Example of the `aitlas` toolbox in the context of multi class image classification

This notebook shows a sample implementation of a multi class image classification using the `aitlas` toolbox and the CLRS dataset.

In [1]:
```
from aitlas.datasets import CLRSDataset
from aitlas.models import VisionTransformer
from aitlas.transforms import ResizeCenterCropFlipHVToTensor, ResizeCenterCropToTen
from aitlas.utils import image_loader
```

Load the dataset

In [2]:
```
dataset_config = {
    "data_dir": "/media/hdd/multi-class/CLRS",
    "csv_file": "/media/hdd/multi-class/CLRS/train.csv",
    "batch_size": 128,
    "shuffle": True,
    "num_workers": 4,
}
dataset = CLRSDataset(dataset_config)
```

Show images from the dataset

In [3]:
```
fig1 = dataset.show_image(1000)
fig2 = dataset.show_image(80)
fig3 = dataset.show_batch(15)
```

Image with index 1000 from the dataset CLRS dataset, with label port

Image with index 80 from the dataset CLRS dataset, with label forest

Inspect the data

In [4]:
```
dataset.show_samples()
```

Out[4]:

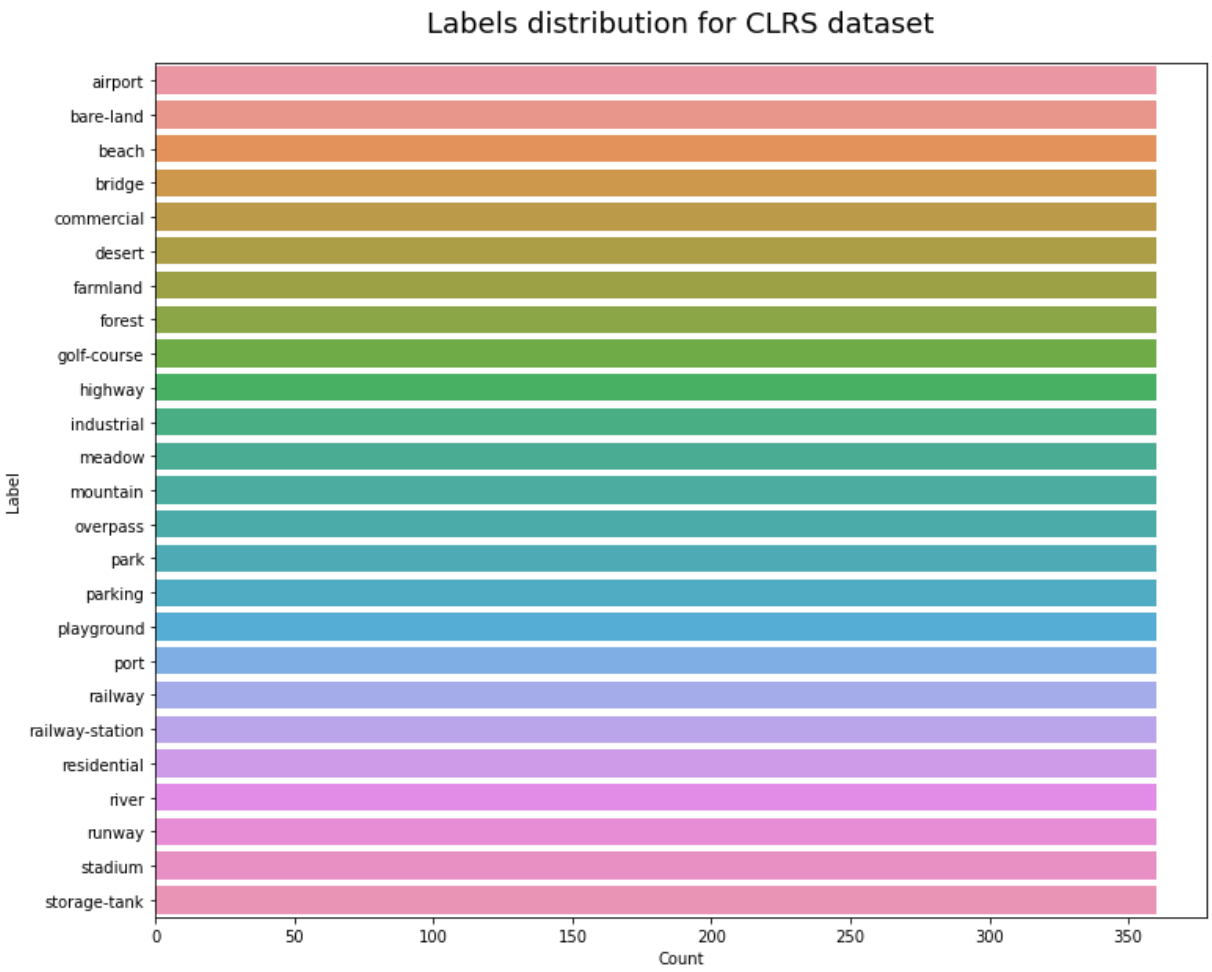
	File name	Label
0	residential/residential_543_Level2_0.84m.tif	residential
1	beach/beach_172_Level1_0.48m.tif	beach
2	residential/residential_530_Level3_1.86m.tif	residential
3	highway/highway_62_Level3_0.93m.tif	highway
4	parking/parking_309_Level1_0.46m.tif	parking
5	port/port_275_Level3_2.44m.tif	port
6	port/port_357_Level3_1.15m.tif	port
7	railway/railway_432_Level2_0.73m.tif	railway
8	meadow/meadow_596_Level1_0.39m.tif	meadow
9	storage-tank/storage-tank_469_Level1_0.60m.tif	storage-tank
10	stadium/stadium_145_Level3_1.95m.tif	stadium
11	stadium/stadium_32_Level3_3.66m.tif	stadium
12	forest/forest_551_Level2_0.73m.tif	forest
13	storage-tank/storage-tank_258_Level3_1.62m.tif	storage-tank
14	airport/airport_444_Level2_0.71m.tif	airport
15	stadium/stadium_540_Level2_1.41m.tif	stadium
16	residential/residential_499_Level3_1.86m.tif	residential
17	railway-station/railway-station_432_Level2_0.7...	railway-station
18	playground/playground_170_Level2_0.93m.tif	playground
19	bridge/bridge_84_Level1_0.73m.tif	bridge

In [5]:
```
dataset.data_distribution_table()
```

Out[5]:

	Label	Count
0	airport	360
1	bare-land	360
2	beach	360
3	bridge	360
4	commercial	360
5	desert	360
6	farmland	360
7	forest	360
8	golf-course	360
9	highway	360
10	industrial	360
11	meadow	360
12	mountain	360
13	overpass	360
14	park	360
15	parking	360
16	playground	360
17	port	360
18	railway	360
19	railway-station	360
20	residential	360
21	river	360
22	runway	360
23	stadium	360
24	storage-tank	360

In [6]:
```
fig = dataset.data_distribution_barchart()
```



Load train and validation splits

In [7]:
```
train_dataset_config = {
    "batch_size": 32,
    "shuffle": True,
    "num_workers": 4,
    "data_dir": "/media/hdd/multi-class/CLRS",
    "csv_file": "/media/hdd/multi-class/CLRS/train.csv",
}

train_dataset = CLRSDataset(train_dataset_config)
train_dataset.transform = ResizeRandomCropFlipHVToTensor()

validation_dataset_config = {
    "batch_size": 32,
    "shuffle": False,
    "num_workers": 4,
    "data_dir": "/media/hdd/multi-class/CLRS",
    "csv_file": "/media/hdd/multi-class/CLRS/val.csv",
    "transforms": ["aitlas.transforms.ResizeCenterCropToTensor"]
}

validation_dataset = CLRSDataset(validation_dataset_config)
len(train_dataset), len(validation_dataset)
```

Out[7]: (9000, 3000)

Setup and create the model for training

In [8]:
```
epochs = 100
model_directory = "./experiments/CLRS"
model_config = {
    "num_classes": 25,
    "learning_rate": 0.0001,
    "pretrained": True,
    "metrics": ["accuracy", "precision", "recall", "f1_score"]
}
model = VisionTransformer(model_config)
model.prepare()
```

Training and validation

In [ ]:
```
model.train_and_evaluate_model(
    train_dataset=train_dataset,
    epochs=epochs,
    model_directory=model_directory,
    val_dataset=validation_dataset,
    run_id='1',
)
```

Test the model

In [ ]:
```
test_dataset_config = {
    "batch_size": 16,
    "shuffle": False,
    "num_workers": 4,
    "data_dir": "/media/hdd/multi-class/CLRS",
    "csv_file": "/media/hdd/multi-class/CLRS/test.csv",
    "transforms": ["aitlas.transforms.ResizeCenterCropToTensor"]
}

test_dataset = CLRSDataset(test_dataset_config)
model_path = "best_checkpoint_1654596678_20.pth.tar"
model.metrics = ["accuracy", "precision", "recall", "f1_score"]
model.running_metrics.reset()
model.evaluate(dataset=test_dataset, model_path=model_path)
model.running_metrics.get_scores(model.metrics)
```

Predictions

In [24]:
```
#labels = CLRSDataset.labels
labels = ["airport", "bare-land", "beach", "bridge", "commercial", "desert", "farml
          "highway", "industrial", "meadow", "mountain", "overpass", "park", "parki
          "railway-station", "residential", "river", "runway", "stadium", "storage-
```

```
transform = ResizeCenterCropToTensor()

model_path = "best_checkpoint_1654596678_20.pth.tar"
model.load_model(model_path)

image = image_loader('/media/hdd/multi-class/CLRS/stadium/stadium_353_Level1_0.95m.
fig = model.predict_image(image, labels, transform)
```

```
2022-10-19 11:55:19,750 INFO Loading checkpoint best_checkpoint_1654596678_20.pth.ta
r
2022-10-19 11:55:20,083 INFO Loaded checkpoint best_checkpoint_1654596678_20.pth.tar
at epoch 21
```