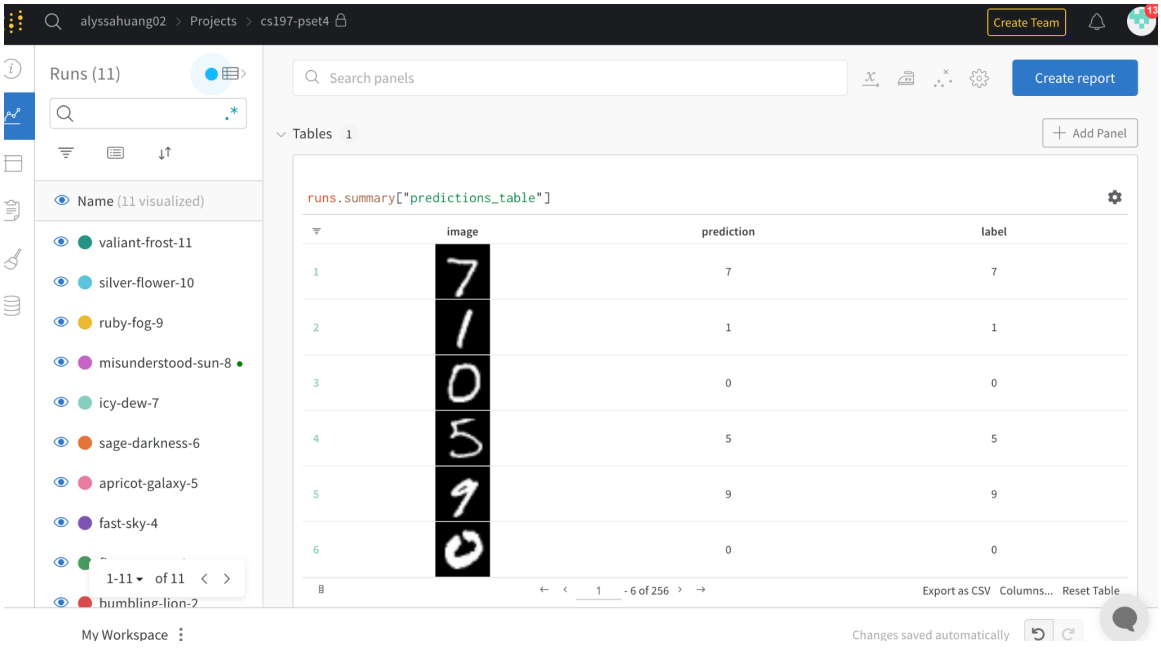
Added function to create the table with images, predictions, and labels

```
def log_image_table(images, predicted, labels):
    "Log a wandb.Table with (image, prediction, label)"
    table = wandb.Table(
        columns=["image", "prediction", "label"])
    for img, pred, label in \
            zip(images.to("cpu"),
                predicted.to("cpu"),
                labels.to("cpu")):
        table.add_data(
            wandb.Image(img[0].numpy()*255), pred, label)
    wandb.log({"predictions_table": table}, commit=False)
```

Modified validate model to call the log_image_table if we're in the last epoch for images in a given batch id

```
if i == batch_idx and log_images:
                log_image_table(
                    images,
                    predicted,
                    labels)
```

Here are the tables in wandb:



Exercise 3

Import necessary packages

```
import os
import numpy as np
import logging
logging.getLogger().setLevel(logging.INFO)
```

Create CheckpointSaver class

```
class CheckpointSaver:
   def __init__(self, dirpath, decreasing=True, top_n=5):
       """
       dirpath: Directory path where to store all model weights
       decreasing: If decreasing is `True`, then lower metric is better
       top_n: Total number of models to track based on validation metric value
       """
       if not os.path.exists(dirpath): os.makedirs(dirpath)
       self.dirpath = dirpath
       self.top_n = top_n
       self.decreasing = decreasing
       self.top_model_paths = []
       self.best_metric_val = np.Inf if decreasing else -np.Inf

   def __call__(self, model, epoch, metric_val):
       model_path = os.path.join(self.dirpath, model.__class__.__name__ +
f'_epoch{epoch}.pt')
       save = metric_val<self.best_metric_val if self.decreasing else
metric_val>self.best_metric_val
       if save:
           logging.info(f"Current metric value better than {metric_val} better than
best {self.best_metric_val}, saving model at {model_path}, & logging model weights to
W&B.")
           self.best_metric_val = metric_val
           torch.save(model.state_dict(), model_path)
           self.log_artifact(f'model-ckpt-epoch-{epoch}.pt', model_path, metric_val)
           self.top_model_paths.append({'path': model_path, 'score': metric_val})
           self.top_model_paths = sorted(self.top_model_paths, key=lambda o:
o['score'], reverse=not self.decreasing)
       if len(self.top_model_paths)>self.top_n:
           self.cleanup()

   def log_artifact(self, filename, model_path, metric_val):
```

```
        artifact = wandb.Artifact(filename, type='model', metadata={'Validation score':
metric_val})
        artifact.add_file(model_path)
        wandb.run.log_artifact(artifact)

    def cleanup(self):
        to_remove = self.top_model_paths[self.top_n:]
        logging.info(f"Removing extra models.. {to_remove}")
        for o in to_remove:
            os.remove(o['path'])
        self.top_model_paths = self.top_model_paths[:self.top_n]
```

Initializing CheckpointSaver

```
checkpoint_saver = CheckpointSaver(dirpath='./model_weights', decreasing=True,
top_n=3)
```

Updating CheckpointSaver

```
checkpoint_saver(model, epoch, val_loss)
```

Logs show that model checkpoints are being updated properly

```
INFO:root:Current metric value better than 0.20425148379802704 better than best 0.21572053372859956, saving model at ./model
_weights/Sequential_epoch5.pt, & logging model weights to W&B.
INFO:root:Removing extra models.. [{'path': './model_weights/Sequential_epoch2.pt', 'score': 0.23770914578437805}]
Train Loss: 0.214,                Valid Loss: 0.204251,                Accuracy: 0.94
```

Exercise 4

Initializing the sweep configuration

```
sweep_configuration = {
   "name": "Hyperparameter Sweep",
   "method": "grid",
   "metric": {"name": "val_loss", "goal": "minimize"},
   "parameters": {
       "batch_size": {
           "values": [100,150,200]
       },
       "epochs": {
           "values": [5,10,15]
       },
       "lr": {
           "values": [1e-2, 1e-3, 1e-4]
       }
   }
}
```

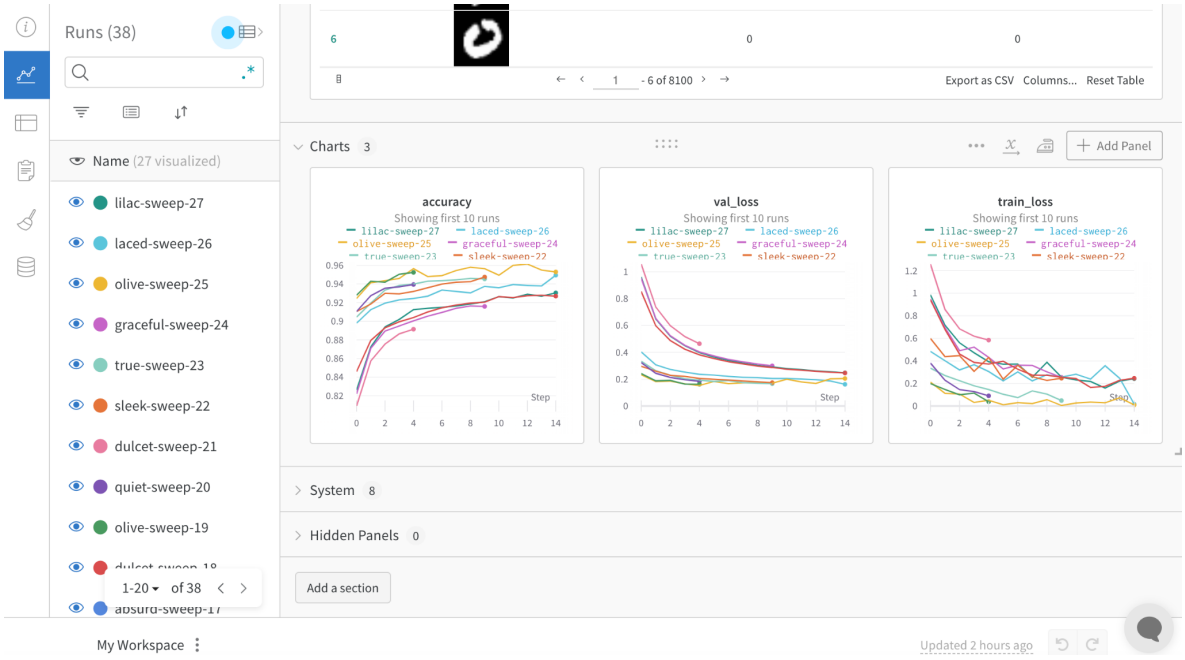
Using sweep config values

```
config_dict = {
           "epochs": wandb.config.epochs,
           "batch_size": wandb.config.batch_size,
           "lr": wandb.config.lr,
           "dropout": random.uniform(0.01, 0.80),
       }
```

Initializing and running the sweep

```
sweep_id = wandb.sweep(sweep_configuration, project="cs197-pset4")
   wandb.agent(sweep_id, function=train)
```

Sweeps visualized in wandb



Exercise 5

config.yaml

```yaml
_target_: torch.nn.Sequential
_args_:
 - _target_: torch.nn.Linear
   in_features: 9216
   out_features: 100

 - _target_: torch.nn.Linear
   in_features: ${..[0].out_features}
   out_features: 10
```

train.py

```python
from omegaconf import DictConfig
import hydra
from hydra.utils import instantiate

@hydra.main(version_base=None, config_path="./configs", config_name="config")
def run(cfg: DictConfig):
   opt = instantiate(cfg)
   print(opt)

if __name__ == "__main__":
   run()
```

Verified that running python train.py outputted in the right result

```
(lec8) alyssahuang@dhcp-10-250-31-248 CS197 Pset4 % python train.py
Sequential(
  (0): Linear(in_features=9216, out_features=100, bias=True)
  (1): Linear(in_features=100, out_features=10, bias=True)
)
```

Exercise 6

config.yaml

```yaml
defaults:
 - classifier: small
```

small.yaml

```yaml
_target_: torch.nn.Sequential
_args_:
 - _target_: torch.nn.Linear
   in_features: 9216
   out_features: 100

 - _target_: torch.nn.Linear
   in_features: ${..[0].out_features}
   out_features: 10
```

large.yaml

```yaml
_target_: torch.nn.Sequential
_args_:
 - _target_: torch.nn.Linear
   in_features: 9216
   out_features: 2040

 - _target_: torch.nn.Linear
   in_features: ${..[0].out_features}
   out_features: 300
  - _target_: torch.nn.Linear
   in_features: ${..[1].out_features}
   out_features: 10
```

Folder structure:

+--configs/
| +--config.yaml
| +--classifiers/
  | +--small.yaml
  | +--large.yaml

Verified that running python train.py outputted in the right result

```
(lec8) alyssahuang@dhcp-10-250-31-248 CS197 Pset4 % python train.py classifier=small
{'classifier': Sequential(
  (0): Linear(in_features=9216, out_features=100, bias=True)
  (1): Linear(in_features=100, out_features=10, bias=True)
)}
(lec8) alyssahuang@dhcp-10-250-31-248 CS197 Pset4 % python train.py
{'classifier': Sequential(
  (0): Linear(in_features=9216, out_features=100, bias=True)
  (1): Linear(in_features=100, out_features=10, bias=True)
)}
(lec8) alyssahuang@dhcp-10-250-31-248 CS197 Pset4 % python train.py classifier=large
{'classifier': Sequential(
  (0): Linear(in_features=9216, out_features=2040, bias=True)
  (1): Linear(in_features=2040, out_features=300, bias=True)
  (2): Linear(in_features=300, out_features=10, bias=True)
)}
```

Extra Credit

https://twitter.com/AlyssaH39378240/status/1582936244941516805