Build my own CNN

Practice – CNN

- Run “7.2. MyCNN.ipynb"

Build my own CNN model

The width and height of the feature maps are calculated based on input image size = 64 x 64x 3

```
class MyCNN(nn.Module):
  def __init__(self):
    super(MyCNN, self).__init__()
    self.features = nn.Sequential(    #Assume input image H/W=64
        nn.Conv2d(3, 32, 3, 1, 1), #feature map H/W=(64+2*1-3)/1+1 = 64
        nn.ReLU(inplace=True),
        nn.MaxPool2d(2, 2, 0),    #H/W=(64+2*0-2)/2+1 = 32
        nn.Conv2d(32, 8, 3, 1, 1), #H/W=(32+2*1-3)/1+1 = 32
        nn.ReLU(inplace=True),
        nn.MaxPool2d(2, 2, 0),    #H/W=(32+2*0-2)/2+1 = 16
    )
    self.classifier = nn.Sequential(
        nn.Dropout(),
        nn.Linear(8 * 16 * 16, 500),
        nn.ReLU(inplace=True),
        nn.Dropout(),
        nn.Linear(500, 100),
        nn.ReLU(inplace=True),
        nn.Dropout(),
        nn.Linear(100, 2),
    )

  def forward(self, x):
    x = self.features(x)
    x = torch.flatten(x, 1)
    x = self.classifier(x)
    return x
```

The MLP used in "4.2. Classification with CE loss"

```
MyNet = nn.Sequential(
    nn.Linear(2, 50),
    nn.ReLU(),
    nn.Linear(50, 100),
    nn.ReLU(),
    nn.Linear(100, 50),
    nn.ReLU(),
    nn.Linear(50, 2),
)
MyNet.to(device)
```

Practice: Draw the structure of MyCNN

```
model = MyCNN().to(device)
print(model)
```

```
MyCNN(
  (features): Sequential(
    (0): Conv2d(3, 32, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (1): ReLU(inplace=True)
    (2): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mo
    (3): Conv2d(32, 8, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (4): ReLU(inplace=True)
    (5): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mo
  )
  (classifier): Sequential(
    (0): Dropout(p=0.5, inplace=False)
    (1): Linear(in_features=2048, out_features=500, bias=True)
    (2): ReLU(inplace=True)
    (3): Dropout(p=0.5, inplace=False)
    (4): Linear(in_features=500, out_features=100, bias=True)
    (5): ReLU(inplace=True)
    (6): Dropout(p=0.5, inplace=False)
    (7): Linear(in_features=100, out_features=2, bias=True)
  )
)
```

My own CNN

```
from torchsummary import summary
summary(model, input_size=(3, 64, 64))
```

```
----------------------------------------------------------------
        Layer (type)               Output Shape         Param #
================================================================
            Conv2d-1           [-1, 32, 64, 64]             896
              ReLU-2           [-1, 32, 64, 64]               0
         MaxPool2d-3           [-1, 32, 32, 32]               0
            Conv2d-4            [-1, 8, 32, 32]           2,312
              ReLU-5            [-1, 8, 32, 32]               0
         MaxPool2d-6            [-1, 8, 16, 16]               0
           Dropout-7                 [-1, 2048]               0
            Linear-8                  [-1, 500]       1,024,500
              ReLU-9                  [-1, 500]               0
          Dropout-10                  [-1, 500]               0
           Linear-11                  [-1, 100]          50,100
             ReLU-12                  [-1, 100]               0
          Dropout-13                  [-1, 100]               0
           Linear-14                    [-1, 2]             202
================================================================
Total params: 1,078,010
Trainable params: 1,078,010
Non-trainable params: 0
----------------------------------------------------------------
Input size (MB): 0.05
Forward/backward pass size (MB): 2.42
Params size (MB): 4.11
Estimated Total Size (MB): 6.58
----------------------------------------------------------------
```

MLP in "4.2. Classification with CE loss"

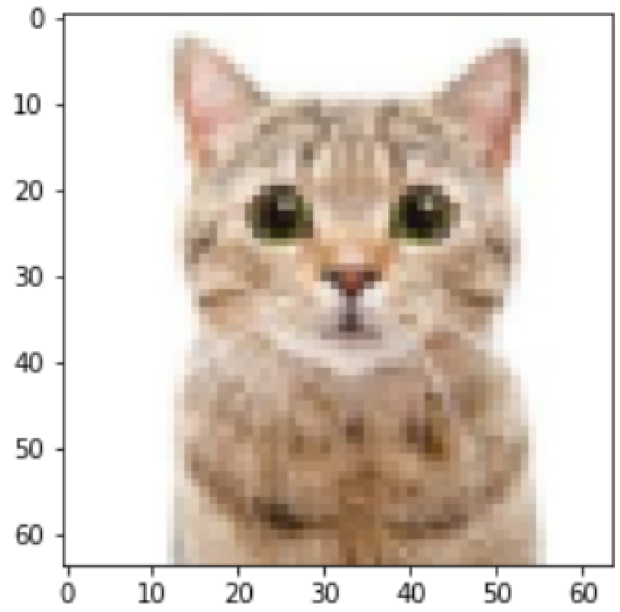
```
BATCH_SIZE = 30
summary(MyNet, input_size=(BATCH_SIZE, 2))
```

```
----------------------------------------------------------------
        Layer (type)               Output Shape         Param #
================================================================
            Linear-1               [-1, 30, 50]             150
              ReLU-2               [-1, 30, 50]               0
            Linear-3              [-1, 30, 100]           5,100
              ReLU-4              [-1, 30, 100]               0
            Linear-5               [-1, 30, 50]           5,050
              ReLU-6               [-1, 30, 50]               0
            Linear-7                [-1, 30, 2]             102
================================================================
Total params: 10,402
Trainable params: 10,402
Non-trainable params: 0
----------------------------------------------------------------
Input size (MB): 0.00
Forward/backward pass size (MB): 0.09
Params size (MB): 0.04
Estimated Total Size (MB): 0.13
----------------------------------------------------------------
```

Input image after pre-processing

In [13]:
```
#visualize the image after pre-processing
# Tensor is channel first, to plot, we need to convert to channel last
import numpy as np
PILImgArray = np.zeros((PILImg.shape[1], PILImg.shape[2], 3))
PILImgArray[:,:,0] = PILImg[0, :, :]
PILImgArray[:,:,1] = PILImg[1, :, :]
PILImgArray[:,:,2] = PILImg[2, :, :]
PILImgArray = PILImgArray*0.5+0.5  # change N(0, 1) to [0, 1]
print(PILImgArray.shape, PILImgArray.min(), PILImgArray.max())
plt.imshow(PILImgArray)
plt.show()
```

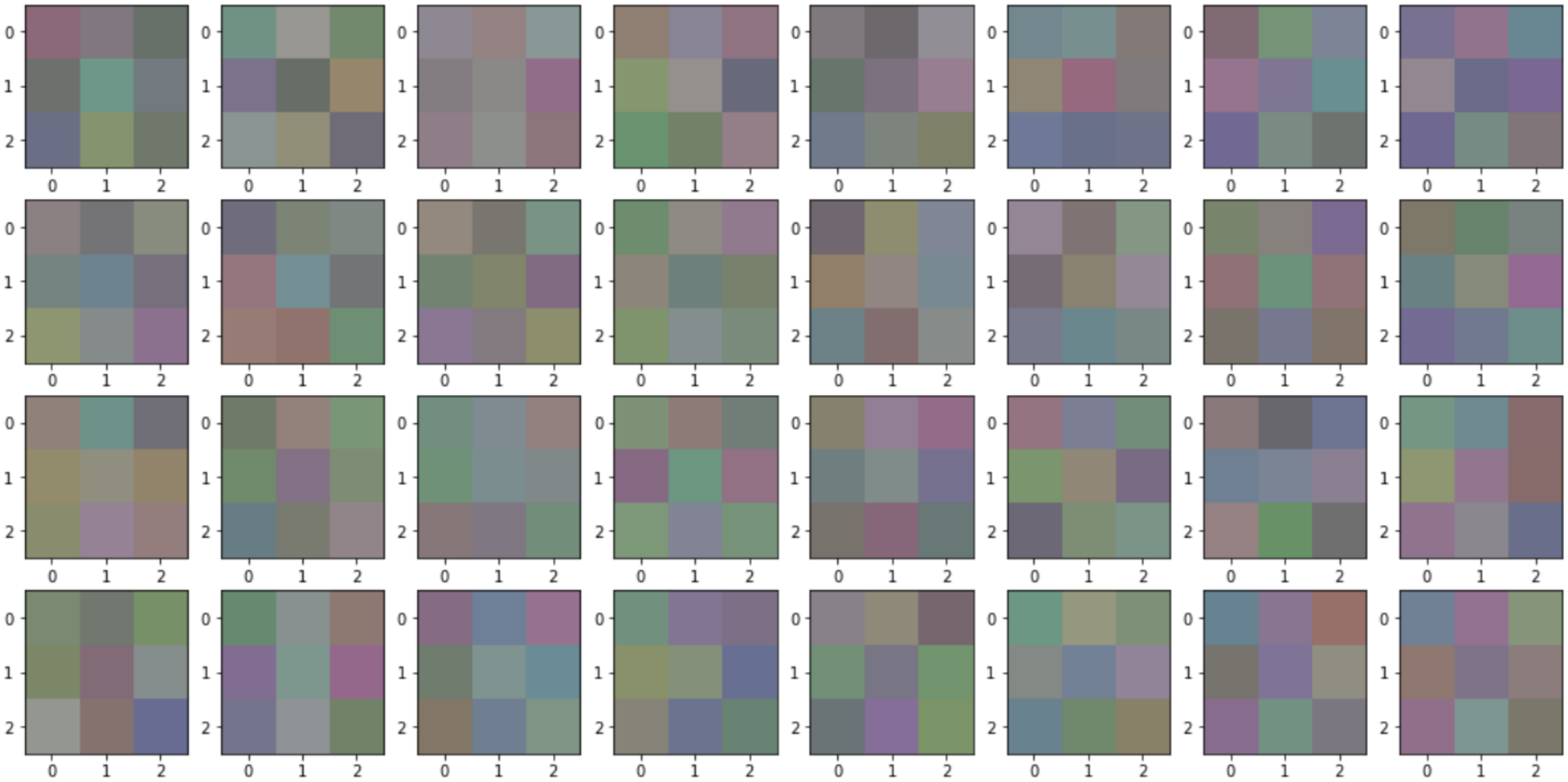
```
(64, 64, 3) 0.027450978755950928 1.0
```



Input image size = 64 x 64x 3

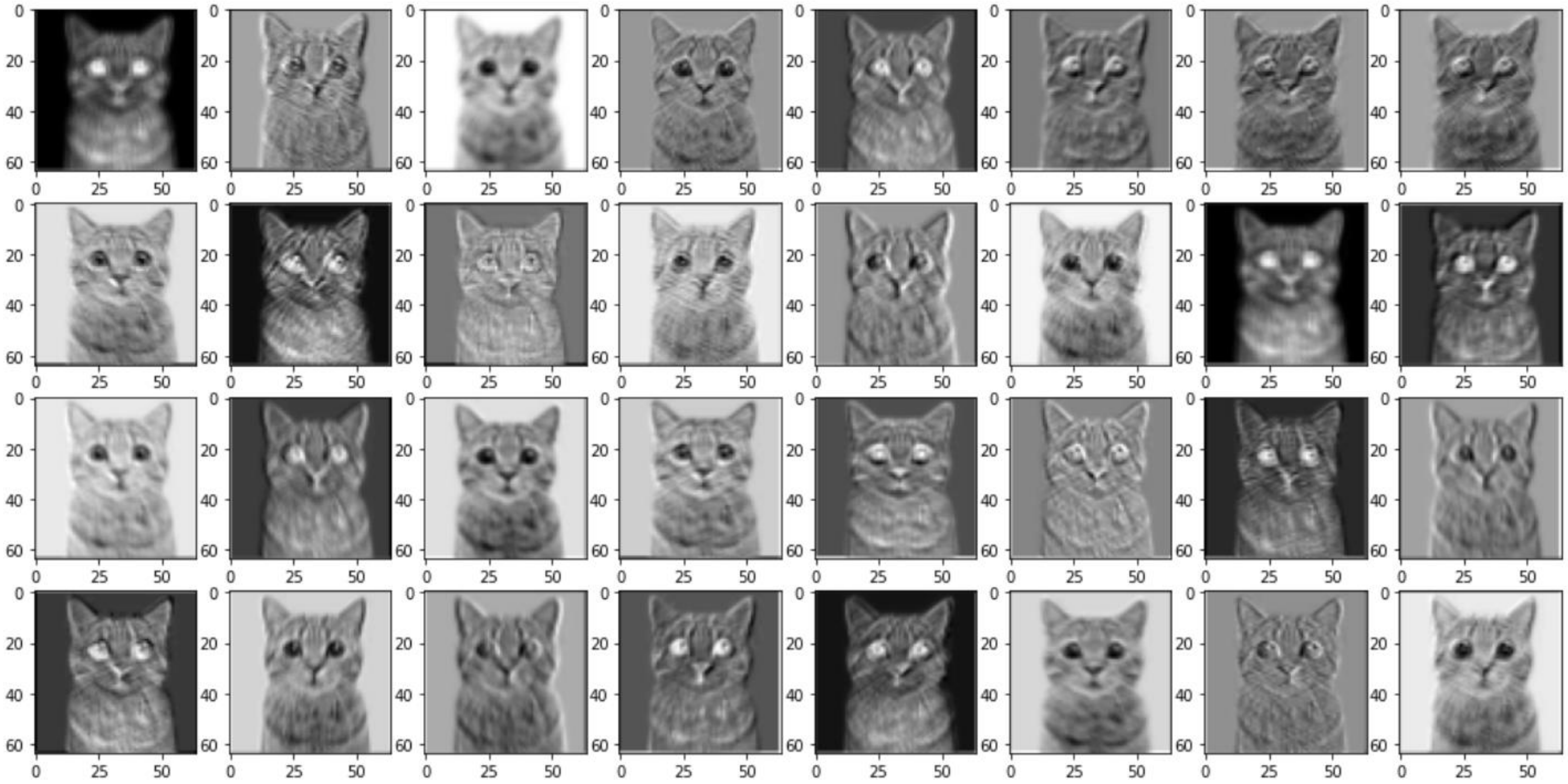
Initial filter weights

```
MyCNN(
  (features): Sequential(
    (0): Conv2d(3, 32, kernel_size=(3, 3), stride=(1, 1), padding
    (1): ReLU(inplace=True)
    (2): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1
    (3): Conv2d(32, 8, kernel_size=(3, 3), stride=(1, 1), padding
    (4): ReLU(inplace=True)
    (5): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1
```



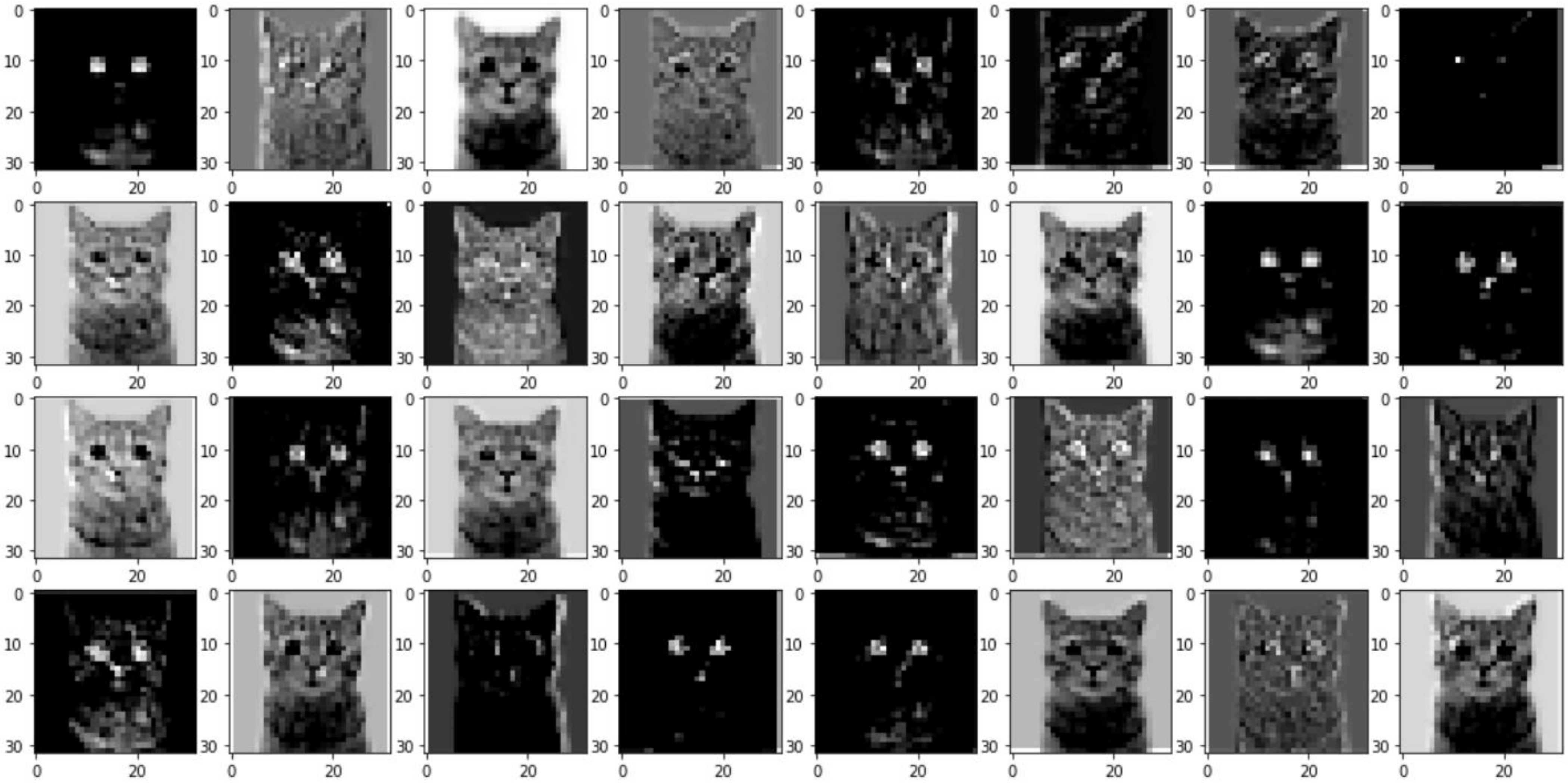
Output feature map, shape = 64x64x32

The width and height of the feature maps are calculated based on input image size = 64 x 64x 3



Feature map after max pooling, shape = 32x32x32

```
torch.Size([1, 32, 32, 32])
```



Flatten

```python
class MyCNN(nn.Module):
  def __init__(self):
    super(MyCNN, self).__init__()
    self.features = nn.Sequential(    #Assume input image H/W=64
        nn.Conv2d(3, 32, 3, 1, 1), #feature map H/W=(64+2*1-3)/1+1 = 64
        nn.ReLU(inplace=True),
        nn.MaxPool2d(2, 2, 0),     #H/W=(64+2*0-2)/2+1 = 32
        nn.Conv2d(32, 8, 3, 1, 1), #H/W=(32+2*1-3)/1+1 = 32
        nn.ReLU(inplace=True),
        nn.MaxPool2d(2, 2, 0),     #H/W=(32+2*0-2)/2+1 = 16
    )
    self.classifier = nn.Sequential(
        nn.Dropout(),
        nn.Linear(8 * 16 * 16, 500),
        nn.ReLU(inplace=True),
        nn.Dropout(),
        nn.Linear(500, 100),
        nn.ReLU(inplace=True),
        nn.Dropout(),
        nn.Linear(100, 2),
    )

  def forward(self, x):
    x = self.features(x)
    x = torch.flatten(x, 1)
    x = self.classifier(x)
    return x
```

```python
model = MyCNN().to(device)
print(model)
```

```
MyCNN(
  (features): Sequential(
    (0): Conv2d(3, 32, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (1): ReLU(inplace=True)
    (2): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mo
    (3): Conv2d(32, 8, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (4): ReLU(inplace=True)
    (5): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mo
  )
  (classifier): Sequential(
    (0): Dropout(p=0.5, inplace=False)
    (1): Linear(in_features=2048, out_features=500, bias=True)
    (2): ReLU(inplace=True)
    (3): Dropout(p=0.5, inplace=False)
    (4): Linear(in_features=500, out_features=100, bias=True)
    (5): ReLU(inplace=True)
    (6): Dropout(p=0.5, inplace=False)
    (7): Linear(in_features=100, out_features=2, bias=True)
  )
)
```

In [22]:
```python
WholeConvLayers = model.features
out1 = WholeConvLayers(imageTensor.to(device))
print(out1.shape)
```

```
torch.Size([1, 8, 16, 16])
```

In [23]:
```python
out2 = torch.flatten(out1, 1)
print(out2.shape)
```

```
torch.Size([1, 2048])
```

In [24]:
```python
ClassifierMLP = model.classifier
out = ClassifierMLP(out2)
```

Class practice

- Let the input image size be 224x224x3. Modify your CNN.

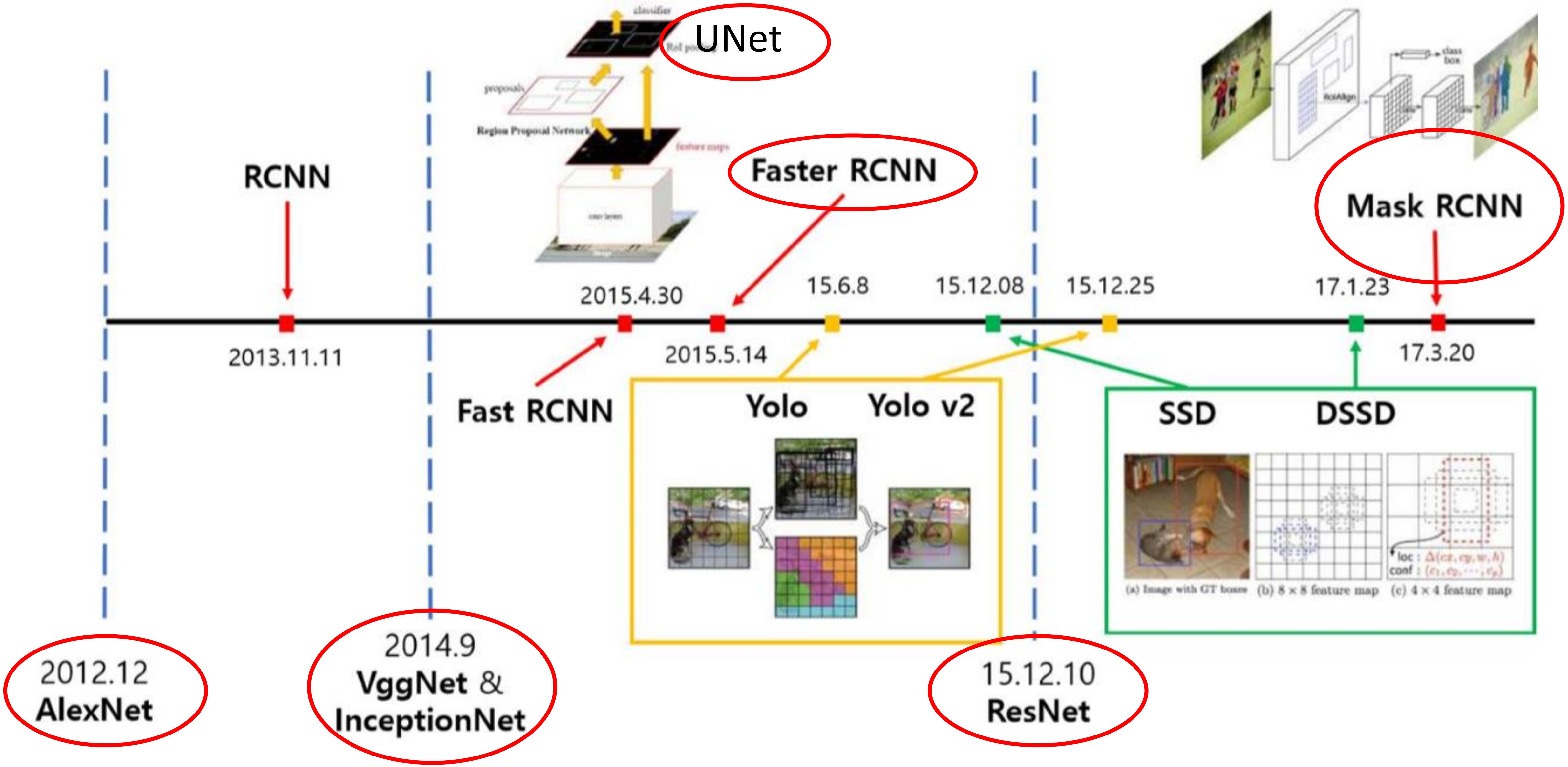
```python
class MyCNN(nn.Module):
  def __init__(self):
    super(MyCNN, self).__init__()
    self.features = nn.Sequential(    #Assume input image H/W=64
        nn.Conv2d(3, 32, 3, 1, 1), #feature map H/W=(64+2*1-3)/1+1 = 64
        nn.ReLU(inplace=True),
        nn.MaxPool2d(2, 2, 0),     #H/W=(64+2*0-2)/2+1 = 32
        nn.Conv2d(32, 8, 3, 1, 1), #H/W=(32+2*1-3)/1+1 = 32
        nn.ReLU(inplace=True),
        nn.MaxPool2d(2, 2, 0),     #H/W=(32+2*0-2)/2+1 = 16
    )
    self.classifier = nn.Sequential(
        nn.Dropout(),
        nn.Linear(8 * 16 * 16, 500),
        nn.ReLU(inplace=True),
        nn.Dropout(),
        nn.Linear(500, 100),
        nn.ReLU(inplace=True),
        nn.Dropout(),
        nn.Linear(100, 2),
    )

  def forward(self, x):
    x = self.features(x)
    x = torch.flatten(x, 1)
    x = self.classifier(x)
    return x
```

```python
[10]: from torchvision import transforms
      transformer = transforms.Compose([
          transforms.Resize(64),
          transforms.CenterCrop(64),
          transforms.ToTensor(),
          transforms.Normalize(mean=[0.5, 0.5
```

VGG16

CNN family



圖來源: 李春煌 FasterRCNN講義 https://youtu.be/2i9CcmJp2yI

Practice – Load ImageNet pre-trained VGG

```
import torchvision
model = torchvision.models.vgg16(pretrained=True)
```

```
Downloading: "https://download.pytorch.org/models/vgg16-397923af.pth"
100% 528M/528M [00:10<00:00, 54.9MB/s]
```

Practice: Draw the structure of VGG16

```
model.eval()
model.to(device)
```

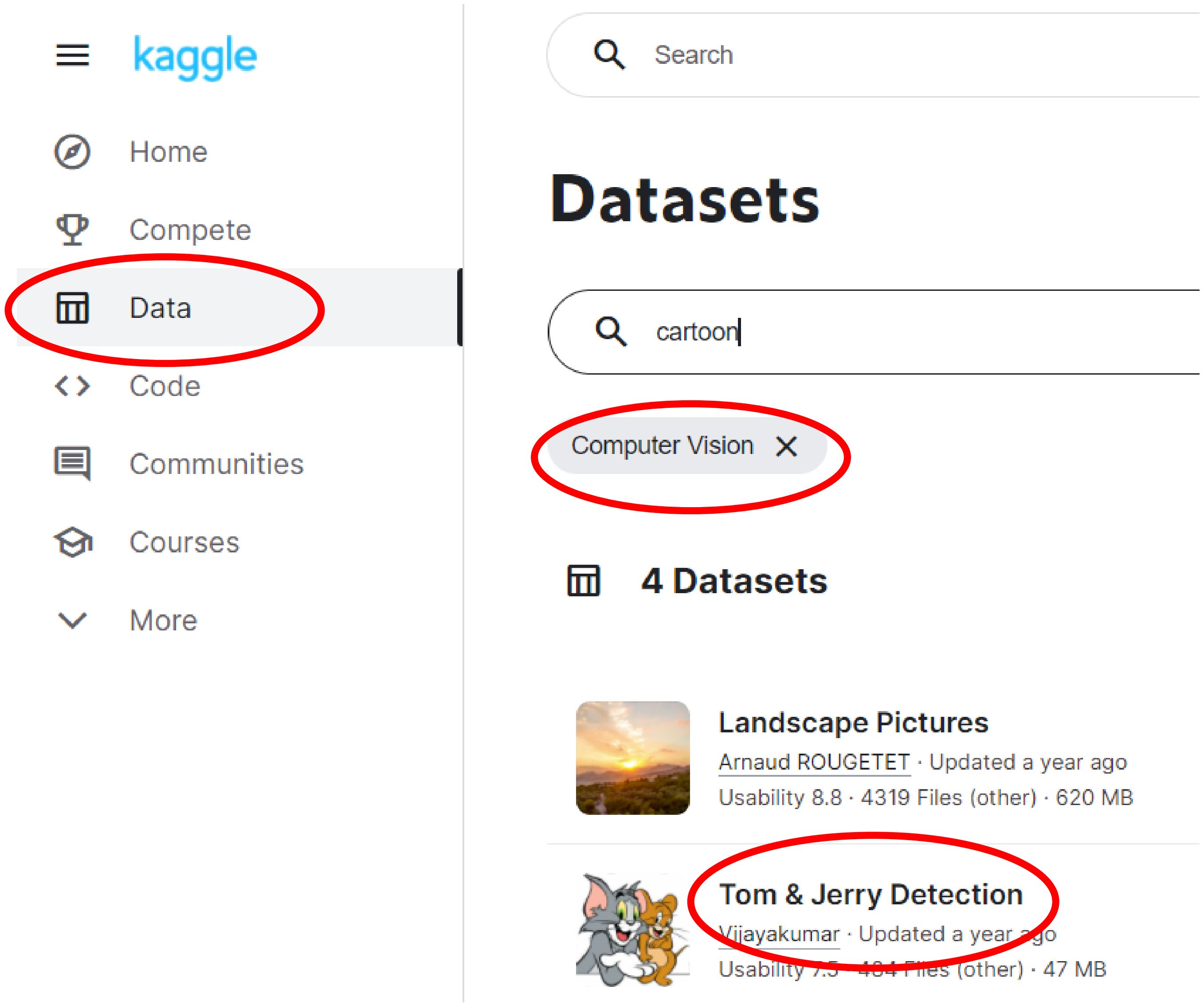
```
VGG(
  (features): Sequential(
    (0): Conv2d(3, 64, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (1): ReLU(inplace=True)
    (2): Conv2d(64, 64, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (3): ReLU(inplace=True)
    (4): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
    (5): Conv2d(64, 128, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (6): ReLU(inplace=True)
    (7): Conv2d(128, 128, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (8): ReLU(inplace=True)
    (9): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
    (10): Conv2d(128, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (11): ReLU(inplace=True)
    (12): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (13): ReLU(inplace=True)
    (14): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (15): ReLU(inplace=True)
    (16): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
    (17): Conv2d(256, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (18): ReLU(inplace=True)
    (19): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (20): ReLU(inplace=True)
```

Practice: Draw the structure of VGG16

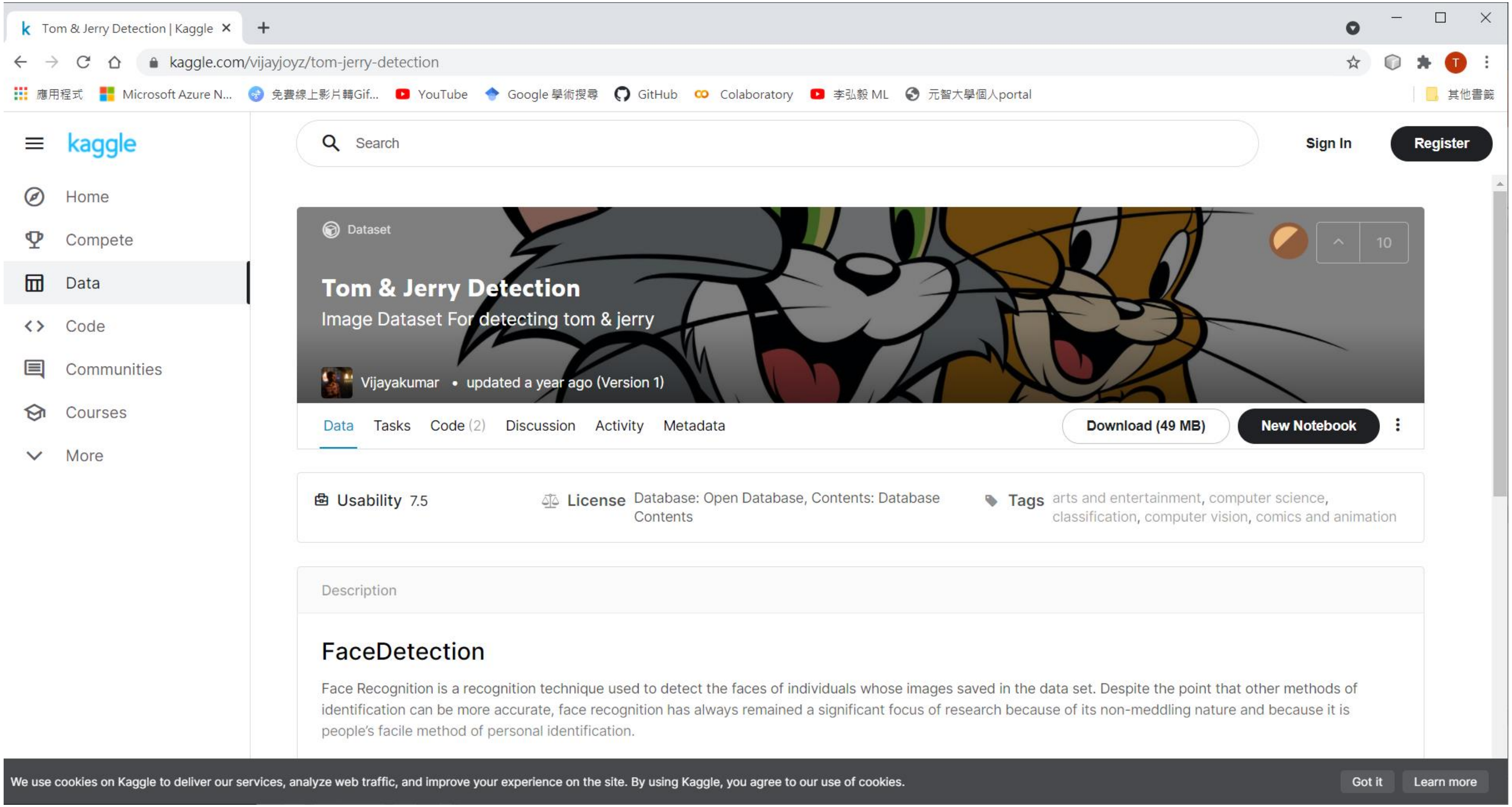
```
    (21): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (22): ReLU(inplace=True)
    (23): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
    (24): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (25): ReLU(inplace=True)
    (26): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (27): ReLU(inplace=True)
    (28): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (29): ReLU(inplace=True)
    (30): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
  )
  (avgpool): AdaptiveAvgPool2d(output_size=(7, 7))
  (classifier): Sequential(
    (0): Linear(in_features=25088, out_features=4096, bias=True)
    (1): ReLU(inplace=True)
    (2): Dropout(p=0.5, inplace=False)
    (3): Linear(in_features=4096, out_features=4096, bias=True)
    (4): ReLU(inplace=True)
    (5): Dropout(p=0.5, inplace=False)
    (6): Linear(in_features=4096, out_features=1000, bias=True)
  )
)
```

Transfer learning

Download images from Kaggle



Tom & Jerry


Tom & Jerry Detection | Kaggle
kaggle.com/vijayjoyz/tom-jerry-detection
應用程式
Microsoft Azure N...
免費線上影片轉Gif...
YouTube
Google 學術搜尋
GitHub
Colaboratory
李弘毅 ML
元智大學個人portal
其他書籤
kaggle
Search
Sign In
Register
Home
Compete
Data
Code
Communities
Courses
More
Dataset
10
Tom & Jerry Detection
Image Dataset For detecting tom & jerry
Vijayakumar • updated a year ago (Version 1)
Data
Tasks
Code (2)
Discussion
Activity
Metadata
Download (49 MB)
New Notebook
Usability 7.5
License Database: Open Database, Contents: Database Contents
Tags arts and entertainment, computer science, classification, computer vision, comics and animation
Description
FaceDetection
Face Recognition is a recognition technique used to detect the faces of individuals whose images saved in the data set. Despite the point that other methods of identification can be more accurate, face recognition has always remained a significant focus of research because of its non-meddling nature and because it is people's facile method of personal identification.
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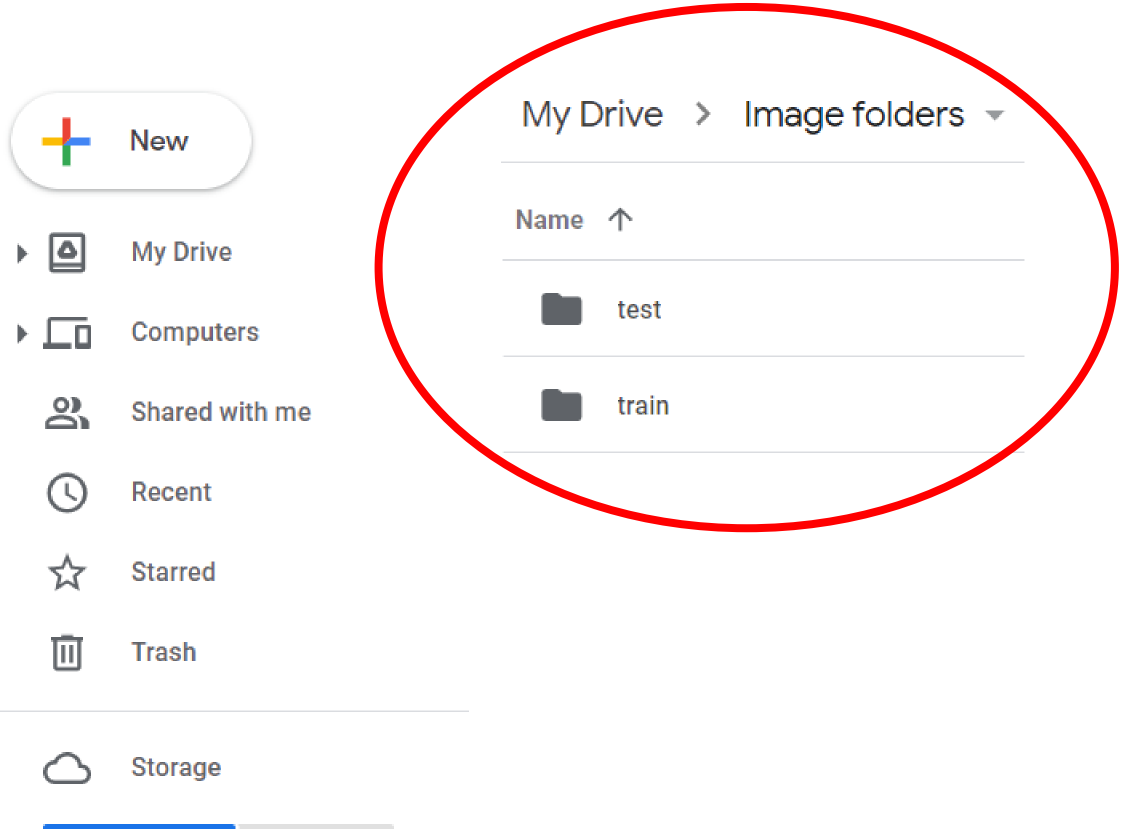
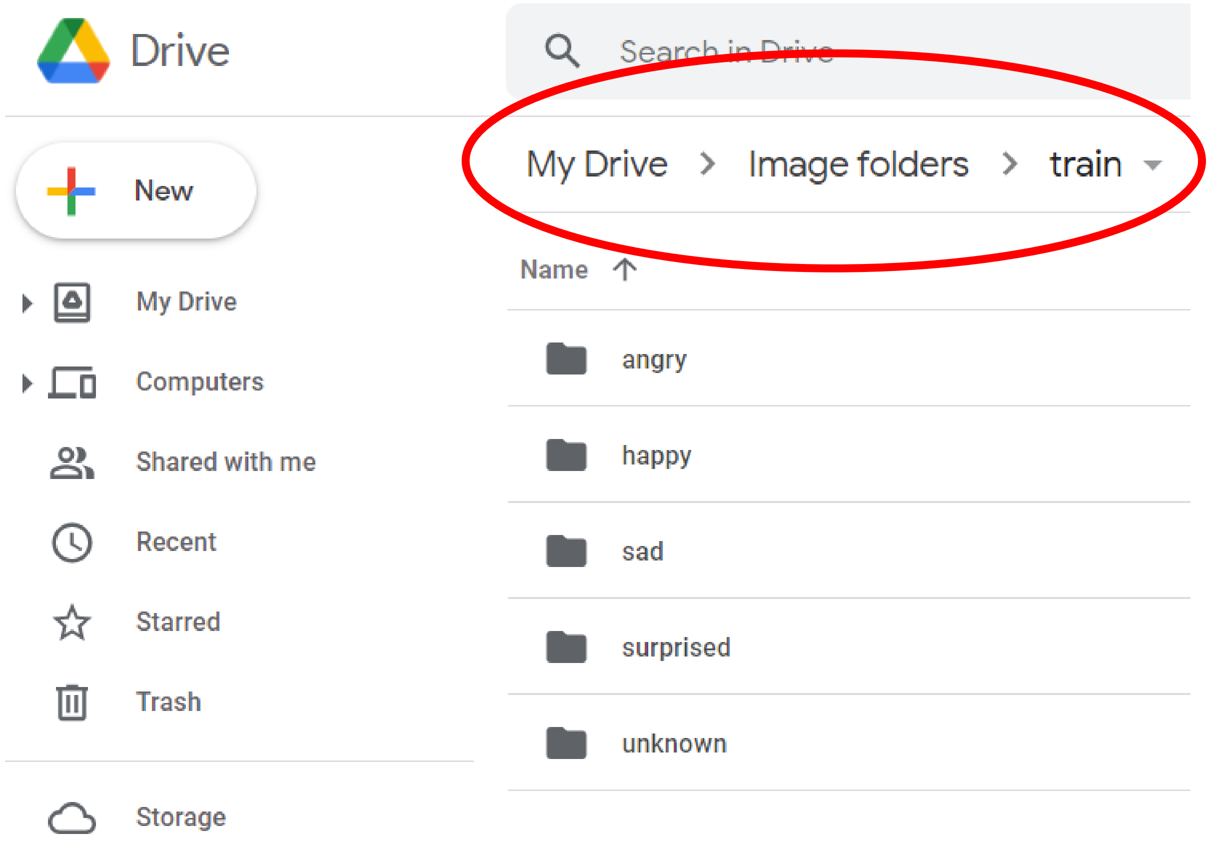
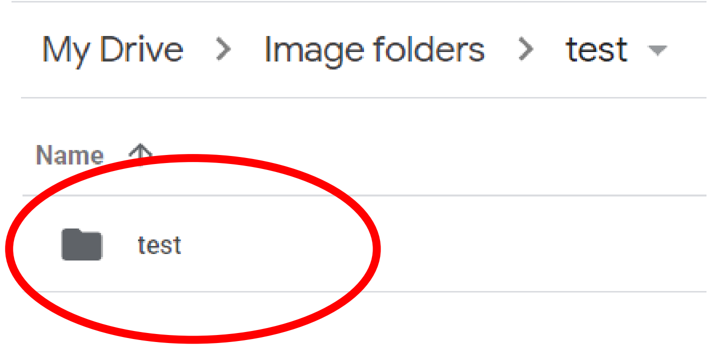
Got it
Learn more

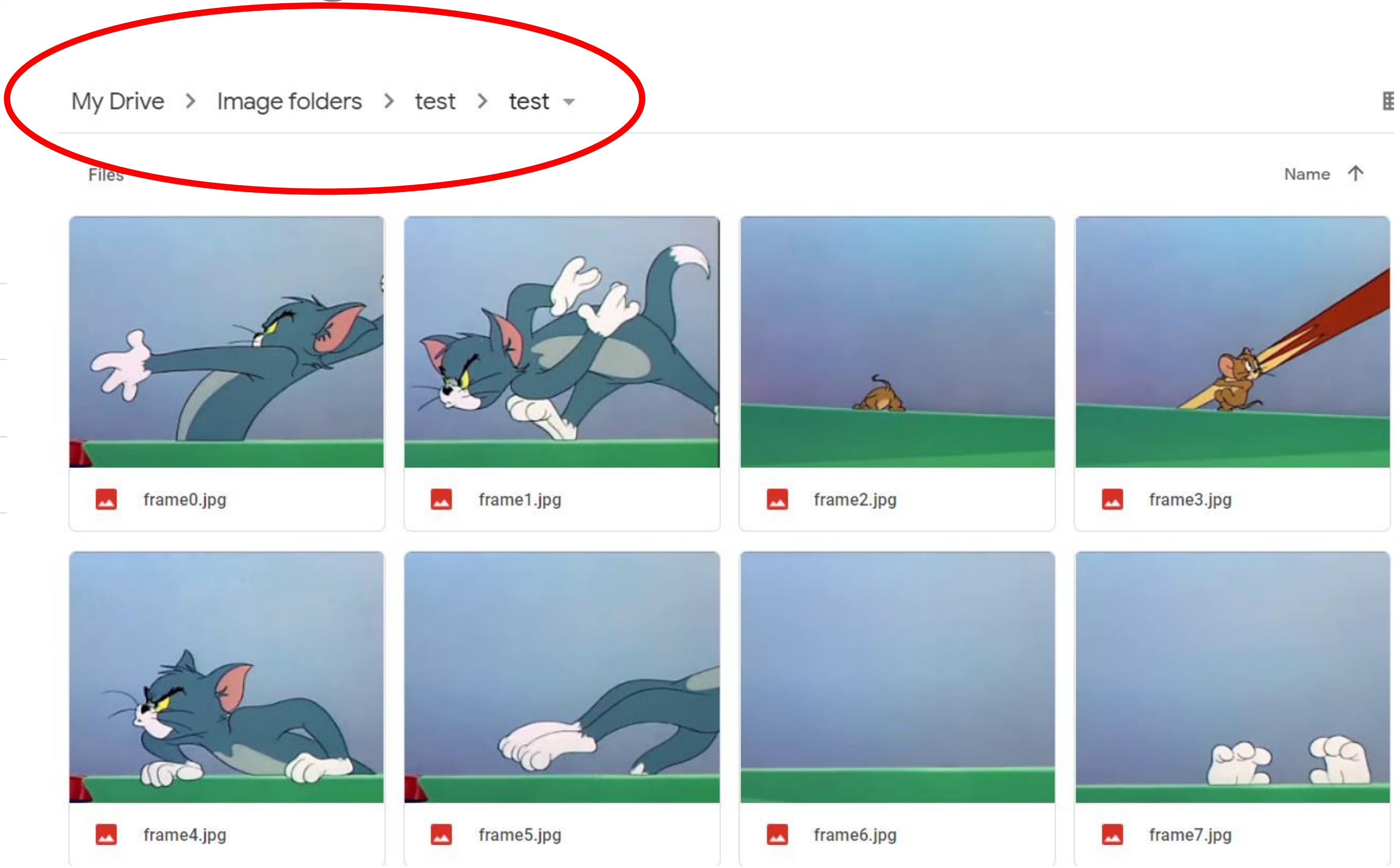
Save images in your Google drive





Save images in your Google drive





Practice

- Run “7.3. Transfer learning.ipynb"

Build our own image classifier

- Suppose input image size = (224, 224, 3)
- Output has 5 classes: Angry, Happy, Sad, Surprised, Unknown

In [3]:
```
import torch.nn as nn
# fix the weight of convolution layers
model.features.eval()

# modify classifier
model.classifier = torch.nn.Sequential(
  nn.Linear(25088, 4096),
  nn.ReLU(inplace=True),
  nn.Dropout(p=0.5, inplace=False),
  nn.Linear(4096, 4096),
  nn.ReLU(inplace=True),
  nn.Dropout(p=0.5, inplace=False),
  torch.nn.Linear(4096, 5))
```

Summary of parameters

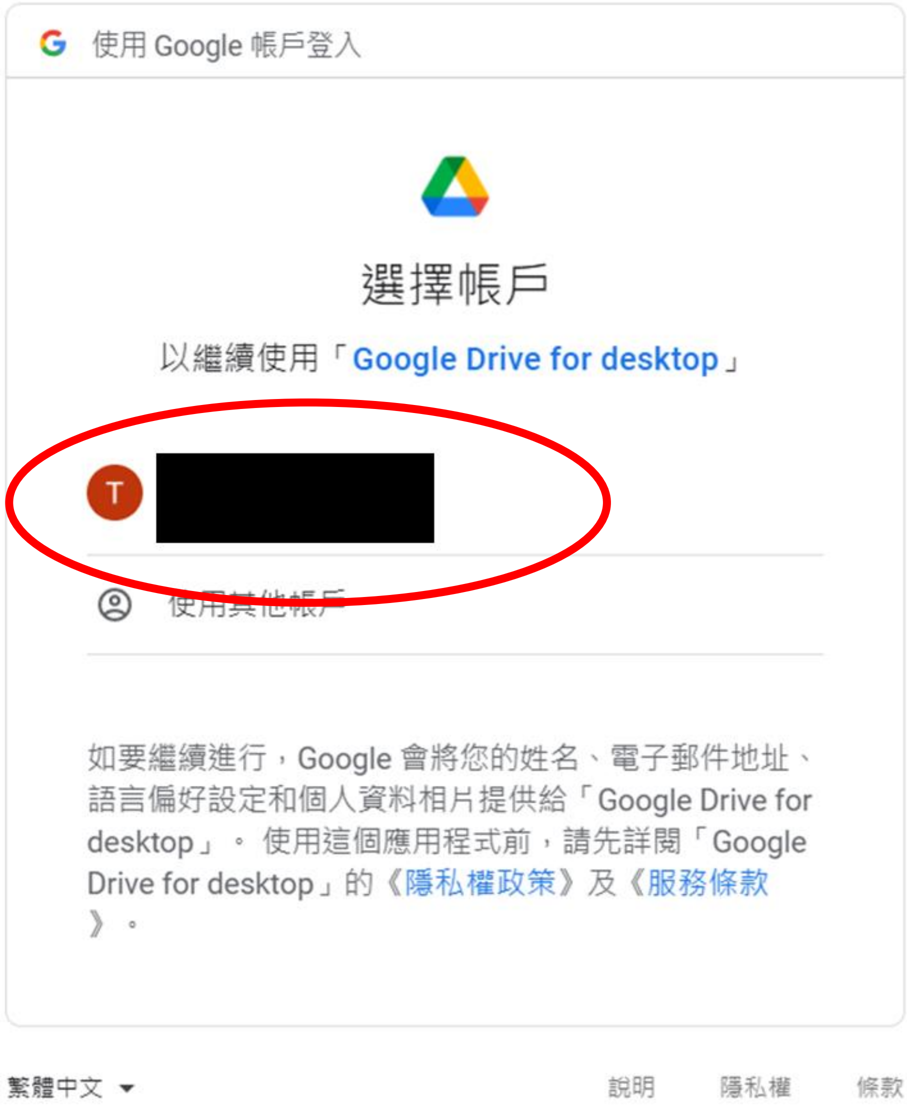
```
Total params: 139,590,725
Trainable params: 139,590,725
Non-trainable params: 0
----------------------------------------------------------------
Input size (MB): 0.57
Forward/backward pass size (MB): 238.68
Params size (MB): 532.50
Estimated Total Size (MB): 771.75
----------------------------------------------------------------
```

MLP in "4.2. Classification with CE loss"

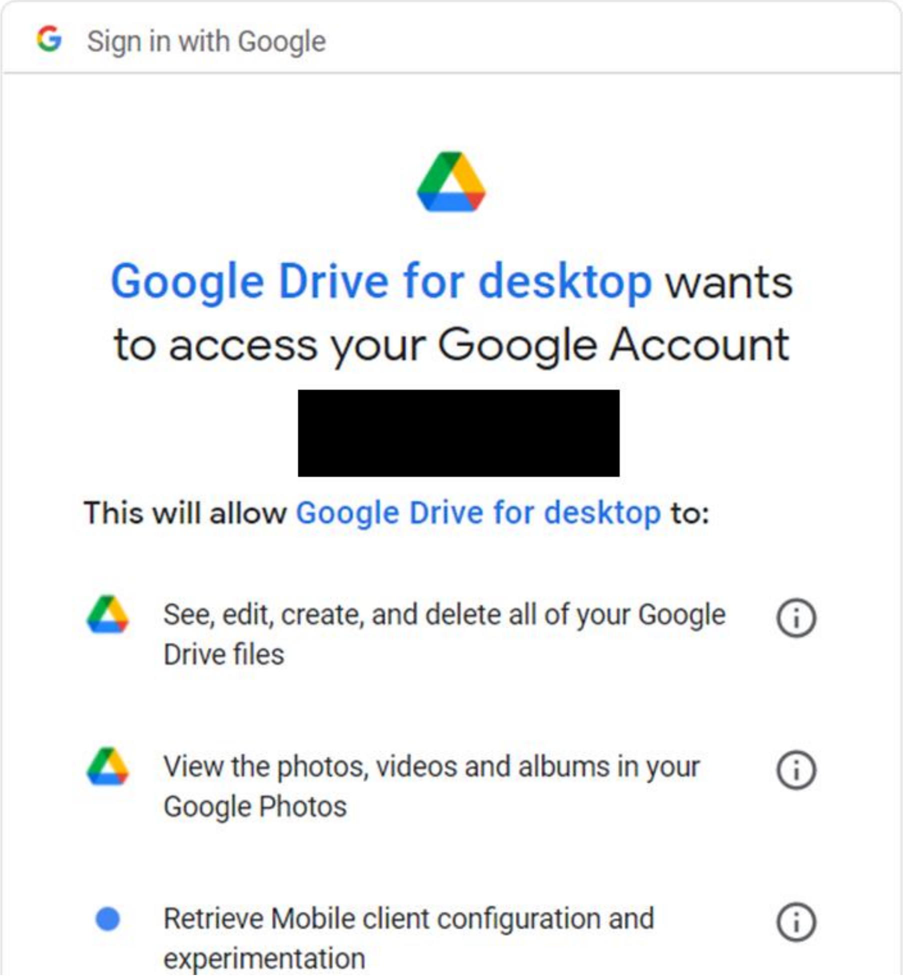
```
BATCH_SIZE = 30
summary(MyNet, input_size=(BATCH_SIZE, 2))
```

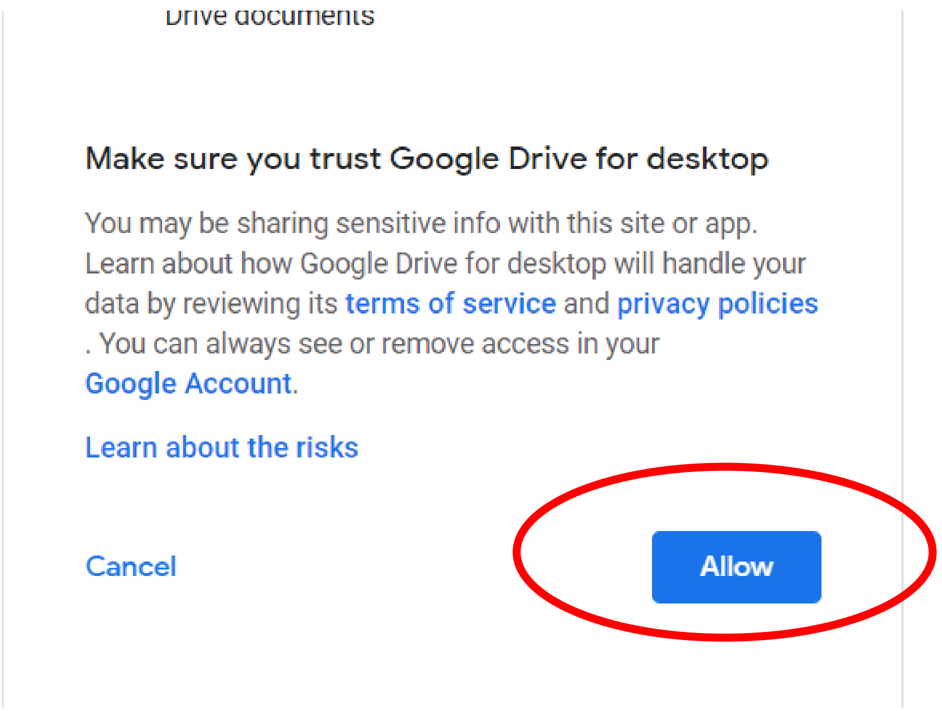
```
----------------------------------------------------------------
        Layer (type)               Output Shape         Param #
================================================================
            Linear-1               [-1, 30, 50]             150
              ReLU-2               [-1, 30, 50]               0
            Linear-3              [-1, 30, 100]           5,100
              ReLU-4              [-1, 30, 100]               0
            Linear-5               [-1, 30, 50]           5,050
              ReLU-6               [-1, 30, 50]               0
            Linear-7                [-1, 30, 2]             102
================================================================
Total params: 10,402
Trainable params: 10,402
Non-trainable params: 0
----------------------------------------------------------------
Input size (MB): 0.00
Forward/backward pass size (MB): 0.09
Params size (MB): 0.04
Estimated Total Size (MB): 0.13
----------------------------------------------------------------
```

Connect to Google drive

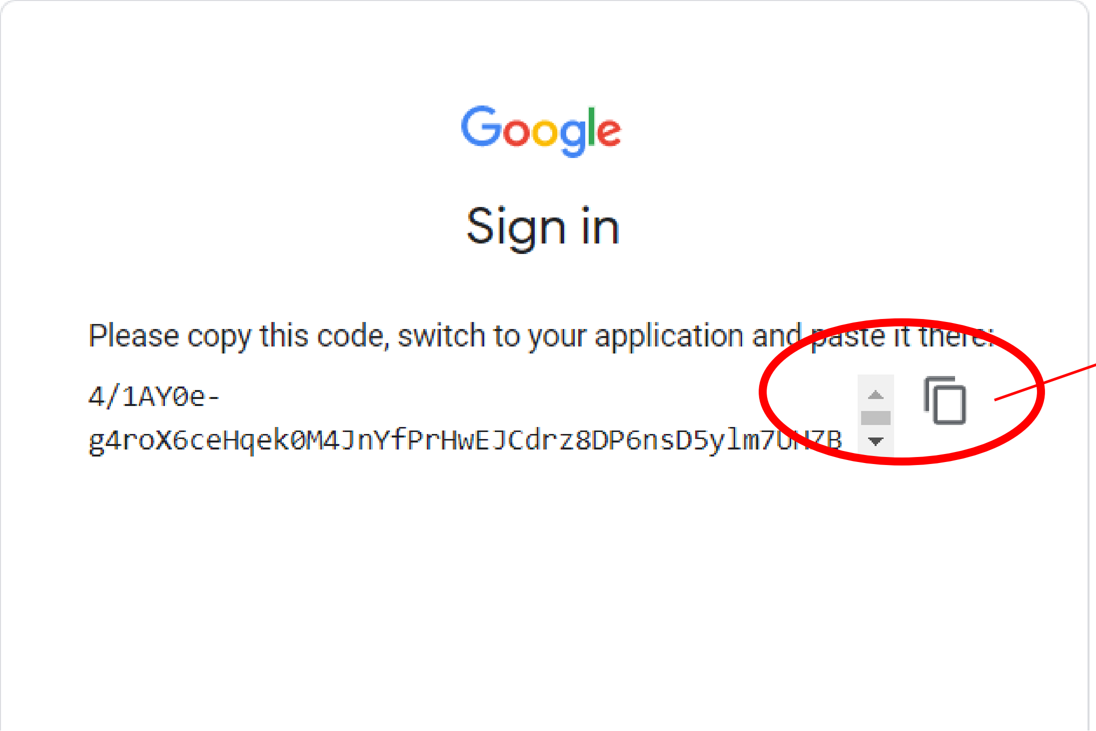


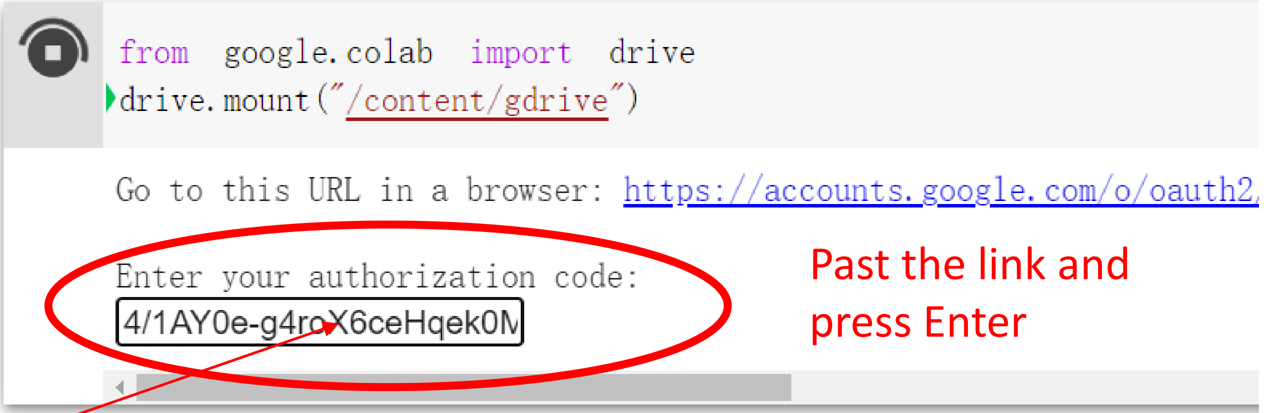
Connect to Google drive





Connect to Google drive





Past the link and
press Enter

```
[7]  from google.colab import drive
     drive.mount("/content/gdrive")

Mounted at /content/gdrive
```

Batch training using Image Folder

In [8]:
```
from torchvision import transforms
transformer = transforms.Compose([
     transforms.Resize((224, 224)),
     transforms.ToTensor(),
     transforms.Normalize(mean=[0.5, 0.5, 0.5], std=[0.5, 0.5, 0.5] )])
```

In [9]:
```
from torchvision import datasets
train_dataset = datasets.ImageFolder(root = "/content/gdrive/MyDrive/Image folders/train", transform = transformer)
```

n [10]:
```
classes = train_dataset.classes
classes_index = train_dataset.class_to_idx
print(classes)
print(classes_index)
```

```
['angry', 'happy', 'sad', 'surprised', 'unknown']
{'angry': 0, 'happy': 1, 'sad': 2, 'surprised': 3, 'unknown': 4}
```

n [11]:
```
import torch.utils.data as Data
loader = Data.DataLoader(dataset=train_dataset,batch_size=4,shuffle=True)
```

Batch training using data in RAM

```
In [9]: tensorX = torch.FloatTensor(trainX).to(device)
        tensorY_hat = torch.LongTensor(trainY_hat).to(device)
        print(tensorX.shape, tensorY_hat.shape)

        torch.Size([128, 2]) torch.Size([128])

In [10]: torch_dataset = Data.TensorDataset(tensorX, tensorY_hat)

In [11]: loader = Data.DataLoader(
             dataset=torch_dataset,
             batch_size=5,
             shuffle=True,
             num_workers=0,    # subprocesses for loading data
         )

In [12]: for (batchX, batchY_hat) in loader:
             break
         print(batchX.shape, batchY_hat)

         torch.Size([5, 2]) tensor([0, 0, 0, 1, 1], device='cuda:0')
```

One batch has 4 images

```
[12]: for batchX, batchY_hat in loader:
        break;
      print(batchX.shape, batchY_hat.shape, batchY_hat)
```

```
torch.Size([4, 3, 224, 224]) torch.Size([4]) tensor([3, 2, 3, 2])
```

```
[13]: import numpy as np
      import matplotlib.pyplot as plt
      imgTensor = torchvision.utils.make_grid(batchX)
      imgArray = imgTensor.numpy()
      imgArray1 = np.zeros((imgArray.shape[1], imgArray.shape[2], 3))
      imgArray1[:,:,0] = imgArray[0, :, :]
      imgArray1[:,:,1] = imgArray[1, :, :]
      imgArray1[:,:,2] = imgArray[2, :, :]
      imgArray1 = imgArray1*0.5+0.5
      plt.figure(figsize=(12, 6))
      plt.imshow(imgArray1)
      plt.show()
      print([classes[i] for i in batchY_hat])
```


```
['surprised', 'sad', 'surprised', 'sad']
```

Batch training loop

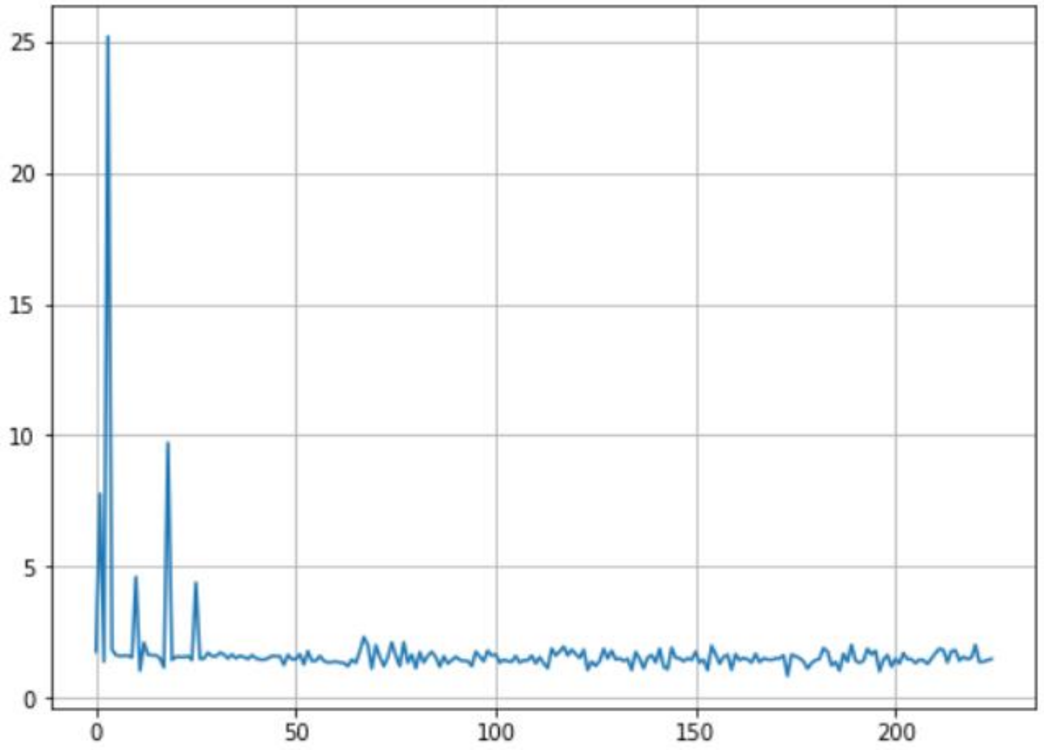
```
[16]: lossLst = []
accuracyLst = []
for epoch in range(1, 4):
  print("\nepoch = ", epoch, end = ", ")
  print("batch: ", end="")
  for step, (batch_x, batchY_hat) in enumerate(loader):
    if(step%5==0):
      print(step, end = ", ")
    tensorY = model(batch_x.to(device))
    loss = loss_func(tensorY, batchY_hat.to(device))
    lossLst.append(float(loss))
    optimizer.zero_grad()
    loss.backward()
    optimizer.step()

    correct = 0
    tensorY = torch.softmax(tensorY, 1)
    MaxIdxOfEachRow = torch.max(tensorY, 1)[1]
    for i in range(batchY_hat.shape[0]):
      if (int(MaxIdxOfEachRow[i]) == int(batchY_hat[i])):
        correct += 1
    accuracy = correct/batchY_hat.shape[0]
    accuracyLst.append(accuracy)
```

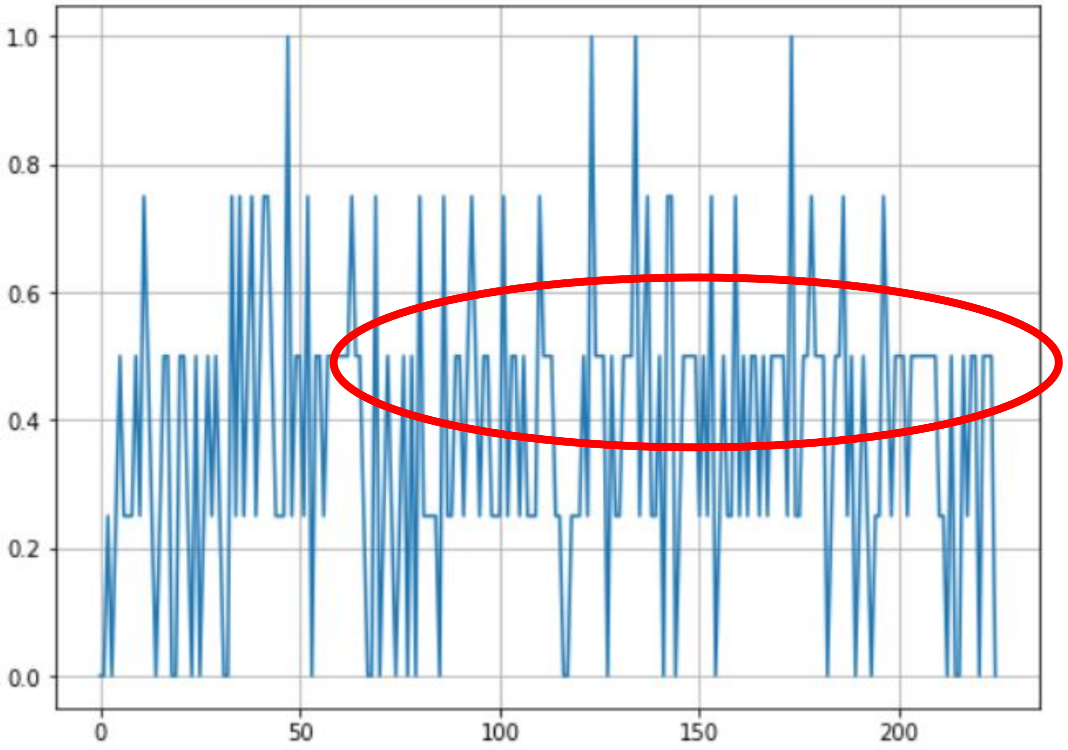
```
epoch =  1, batch: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45,
epoch =  2, batch: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45,
epoch =  3, batch: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45,
```

MLP in "4.2. Classification with CE loss"

```
lossLst = []
accuracyLst = []
for epoch in range(1, 500):
  for (batchX, batchY_hat) in loader:
    tensorY = MyNet(batchX)
    loss = loss_func(tensorY, batchY_hat)
    lossLst.append(float(loss))
    optimizer.zero_grad()
    loss.backward()
    optimizer.step()

    correct = 0
    tensorY = torch.softmax(tensorY, 1)
    MaxIdxOfEachRow = torch.max(tensorY, 1)[1]
    for i in range(batchY_hat.shape[0]):
      if (int(MaxIdxOfEachRow[i]) == int(batchY_hat[i])):
        correct += 1
    accuracy = correct/batchY_hat.shape[0]
    accuracyLst.append(accuracy)
```

Why training is not good?





Biased prediction, why?

```
In [24]: tensorY = torch.softmax(tensorY, 1)
         print(tensorY)

tensor([[0.1225, 0.1490, 0.1598, 0.2189, 0.3498]], device='cuda:0',
       grad_fn=<SoftmaxBackward>)

In [25]: print(classes)

['angry', 'happy', 'sad', 'surprised', 'unknown']
```

Transfer learning design 2

Use first 10 layers in convolution section

Let input image size = (224, 224, 3), Output has 5 classes: Angry, Happy, Sad, Surprised, Unknown

```
[3]  import torch.nn as nn
     class MyCNN(nn.Module):
         def __init__(self):
             super(MyCNN, self).__init__()
             self.features = vgg19.features[0:10] #layer 0-9
             self.classifier = nn.Sequential(
                 nn.Dropout(),
                 nn.Linear(56*56*128, 4096),
                 nn.ReLU(inplace=True),
                 nn.Dropout(p=0.5, inplace=False),
                 nn.Linear(4096, 4096),
                 nn.ReLU(inplace=True),
                 nn.Dropout(p=0.5, inplace=False),
                 nn.Linear(4096, 5),
             )
         def forward(self, x):
             x = self.features(x)
             x = torch.flatten(x, 1)
             x = self.classifier(x)
             return x
```

1,661M parameters !

```
[5] from torchsummary import summary
    summary(model, input_size=(3, 224, 224))
```

```
----------------------------------------------------------------
        Layer (type)               Output Shape         Param #
================================================================
            Conv2d-1         [-1, 64, 224, 224]           1,792
              ReLU-2         [-1, 64, 224, 224]               0
            Conv2d-3         [-1, 64, 224, 224]          36,928
              ReLU-4         [-1, 64, 224, 224]               0
         MaxPool2d-5         [-1, 64, 112, 112]               0
            Conv2d-6        [-1, 128, 112, 112]          73,856
              ReLU-7        [-1, 128, 112, 112]               0
            Conv2d-8        [-1, 128, 112, 112]         147,584
              ReLU-9        [-1, 128, 112, 112]               0
        MaxPool2d-10          [-1, 128, 56, 56]               0
          Dropout-11              [-1, 401408]                0
           Linear-12                [-1, 4096]    1,644,171,264
             ReLU-13                [-1, 4096]                0
          Dropout-14                [-1, 4096]                0
           Linear-15                [-1, 4096]       16,781,312
             ReLU-16                [-1, 4096]                0
          Dropout-17                [-1, 4096]                0
           Linear-18                   [-1, 5]           20,485
================================================================
Total params: 1,661,233,221
Trainable params: 1,661,233,221
Non-trainable params: 0
```

```
Total params: 139,590,725
Trainable params: 139,590,725
Non-trainable params: 0
----------------------------------------
Input size (MB): 0.57
Forward/backward pass size (MB): 238.68
Params size (MB): 532.50
Estimated Total Size (MB): 771.75
----------------------------------------
```

CUDA out of memory!

```
epoch =  1, batch: 0,
---------------------------------------------------------------------------
RuntimeError                              Traceback (most recent call last)
<ipython-input-17-94eca5998520> in <module>()
     11     lossLst.append(float(loss))
     12     optimizer.zero_grad()
---> 13     loss.backward()
     14     optimizer.step()
     15
```

1 frames

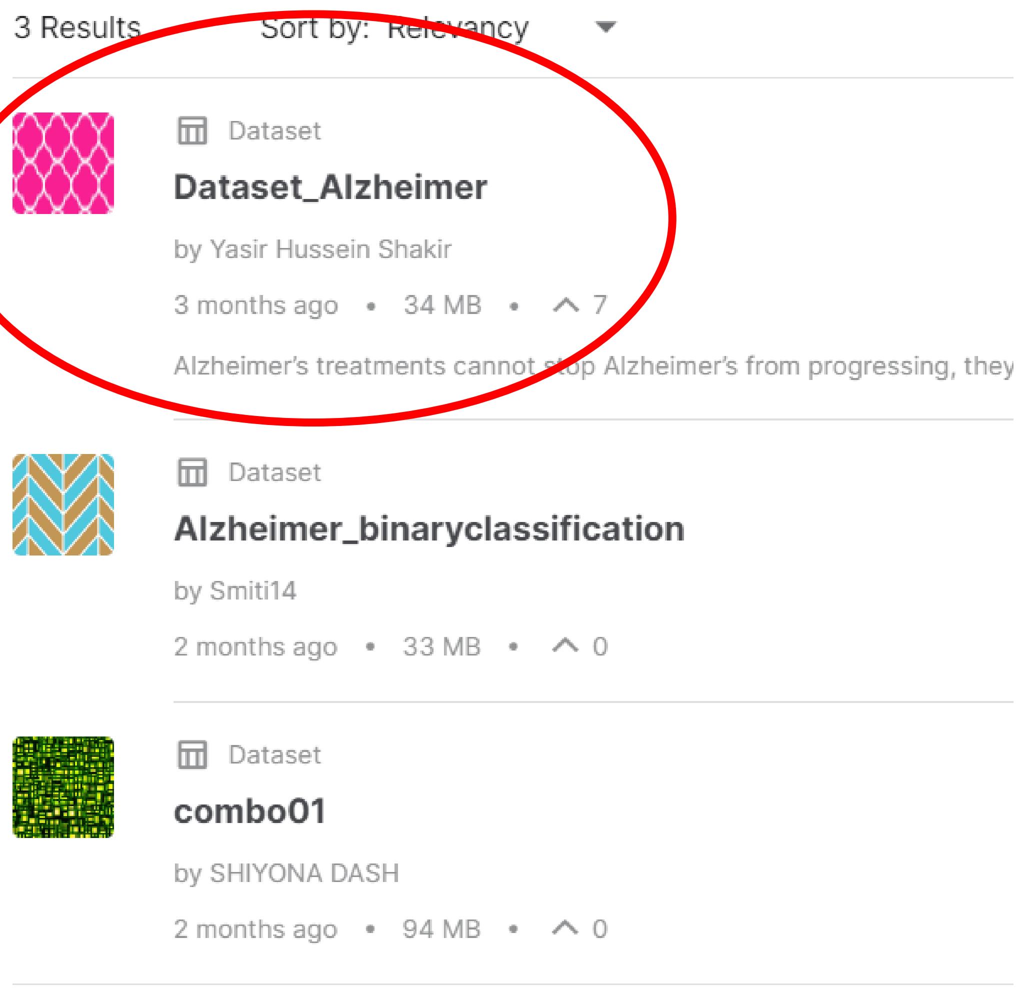
```
/usr/local/lib/python3.7/dist-packages/torch/autograd/__init__.py in backward(tensors, grad_tensors, retain_graph, create_graph, grad_variables, inputs)
    145     Variable._execution_engine.run_backward(
    146         tensors, grad_tensors_, retain_graph, create_graph, inputs,
--> 147         allow_unreachable=True, accumulate_grad=True)  # allow_unreachable flag
    148
    149

RuntimeError: CUDA out of memory. Tried to allocate 6.12 GiB (GPU 0; 11.17 GiB total capacity; 6.46 GiB already allocated; 4.27 GiB free; 6.47 GiB reserved in total by PyTorch)
```

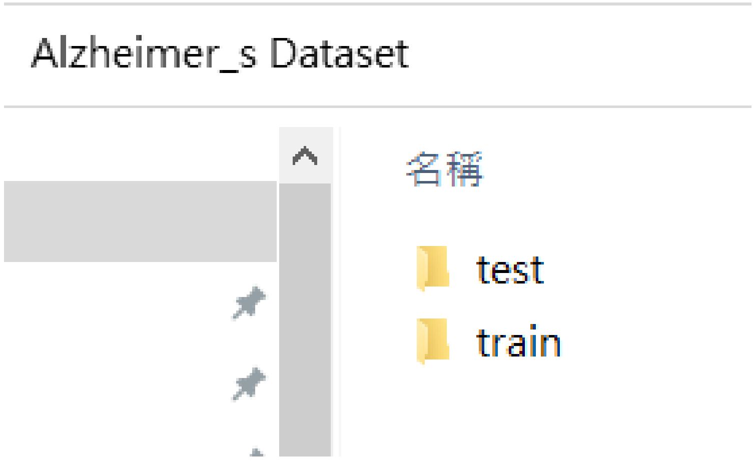
HW – Can CNN recognize your facial expression?

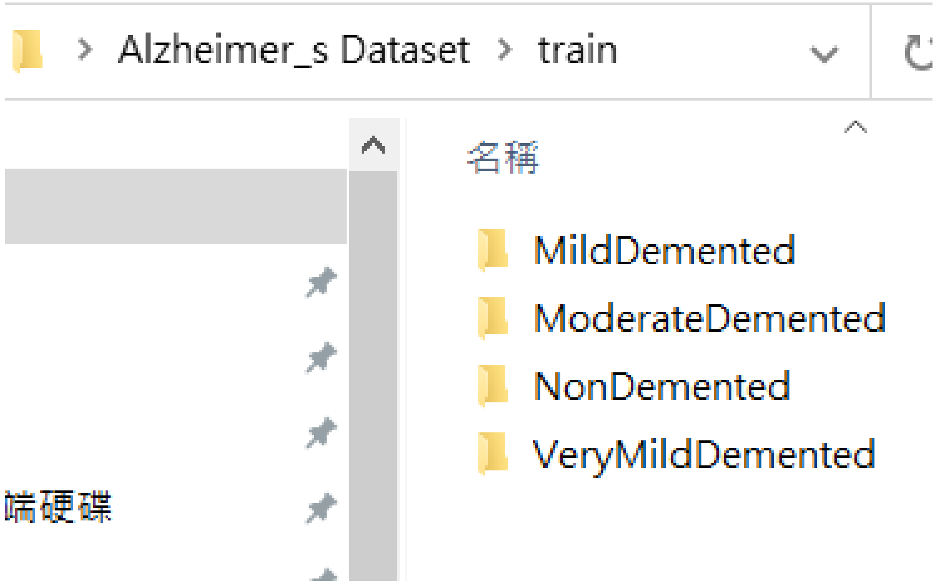
- Use transfer learning to train an image classifier to recognize happy and angry faces.

HW5 – Recognize Alzheimer disease from MRI

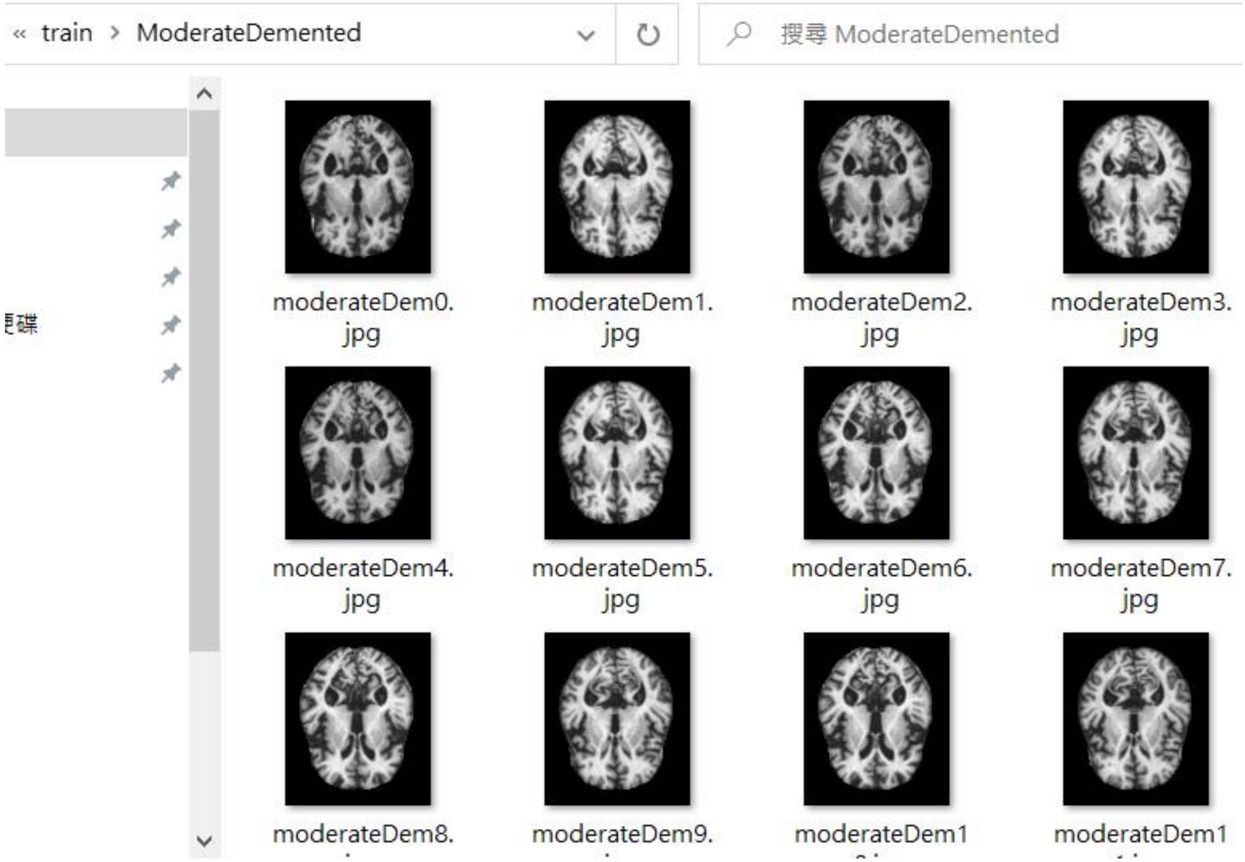
Results by searching "dementia" in Kaggle

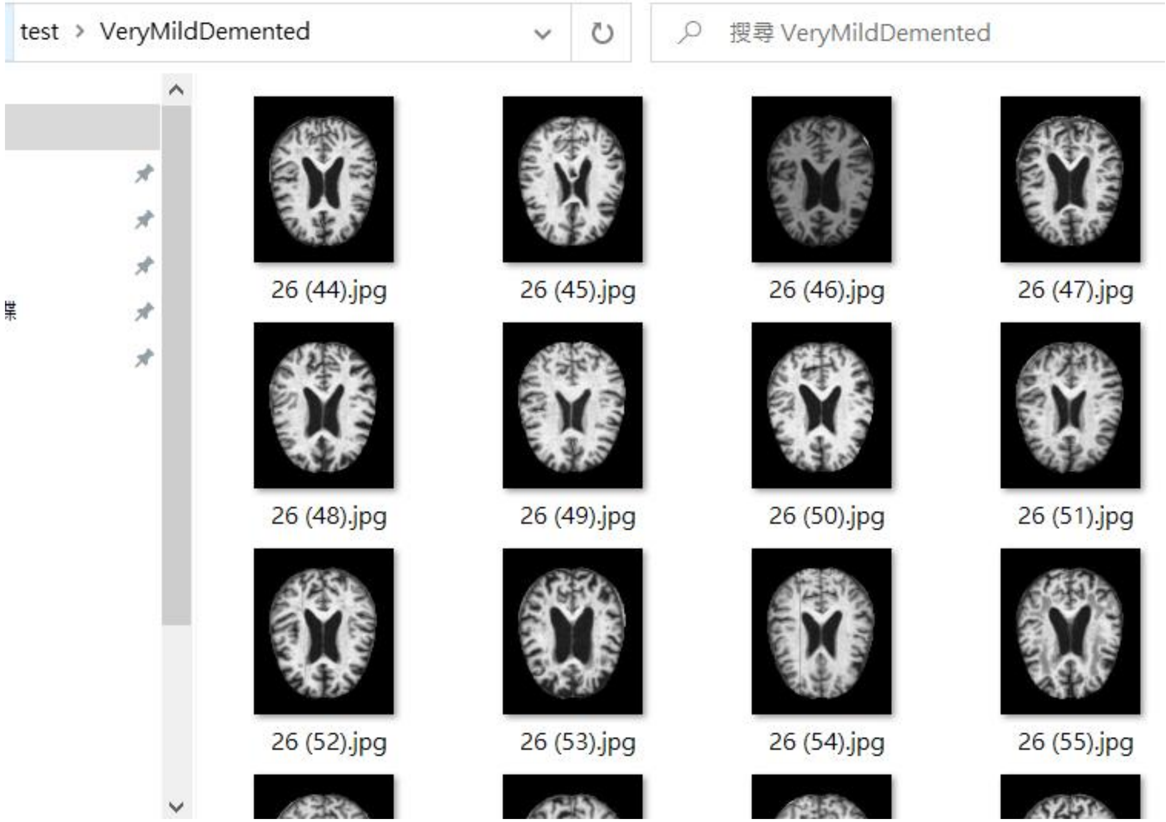




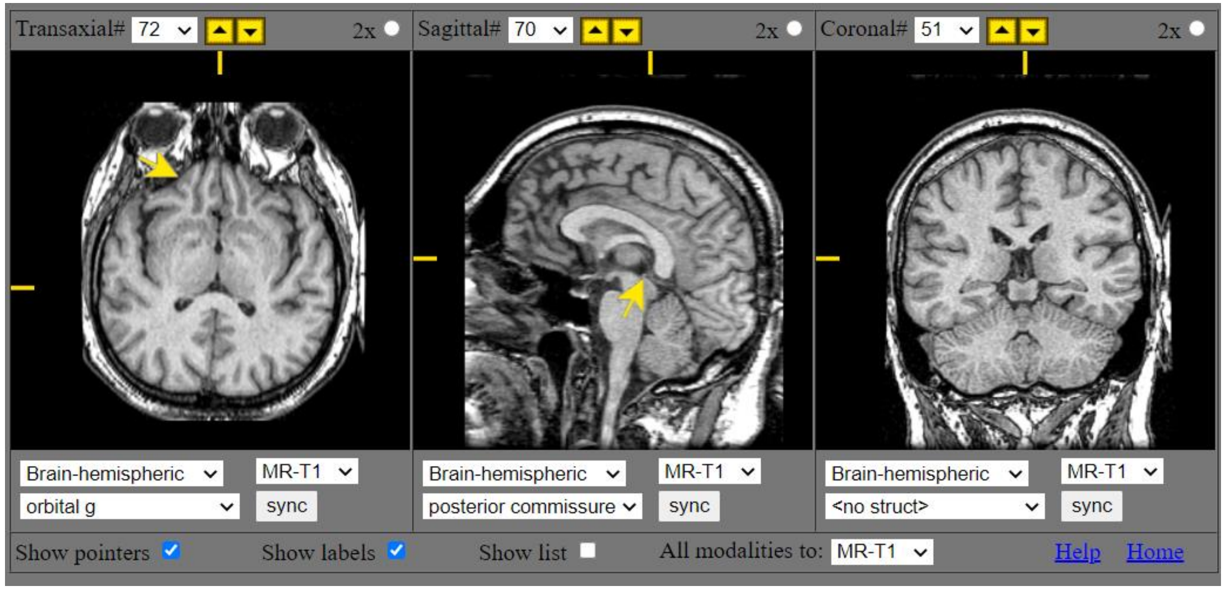


HW5 (2) – Recognize Alzheimer disease from MRI

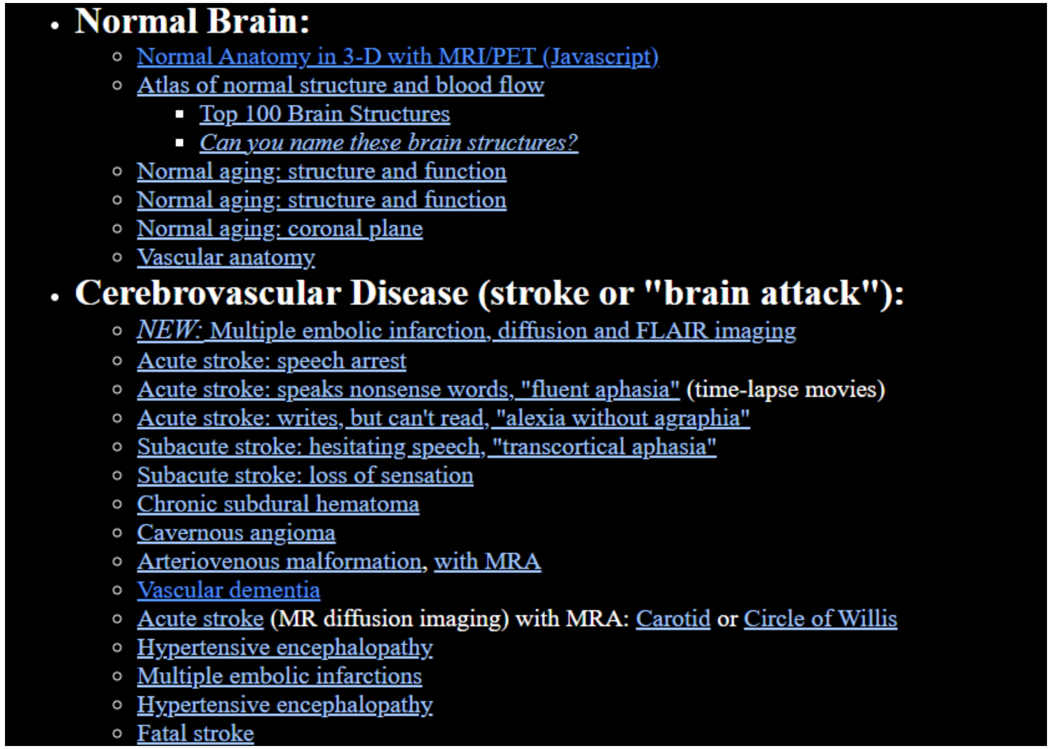




If you want to understand more about MRI brain scan images



https://www.med.harvard.edu/aANliB/cases/caseNA/pb9.htm



- **Normal Brain:**
  - Normal Anatomy in 3-D with MRI/PET (Javascript)
  - Atlas of normal structure and blood flow
    - Top 100 Brain Structures
    - *Can you name these brain structures?*
  - Normal aging: structure and function
  - Normal aging: structure and function
  - Normal aging: coronal plane
  - Vascular anatomy
- **Cerebrovascular Disease (stroke or "brain attack"):**
  - *NEW:* Multiple embolic infarction, diffusion and FLAIR imaging
  - Acute stroke: speech arrest
  - Acute stroke: speaks nonsense words, "fluent aphasia" (time-lapse movies)
  - Acute stroke: writes, but can't read, "alexia without agraphia"
  - Subacute stroke: hesitating speech, "transcortical aphasia"
  - Subacute stroke: loss of sensation
  - Chronic subdural hematoma
  - Cavernous angioma
  - Arteriovenous malformation, with MRA
  - Vascular dementia
  - Acute stroke (MR diffusion imaging) with MRA: Carotid or Circle of Willis
  - Hypertensive encephalopathy
  - Multiple embolic infarctions
  - Hypertensive encephalopathy
  - Fatal stroke

https://www.med.harvard.edu/aANliB/home.html

HW – Can we recognize dementia disease from facial expression ?

Facial expressions can detect Parkinson's disease: preliminary evidence from videos collected online

Mohammad Rafayet Ali, Taylor Myers, Ellen Wagner, Harshil Ratnu, E. Ray Dorsey, Ehsan Hoque

https://arxiv.org/abs/2012.05373

中文解讀: https://ai-scholar.tech/zh/articles/image-recognition/facial_expressions_perkinson

HW5 (2) – Can CNN detect Autism from a facial image?

Datasets

facial image

Datasets | Tasks | Computer Science | Education | Cla

1 Tasks

Detect Autism with 98% accuracy

Gerry · 0 Submissions

Detect Autism from a facial image

Gerry · Usability 7.5

- consolidated
- test
- train
- valid
- autism-2
- autism-S-224-89.33.h5