

```
1 from google.colab import drive
2 drive.mount('/content/drive')
```

Mounted at /content/drive

+ Code

+ Text

```
1 import pandas as pd
2 import numpy as np
3 import matplotlib.pyplot as plt
4
5 csv_path = '/content/drive/MyDrive/Datasets/CK+/ckextended.csv'
6 df_ck = pd.read_csv(csv_path)
7
8 def display_ck_images(df, num_samples=5):
9     plt.figure(figsize=(15,5))
10    for i in range(num_samples):
11        pixel_values = [int(p) for p in df.iloc[i]['pixels'].split()]
12        image = np.array(pixel_values).reshape(48, 48)
13        label = df.iloc[i]['emotion']
14
15        plt.subplot(1, num_samples, i+1)
16        plt.imshow(image, cmap='gray')
17        plt.title(f'Label: {label}')
18        plt.axis('off')
19    plt.show()
20
21 display_ck_images(df_ck, num_samples=5)
22
```



```
1 import cv2
2
3 # تحويل CSV إلى صورة RGB و Grayscale
4 pixel_values = [int(p) for p in df_ck.iloc[0]['pixels'].split()]
5 image_48 = np.array(pixel_values, dtype='uint8').reshape(48, 48)
6
7 # تحويل إلى 3 قنوات لتصبح RGB
8 image_rgb = cv2.cvtColor(image_48, cv2.COLOR_GRAY2RGB)
9
10 # إعادة الحجم إلى 128x128
11 image_rgb_resized = cv2.resize(image_rgb, (128,128))
12 image_gray = cv2.cvtColor(image_rgb_resized, cv2.COLOR_RGB2GRAY)
13
14 plt.subplot(1,2,1)
15 plt.imshow(image_rgb_resized)
16 plt.title("RGB Image Resized")
17 plt.axis("off")
18
19 plt.subplot(1,2,2)
20 plt.imshow(image_gray, cmap='gray')
21 plt.title("Grayscale Image")
22 plt.axis("off")
23
24 plt.show()
25
26 print(f"Dimensions of RGB Image: {image_rgb_resized.shape}")
27
```

What can I help you build?





RGB Image Resized



Grayscale Image



Dimensions of RGB Image: (128, 128, 3)

```
1 import os
2 from PIL import Image
3 import matplotlib.pyplot as plt
4
5 jaffe_path = '/content/drive/MyDrive/Datasets/jaffe'
6
7 def display_jaffe_samples(directory, num_samples=5):
8     images = [f for f in os.listdir(directory) if f.endswith('.tiff')]
9     plt.figure(figsize=(15,5))
10    for i, img_name in enumerate(images[:num_samples]):
11        img_path = os.path.join(directory, img_name)
12        img = Image.open(img_path)
13        plt.subplot(1, num_samples, i+1)
14        plt.imshow(img, cmap='gray')
15        plt.title(img_name)
16        plt.axis('off')
17    plt.show()
18
19 display_jaffe_samples(jaffe_path, num_samples=5)
20
```



KL.SU2.165.tiff



TM.NE1.177.tiff



NM.FE2.111.tiff



NA.AN3.213.tiff



KL.DI1.170.tiff



```
1 import os
2 from PIL import Image
3 import torch
4 from torch.utils.data import Dataset, DataLoader
5 from torchvision import transforms
6
7 jaffe_path = '/content/drive/MyDrive/Datasets/jaffe'
8
9 class JaffeDataset(Dataset):
10    def __init__(self, root_dir, transform=None):
11        self.root_dir = root_dir
12        self.image_files = [f for f in os.listdir(root_dir) if f.endswith(".tiff")]
13        self.transform = transform
14        self.labels = [self.get_label(f) for f in self.image_files]
15        self.labe
16
```

```
1 import os
2 from PIL import Image
3 import torch
```

```

4 from torch.utils.data import Dataset, DataLoader
5 from torchvision import transforms
6
7 jaffe_path = '/content/drive/MyDrive/Datasets/jaffe'
8
9 class JaffeDataset(Dataset):
10     def __init__(self, root_dir, transform=None):
11         self.root_dir = root_dir
12         self.image_files = [f for f in os.listdir(root_dir) if f.endswith(".tiff")]
13         self.transform = transform
14         self.labels = [self.get_label(f) for f in self.image_files]
15         self.label_map = {label: idx for idx, label in enumerate(sorted(set(self.labels)))}
16         self.labels_idx = [self.label_map[label] for label in self.labels]
17
18     def get_label(self, filename):
19         return filename.split('.')[1] # AN, HA, etc.
20
21     def __len__(self):
22         return len(self.image_files)
23
24     def __getitem__(self, idx):
25         img_path = os.path.join(self.root_dir, self.image_files[idx])
26         image = Image.open(img_path).convert('RGB')
27         if self.transform:
28             image = self.transform(image)
29         label = self.labels_idx[idx]
30         return image, label
31
32 transform = transforms.Compose([
33     transforms.Resize((128,128)),
34     transforms.ToTensor()
35 ])
36
37 jaffe_dataset = JaffeDataset(jaffe_path, transform=transform)
38 jaffe_loader = DataLoader(jaffe_dataset, batch_size=8, shuffle=True)
39

```

```

1 import pandas as pd
2 import numpy as np
3
4 csv_path = '/content/drive/MyDrive/Datasets/CK+/ckextended.csv'
5 df_ck = pd.read_csv(csv_path)
6
7 class CKPlusDataset(Dataset):
8     def __init__(self, dataframe, transform=None):
9         self.df = dataframe
10        self.transform = transform
11
12    def __len__(self):
13        return len(self.df)
14
15    def __getitem__(self, idx):
16        pixel_values = [int(p) for p in self.df.iloc[idx]['pixels'].split()]
17        image = np.array(pixel_values, dtype='uint8').reshape(48, 48)
18        image = cv2.cvtColor(image, cv2.COLOR_GRAY2RGB)
19        image = cv2.resize(image, (128,128))
20        image = Image.fromarray(image)
21        label = self.df.iloc[idx]['emotion']
22        if self.transform:
23            image = self.transform(image)
24        return image, label
25
26 ck_dataset = CKPlusDataset(df_ck, transform=transform)
27 ck_loader = DataLoader(ck_dataset, batch_size=8, shuffle=True)
28

```

```

1 from torchvision import models
2 import torch.nn as nn
3

```

```

4 device = torch.device('cuda' if torch.cuda.is_available() else 'cpu')
5
6 num_classes_jaffe = len(set(jaffe_dataset.labels))
7 num_classes_ck = df_ck['emotion'].nunique()
8
9 model = models.mobilenet_v2(pretrained=False)
10 model.classifier[1] = nn.Linear(model.last_channel, num_classes_jaffe) # سنبديله لاحقاً لـ CK+
11 model = model.to(device)
12
13 criterion = nn.CrossEntropyLoss()
14 optimizer = torch.optim.Adam(model.parameters(), lr=0.001)
15

```

⚠ /usr/local/lib/python3.11/dist-packages/torchvision/models/_utils.py:208: UserWarning: The parameter 'pretrained' is deprecated since 0. warnings.warn(
 /usr/local/lib/python3.11/dist-packages/torchvision/models/_utils.py:223: UserWarning: Arguments other than a weight enum or `None` for
 warnings.warn(msg)

```

1 epochs = 3
2 for epoch in range(epochs):
3     model.train()
4     running_loss, correct = 0.0, 0
5     for inputs, labels in jaffe_loader:
6         inputs, labels = inputs.to(device), labels.to(device)
7         optimizer.zero_grad()
8         outputs = model(inputs)
9         loss = criterion(outputs, labels)
10        loss.backward()
11        optimizer.step()
12        _, preds = torch.max(outputs, 1)
13        correct += torch.sum(preds == labels.data)
14        running_loss += loss.item() * inputs.size(0)
15
16    epoch_acc = correct.double() / len(jaffe_dataset)
17    print(f'JAFPE Epoch {epoch+1}: Accuracy={epoch_acc:.4f}, Loss={running_loss/len(jaffe_dataset):.4f}')
18

```

⚠ JAFPE Epoch 1: Accuracy=0.0282, Loss=3.4949
 JAFPE Epoch 2: Accuracy=0.0516, Loss=3.3550
 JAFPE Epoch 3: Accuracy=0.0610, Loss=3.1499

```

1 model.classifier[1] = nn.Linear(model.last_channel, num_classes_ck)
2 model = model.to(device)
3
4 for epoch in range(3):
5     model.train()
6     running_loss, correct = 0.0, 0
7     for inputs, labels in ck_loader:
8         inputs, labels = inputs.to(device), labels.to(device)
9         optimizer.zero_grad()
10        outputs = model(inputs)
11        loss = criterion(outputs, labels)
12        loss.backward()
13        optimizer.step()
14        _, preds = torch.max(outputs, 1)
15        correct += torch.sum(preds == labels.data)
16        running_loss += loss.item() * inputs.size(0)
17
18    epoch_acc = correct.double() / len(ck_dataset)
19    print(f'CK+ Epoch {epoch+1}: Accuracy={epoch_acc:.4f}, Loss={running_loss/len(ck_dataset):.4f}')
20

```

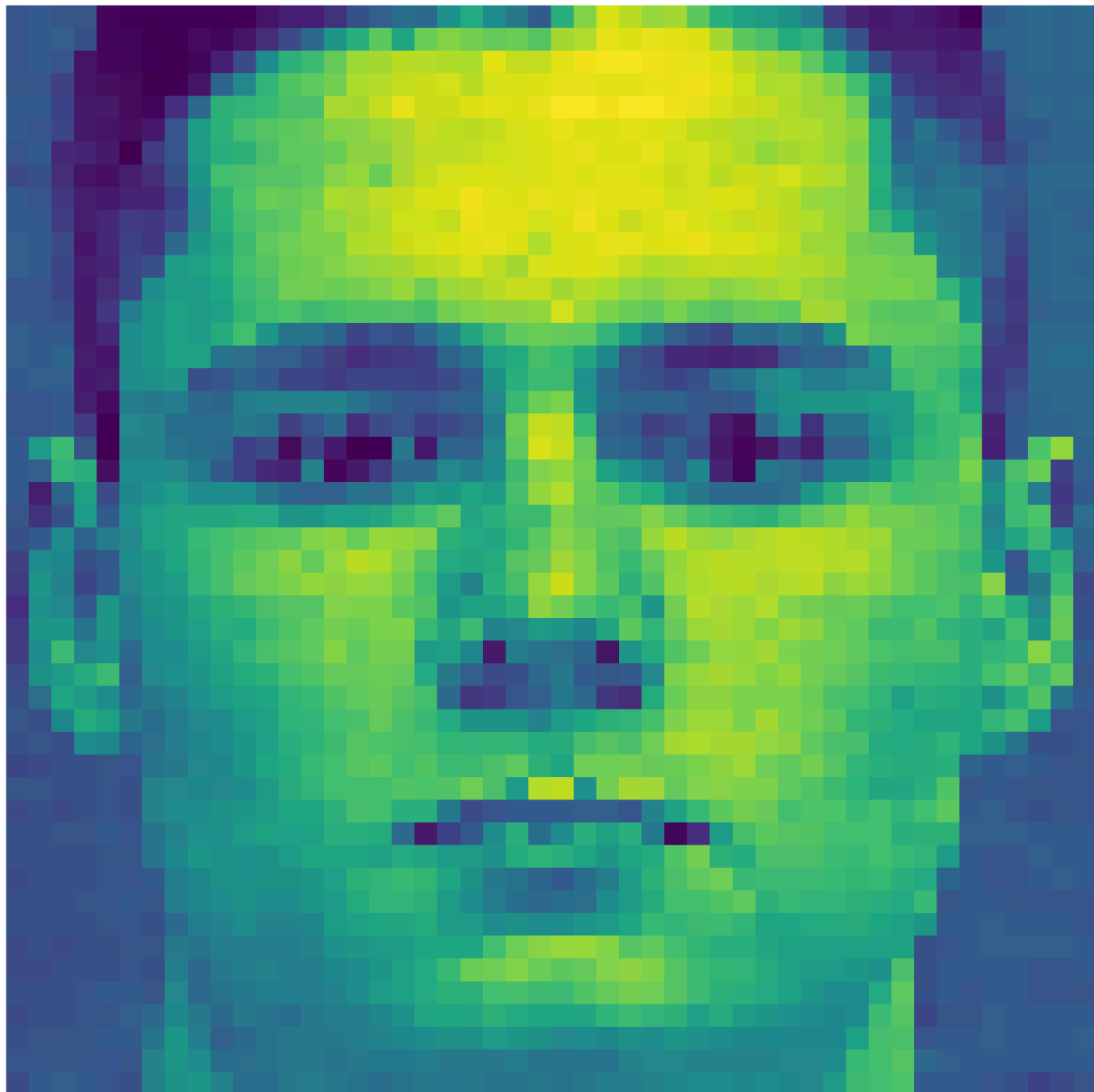
⚠ CK+ Epoch 1: Accuracy=0.5326, Loss=1.5613
 CK+ Epoch 2: Accuracy=0.6641, Loss=1.1389
 CK+ Epoch 3: Accuracy=0.7402, Loss=0.9186

```

1 import cv2
2
3 resized_image = cv2.resize(image, (128, 128), interpolation=cv2.INTER_CUBIC)
4

```

```
1 from PIL import Image
2
3 img_pil = Image.fromarray(image)
4 img_resized = img_pil.resize((128,128), Image.BICUBIC)
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```



```
1 gray_image = cv2.imread('/content/drive/MyDrive/Datasets/jaffe/KA.AN1.39.tiff', cv2.IMREAD_GRAYSCALE)
```

2

```

1 rgb_image = cv2.cvtColor(gray_image, cv2.COLOR_GRAY2RGB)
2 resized_rgb = cv2.resize(rgb_image, (128,128), interpolation=cv2.INTER_CUBIC)
3
4 plt.imshow(resized_rgb)
5 plt.title('Resized RGB Image')
6 plt.axis('off')
7 plt.show()
8

```



Resized RGB Image



```

1 import pandas as pd
2 import numpy as np
3 import cv2
4 from PIL import Image
5 from torch.utils.data import Dataset, DataLoader
6 from torchvision import transforms
7 import os
8
9 csv_path = '/content/drive/MyDrive/Datasets/CK+/ckextended.csv'
10
11 class CKPlusDataset(Dataset):
12     def __init__(self, dataframe, transform=None):
13         self.df = dataframe
14         self.transform = transform
15
16     def __len__(self):
17         return len(self.df)
18
19     def __getitem__(self, idx):
20         pixel_values = [int(p) for p in self.df.iloc[idx]['pixels'].split()]
21         image = np.array(pixel_values, dtype='uint8').reshape(48, 48)
22         image = cv2.cvtColor(image, cv2.COLOR_GRAY2RGB)
23         image = cv2.resize(image, (128,128))
24         image = Image.fromarray(image)
25         label = self.df.iloc[idx]['emotion']
26         if self.transform:
27             image = self.transform(image)
28         return image, label
29
30 df_ck = pd.read_csv(csv_path)
31
32 transform = transforms.Compose([
33     transforms.ToTensor()
34 ])
35
36 ck_dataset = CKPlusDataset(df_ck, transform=transform)
37 ck_loader = DataLoader(ck_dataset, batch_size=8, shuffle=True)
38

```

```

38 num_classes_ck = ut_ck[ emotion ].unique()
39

1 jaffe_path = '/content/drive/MyDrive/Datasets/jaffe'
2
3 class JaffeDataset(Dataset):
4     def __init__(self, root_dir, transform=None):
5         self.root_dir = root_dir
6         self.image_files = [f for f in os.listdir(root_dir) if f.endswith(".tiff")]
7         self.transform = transform
8         self.labels = [self.get_label(f) for f in self.image_files]
9         self.label_map = {label: idx for idx, label in enumerate(sorted(set(self.labels)))}
10        self.labels_idx = [self.label_map[label] for label in self.labels]
11
12    def get_label(self, filename):
13        return filename.split('.')[1] # AN, HA, etc.
14
15    def __len__(self):
16        return len(self.image_files)
17
18    def __getitem__(self, idx):
19        img_path = os.path.join(self.root_dir, self.image_files[idx])
20        image = Image.open(img_path).convert('RGB')
21        if self.transform:
22            image = self.transform(image)
23        label = self.labels_idx[idx]
24        return image, label
25
26 jaffe_dataset = JaffeDataset(jaffe_path, transform=transform)
27 jaffe_loader = DataLoader(jaffe_dataset, batch_size=8, shuffle=True)
28 num_classes_jaffe = len(set(jaffe_dataset.labels))
29

```

```

1 import torch
2 import torch.nn as nn
3
4 class SimpleCNN(nn.Module):
5     def __init__(self, num_classes):
6         super(SimpleCNN, self).__init__()
7         self.model = nn.Sequential(
8             nn.Conv2d(3, 32, kernel_size=3, stride=1, padding=1),
9             nn.ReLU(),
10            nn.MaxPool2d(2),
11
12            nn.Conv2d(32, 64, kernel_size=3, stride=1, padding=1),
13            nn.ReLU(),
14            nn.MaxPool2d(2),
15
16            nn.Conv2d(64, 128, kernel_size=3, stride=1, padding=1),
17            nn.ReLU(),
18            nn.MaxPool2d(2),
19
20            nn.Flatten(),
21            nn.Linear(128 * 16 * 16, 128),
22            nn.ReLU(),
23            nn.Dropout(0.5),
24            nn.Linear(128, num_classes)
25        )
26
27    def forward(self, x):
28        return self.model(x)
29

```

```

1 from torchvision import models
2
3 def get_mobilenetv2(num_classes):
4     model = models.mobilenet_v2(pretrained=False)
5     model.classifier[1] = nn.Linear(model.last_channel, num_classes)
6     return model

```

7

```

1 device = torch.device('cuda' if torch.cuda.is_available() else 'cpu')
2
3 model = get_mobilenetv2(num_classes_jaffe)
4 model = model.to(device)
5 optimizer = torch.optim.Adam(model.parameters(), lr=0.001)
6 criterion = nn.CrossEntropyLoss()
7
8 epochs = 5
9 train_losses, train_accs = [], []
10
11 for epoch in range(epochs):
12     model.train()
13     running_loss, correct = 0.0, 0
14     for inputs, labels in jaffe_loader:
15         inputs, labels = inputs.to(device), labels.to(device)
16         optimizer.zero_grad()
17         outputs = model(inputs)
18         loss = criterion(outputs, labels)
19         loss.backward()
20         optimizer.step()
21
22         running_loss += loss.item() * inputs.size(0)
23         _, preds = torch.max(outputs, 1)
24         correct += torch.sum(preds == labels.data)
25
26     epoch_loss = running_loss / len(jaffe_dataset)
27     epoch_acc = correct.double() / len(jaffe_dataset)
28
29     train_losses.append()
30     train_accs.append(epoch_acc.item())
31
32     print(f"Epoch {epoch+1}/{epochs}: Loss={epoch_loss:.4f}, Accuracy={epoch_acc:.4f}")
33

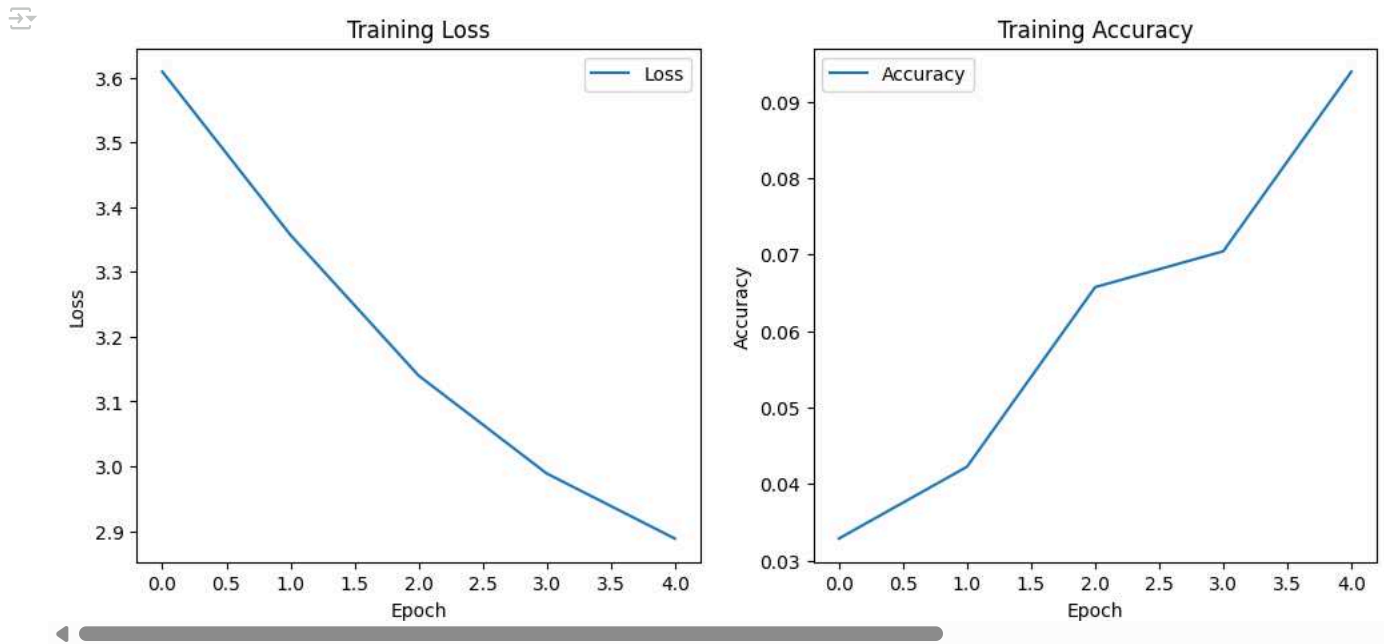
```

 /usr/local/lib/python3.11/dist-packages/torchvision/models/_utils.py:208: UserWarning: The parameter 'pretrained' is deprecated since 0.
 warnings.warn(
 /usr/local/lib/python3.11/dist-packages/torchvision/models/_utils.py:223: UserWarning: Arguments other than a weight enum or `None` for
 warnings.warn(msg)
 Epoch 1/5: Loss=3.6092, Accuracy=0.0329
 Epoch 2/5: Loss=3.3570, Accuracy=0.0423
 Epoch 3/5: Loss=3.1400, Accuracy=0.0657
 Epoch 4/5: Loss=2.9888, Accuracy=0.0704
 Epoch 5/5: Loss=2.8883, Accuracy=0.0939

```

1 import matplotlib.pyplot as plt
2
3 plt.figure(figsize=(12,5))
4
5 plt.subplot(1,2,1)
6 plt.plot(train_losses, label='Loss')
7 plt.title('Training Loss')
8 plt.xlabel('Epoch')
9 plt.ylabel('Loss')
10 plt.legend()
11
12 plt.subplot(1,2,2)
13 plt.plot(train_accs, label='Accuracy')
14 plt.title('Training Accuracy')
15 plt.xlabel('Epoch')
16 plt.ylabel('Accuracy')
17 plt.legend()
18
19 plt.show()
20

```



```

1 from sklearn.metrics import confusion_matrix, classification_report
2 import seaborn as sns
3
4 y_true = []
5 y_pred = []
6
7 model.eval()
8 with torch.no_grad():
9     for inputs, labels in jaffe_loader:
10         inputs = inputs.to(device)
11         outputs = model(inputs)
12         _, preds = torch.max(outputs, 1)
13         y_true.extend(labels.numpy())
14         y_pred.extend(preds.cpu().numpy())
15
16 cm = confusion_matrix(y_true, y_pred)
17 print("Classification Report:\n", classification_report(y_true, y_pred))
18
19 plt.figure(figsize=(6,5))
20 sns.heatmap(cm, annot=True, fmt='d', cmap='Blues')
21 plt.title('Confusion Matrix')
22 plt.xlabel('Predicted')
23 plt.ylabel('True')
24 plt.show()
25

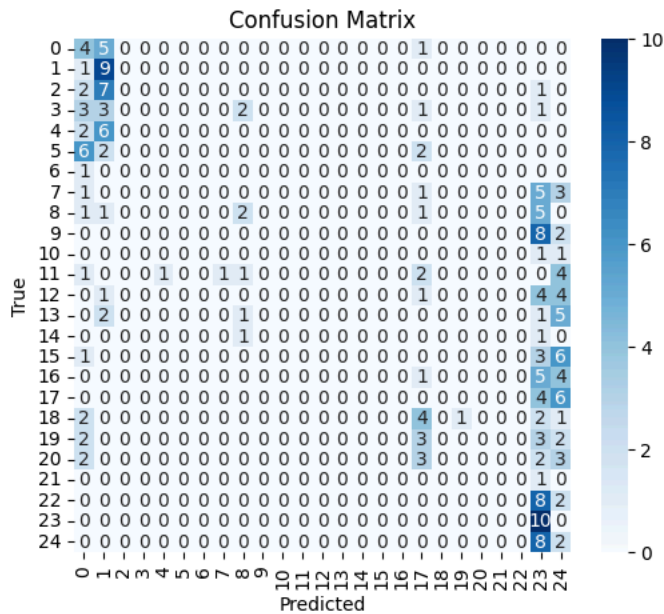
```

```

/usr/local/lib/python3.11/dist-packages/sklearn/metrics/_classification.py:1565: UndefinedMetricWarning: Precision is ill-defined and be
_warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
/usr/local/lib/python3.11/dist-packages/sklearn/metrics/_classification.py:1565: UndefinedMetricWarning: Precision is ill-defined and be
_warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
/usr/local/lib/python3.11/dist-packages/sklearn/metrics/_classification.py:1565: UndefinedMetricWarning: Precision is ill-defined and be
_warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Classification Report:

```

	precision	recall	f1-score	support
0	0.14	0.40	0.21	10
1	0.25	0.90	0.39	10
2	0.00	0.00	0.00	10
3	0.00	0.00	0.00	10
4	0.00	0.00	0.00	8
5	0.00	0.00	0.00	10
6	0.00	0.00	0.00	1
7	0.00	0.00	0.00	10
8	0.29	0.20	0.24	10
9	0.00	0.00	0.00	10
10	0.00	0.00	0.00	2
11	0.00	0.00	0.00	10
12	0.00	0.00	0.00	10
13	0.00	0.00	0.00	9
14	0.00	0.00	0.00	2
15	0.00	0.00	0.00	10
16	0.00	0.00	0.00	10
17	0.00	0.00	0.00	10
18	0.00	0.00	0.00	10
19	0.00	0.00	0.00	10
20	0.00	0.00	0.00	10
21	0.00	0.00	0.00	1
22	0.00	0.00	0.00	10
23	0.14	1.00	0.24	10
24	0.04	0.20	0.07	10
accuracy			0.13	213
macro avg	0.03	0.11	0.05	213
weighted avg	0.04	0.13	0.05	213



```

1 import os
2 import numpy as np
3 import torch
4 from torch.utils.data import Dataset, DataLoader
5 from torchvision import datasets, transforms as T, models
6 from torch import nn, optim
7 import warnings
8 warnings.filterwarnings("ignore")
9 from tqdm import tqdm
10 from sklearn.metrics import confusion_matrix, accuracy_score, precision_score, recall_score, f1_score, classification_r
11 import matplotlib.pyplot as plt
12 import seaborn as sns
13 from sklearn.metrics import confusion_matrix

```

```

13 from PIL import image
14 import cv2
15 import pandas as pd
16

1 jaffe_path = '/content/drive/MyDrive/Datasets/jaffe'
2
3 class JaffeDataset(Dataset):
4     def __init__(self, root_dir, transform=None):
5         self.root_dir = root_dir
6         self.image_files = [f for f in os.listdir(root_dir) if f.endswith(".tiff")]
7         self.transform = transform
8         self.labels = [self.get_label(f) for f in self.image_files]
9         self.label_map = {label: idx for idx, label in enumerate(sorted(set(self.labels)))}
10        self.labels_idx = [self.label_map[label] for label in self.labels]
11
12    def get_label(self, filename):
13        return filename.split('.')[1] # AN, HA, etc.
14
15    def __len__(self):
16        return len(self.image_files)
17
18    def __getitem__(self, idx):
19        img_path = os.path.join(self.root_dir, self.image_files[idx])
20        image = Image.open(img_path).convert('RGB')
21        if self.transform:
22            image = self.transform(image)
23        label = self.labels_idx[idx]
24        return image, label
25
26 transform = T.Compose([
27     T.RandomHorizontalFlip(),
28     T.RandomVerticalFlip(),
29     T.RandomRotation(10),
30     T.Resize((128,128)),
31     T.ToTensor()
32 ])
33
34 jaffe_dataset = JaffeDataset(jaffe_path, transform=transform)
35 jaffe_loader = DataLoader(jaffe_dataset, batch_size=8, shuffle=True)
36 num_classes_jaffe = len(set(jaffe_dataset.labels))
37

1 jaffe_path = '/content/drive/MyDrive/Datasets/jaffe'
2
3 class JaffeDataset(Dataset):
4     def __init__(self, root_dir, transform=None):
5         self.root_dir = root_dir
6         self.image_files = [f for f in os.listdir(root_dir) if f.endswith(".tiff")]
7         self.transform = transform
8         self.labels = [self.get_label(f) for f in self.image_files]
9         self.label_map = {label: idx for idx, label in enumerate(sorted(set(self.labels)))}
10        self.labels_idx = [self.label_map[label] for label in self.labels]
11
12    def get_label(self, filename):
13        return filename.split('.')[1] # AN, HA, etc.
14
15    def __len__(self):
16        return len(self.image_files)
17
18    def __getitem__(self, idx):
19        img_path = os.path.join(self.root_dir, self.image_files[idx])
20        image = Image.open(img_path).convert('RGB')
21        if self.transform:
22            image = self.transform(image)
23        label = self.labels_idx[idx]
24        return image, label
25
26 transform = T.Compose([
27     T.RandomHorizontalFlip(),

```

```

27     T.RandomHorizontalFlip(),
28     T.RandomVerticalFlip(),
29     T.RandomRotation(10),
30     T.Resize((128,128)),
31     T.ToTensor()
32 ])
33
34 jaffe_dataset = JaffeDataset(jaffe_path, transform=transform)
35 jaffe_loader = DataLoader(jaffe_dataset, batch_size=8, shuffle=True)
36 num_classes_jaffe = len(set(jaffe_dataset.labels))
37
38
39 1 device = torch.device('cuda' if torch.cuda.is_available() else 'cpu')
40 2
41 3 model = models.resnet18(pretrained=False)
42 4 model.fc = nn.Linear(model.fc.in_features, num_classes_jaffe)
43 5 model = model.to(device)
44 6
45 7 criterion = nn.CrossEntropyLoss()
46 8 optimizer = optim.AdamW(model.parameters(), lr=0.001)
47 9 scheduler = optim.lr_scheduler.StepLR(optimizer, step_size=3, gamma=0.97)
48 10
49
50 1 def train_model(model, criterion, optimizer, scheduler, num_epochs=2):
51 2     for epoch in range(num_epochs):
52 3         print(f"Epoch {epoch+1}/{num_epochs}")
53 4         print('-' * 10)
54 5
55 6         model.train()
56 7         running_loss = 0.0
57 8         running_corrects = 0
58 9
59 10        for inputs, labels in jaffe_loader:
60 11            inputs, labels = inputs.to(device), labels.to(device)
61 12
62 13            optimizer.zero_grad()
63 14            outputs = model(inputs)
64 15            loss = criterion(outputs, labels)
65 16            loss.backward()
66 17            optimizer.step()
67 18
68 19            _, preds = torch.max(outputs, 1)
69 20            running_loss += loss.item() * inputs.size(0)
70 21            running_corrects += torch.sum(preds == labels.data)
71 22
72 23            scheduler.step()
73 24            epoch_loss = running_loss / len(jaffe_dataset)
74 25            epoch_acc = running_corrects.double() / len(jaffe_dataset)
75 26
76 27            print(f"Loss: {epoch_loss:.4f} Acc: {epoch_acc:.4f}")
77 28        return model
78 29
79 30 model = train_model(model, criterion, optimizer, scheduler, num_epochs=2)
80 31

```

```

→ Epoch 1/2
-----
Loss: 3.5536 Acc: 0.0282
Epoch 2/2
-----
Loss: 3.4113 Acc: 0.0235

```

```

1 y_true, y_pred, y_proba = [], [], []
2
3 model.eval()
4 with torch.no_grad():
5     for inputs, labels in jaffe_loader:
6         inputs = inputs.to(device)
7         outputs = model(inputs)
8         probabilities = torch.softmax(outputs, dim=1)

```

```
9         preds = torch.argmax(probabilities, axis=1)
10
11         y_true.extend(labels.numpy())
12         y_pred.extend(preds.cpu().numpy())
13         y_proba.extend(probabilities.cpu().numpy())
14
15 y_true = np.array(y_true)
16 y_pred = np.array(y_pred)
17 y_proba = np.array(y_proba)
18
19
20 def evaluate_model(model_name, y_true, y_pred, y_proba):
21     labels = list(jaffe_dataset.label_map.keys())
22     accuracy = accuracy_score(y_true, y_pred)
23     precision = precision_score(y_true, y_pred, average='weighted', zero_division=0)
24     recall = recall_score(y_true, y_pred, average='weighted')
25     f1 = f1_score(y_true, y_pred, average='weighted')
26     cm = confusion_matrix(y_true, y_pred)
27
28     print(f"[{model_name}] Accuracy: {accuracy:.4f}")
29     print("Precision:", precision)
30     print("Recall:", recall)
31     print("F1-score:", f1)
32     print("Classification Report:\n", classification_report(y_true, y_pred, target_names=labels))
33
34     plt.figure(figsize=(6,5))
35     sns.heatmap(cm, annot=True, fmt='d', cmap='Blues', xticklabels=labels, yticklabels=labels)
36     plt.title('Confusion Matrix')
37     plt.show()
38
39 evaluate_model("ResNet18 on JAFFE", y_true, y_pred, y_proba)
```



[ResNet18 on JAFFE] Accuracy: 0.0563

Precision: 0.009428280207561158

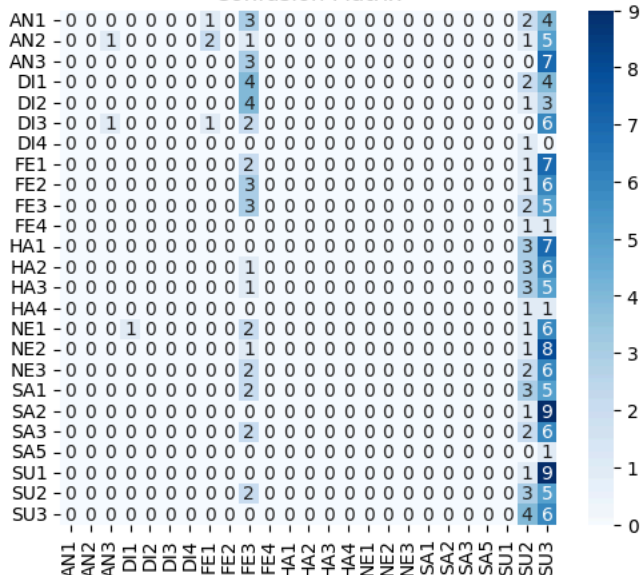
Recall: 0.056338028169014086

F1-score: 0.015584813227189222

Classification Report:

	precision	recall	f1-score	support
AN1	0.00	0.00	0.00	10
AN2	0.00	0.00	0.00	10
AN3	0.00	0.00	0.00	10
DI1	0.00	0.00	0.00	10
DI2	0.00	0.00	0.00	8
DI3	0.00	0.00	0.00	10
DI4	0.00	0.00	0.00	1
FE1	0.00	0.00	0.00	10
FE2	0.00	0.00	0.00	10
FE3	0.08	0.30	0.12	10
FE4	0.00	0.00	0.00	2
HA1	0.00	0.00	0.00	10
HA2	0.00	0.00	0.00	10
HA3	0.00	0.00	0.00	9
HA4	0.00	0.00	0.00	2
NE1	0.00	0.00	0.00	10
NE2	0.00	0.00	0.00	10
NE3	0.00	0.00	0.00	10
SA1	0.00	0.00	0.00	10
SA2	0.00	0.00	0.00	10
SA3	0.00	0.00	0.00	10
SA5	0.00	0.00	0.00	1
SU1	0.00	0.00	0.00	10
SU2	0.07	0.30	0.12	10
SU3	0.05	0.60	0.09	10
accuracy			0.06	213
macro avg	0.01	0.05	0.01	213
weighted avg	0.01	0.06	0.02	213

Confusion Matrix



```

1 csv_path = '/content/drive/MyDrive/Datasets/CK+/ckextended.csv'
2 df_ck = pd.read_csv(csv_path)
3

```

```

1 class CKPlusDataset(Dataset):
2     def __init__(self, dataframe, transform=None):
3         self.df = dataframe
4         self.transform = transform
5
6     def __len__(self):
7         return len(self.df)
8
9     def __getitem__(self, idx):
10        pixel_values = [int(p) for p in self.df.iloc[idx]['pixels'].split()]
11        image = np.array(pixel_values, dtype='uint8').reshape(48, 48)

```

```

12     image = cv2.cvtColor(image, cv2.COLOR_GRAY2RGB)
13     image = cv2.resize(image, (128,128))
14     image = Image.fromarray(image)
15     label = self.df.iloc[idx]['emotion']
16     if self.transform:
17         image = self.transform(image)
18     return image, label
19
20 transform = T.Compose([
21     T.RandomHorizontalFlip(),
22     T.RandomVerticalFlip(),
23     T.RandomRotation(10),
24     T.Resize((128,128)),
25     T.ToTensor()
26 ])
27
28 ck_dataset = CKPlusDataset(df_ck, transform=transform)
29 ck_loader = DataLoader(ck_dataset, batch_size=8, shuffle=True)
30 num_classes_ck = df_ck['emotion'].nunique()
31
32
33 1 model = models.resnet18(pretrained=False)
34 2 model.fc = nn.Linear(model.fc.in_features, num_classes_ck)
35 3 model = model.to(device)
36 4
37 5 criterion = nn.CrossEntropyLoss()
38 6 optimizer = optim.AdamW(model.parameters(), lr=0.001)
39 7 scheduler = optim.lr_scheduler.StepLR(optimizer, step_size=3, gamma=0.97)
40 8
41
42 1 epochs = 2
43 2 for epoch in range(epochs):
44 3     print(f"\nEpoch {epoch+1}/{epochs}")
45 4     model.train()
46 5     running_loss, correct = 0.0, 0
47 6
48 7     for inputs, labels in ck_loader:
49 8         inputs, labels = inputs.to(device), labels.to(device)
50 9         optimizer.zero_grad()
51 10        outputs = model(inputs)
52 11        loss = criterion(outputs, labels)
53 12        loss.backward()
54 13        optimizer.step()
55 14
56 15        _, preds = torch.max(outputs, 1)
57 16        correct += torch.sum(preds == labels.data)
58 17        running_loss += loss.item() * inputs.size(0)
59 18
60 19        epoch_loss = running_loss / len(ck_dataset)
61 20        epoch_acc = correct.double() / len(ck_dataset)
62 21        print(f"Loss: {epoch_loss:.4f} Acc: {epoch_acc:.4f}")
63 22

```



```

Epoch 1/2
Loss: 1.4377 Acc: 0.6152

Epoch 2/2
Loss: 1.1417 Acc: 0.6815

```

```

1 y_true, y_pred, y_proba = [], [], []
2
3 model.eval()
4 with torch.no_grad():
5     for inputs, labels in ck_loader:
6         inputs = inputs.to(device)
7         outputs = model(inputs)
8         probabilities = torch.softmax(outputs, dim=1)
9         preds = torch.argmax(probabilities, axis=1)
10

```

```

11 y_true.extend(labels.numpy())
12 y_pred.extend(preds.cpu().numpy())
13 y_proba.extend(probabilities.cpu().numpy())
14

1 def evaluate_model(model_name, y_true, y_pred, y_proba):
2     labels = sorted(df_ck['emotion'].unique())
3     accuracy = accuracy_score(y_true, y_pred)
4     precision = precision_score(y_true, y_pred, average='weighted', zero_division=0)
5     recall = recall_score(y_true, y_pred, average='weighted')
6     f1 = f1_score(y_true, y_pred, average='weighted')
7     cm = confusion_matrix(y_true, y_pred)
8
9     print(f"[{model_name}] Accuracy: {accuracy:.4f}")
10    print("Precision:", precision)
11    print("Recall:", recall)
12    print("F1-score:", f1)
13    print("Classification Report:\n", classification_report(y_true, y_pred))
14
15    plt.figure(figsize=(6,5))
16    sns.heatmap(cm, annot=True, fmt='d', cmap='Blues')
17    plt.title('Confusion Matrix')
18    plt.xlabel('Predicted')
19    plt.ylabel('True')
20    plt.show()
21
22 evaluate_model("ResNet18 on CK+", y_true, y_pred, y_proba)
23

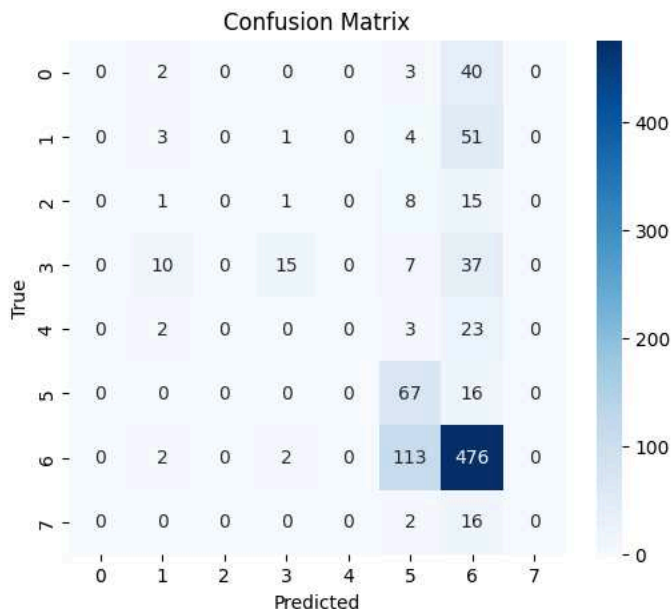
```

```

[ResNet18 on CK+] Accuracy: 0.6098
Precision: 0.5532431203647419
Recall: 0.6097826086956522
F1-score: 0.5564397009156161
Classification Report:

```

	precision	recall	f1-score	support
0	0.00	0.00	0.00	45
1	0.15	0.05	0.08	59
2	0.00	0.00	0.00	25
3	0.79	0.22	0.34	69
4	0.00	0.00	0.00	28
5	0.32	0.81	0.46	83
6	0.71	0.80	0.75	593
7	0.00	0.00	0.00	18
accuracy			0.61	920
macro avg	0.25	0.23	0.20	920
weighted avg	0.55	0.61	0.56	920



```

1 model = models.mobilenet_v2(pretrained=False)
2 model.classifier[1] = nn.Linear(model.last_channel, num_classes_ck)
3 model = model.to(device)
4
5 criterion = nn.CrossEntropyLoss()
6 optimizer = optim.AdamW(model.parameters(), lr=0.001)
7 scheduler = optim.lr_scheduler.StepLR(optimizer, step_size=3, gamma=0.97)
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

```



```

Epoch 1/2
Loss: 1.4453 Acc: 0.6250

Epoch 2/2
Loss: 1.4050 Acc: 0.6326

```

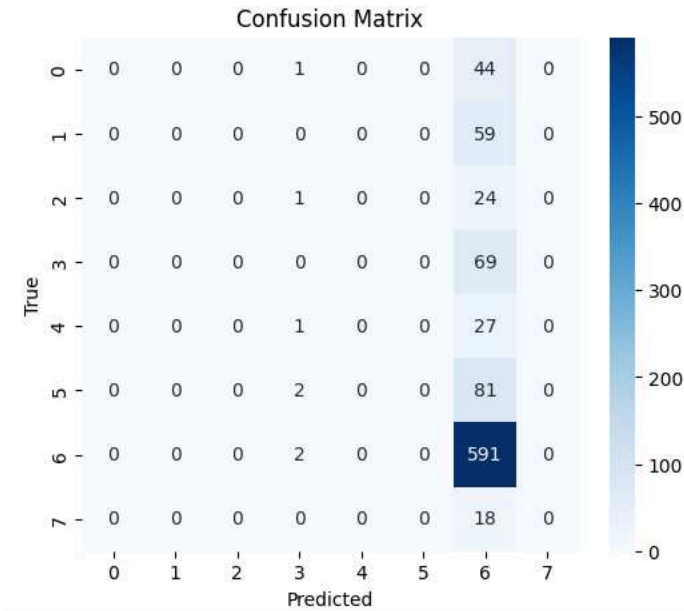
```

1 y_true, y_pred, y_proba = [], [], []
2
3 model.eval()
4 with torch.no_grad():
5     for inputs, labels in ck_loader:
6         inputs = inputs.to(device)
7         outputs = model(inputs)
8         probabilities = torch.softmax(outputs, dim=1)
9         preds = torch.argmax(probabilities, axis=1)
10
11     y_true.extend(labels.numpy())
12     y_pred.extend(preds.cpu().numpy())
13     y_proba.extend(probabilities.cpu().numpy())
14
15
16
17
18
19
20
21
22

```

 [MobileNetV2 on CK+] Accuracy: 0.6424
 Precision: 0.4172377256059812
 Recall: 0.6423913043478261
 F1-score: 0.505893816040187
 Classification Report:

	precision	recall	f1-score	support
0	0.00	0.00	0.00	45
1	0.00	0.00	0.00	59
2	0.00	0.00	0.00	25
3	0.00	0.00	0.00	69
4	0.00	0.00	0.00	28
5	0.00	0.00	0.00	83
6	0.65	1.00	0.78	593
7	0.00	0.00	0.00	18
accuracy			0.64	920
macro avg	0.08	0.12	0.10	920
weighted avg	0.42	0.64	0.51	920



```

1 import pandas as pd
2 import numpy as np
3 import torch
4 from torch.utils.data import Dataset, DataLoader
5 from torchvision import transforms, models
6 from PIL import Image
7 import cv2
8
9 csv_path = '/content/drive/MyDrive/Datasets/CK+/ckextended.csv'
10 df_ck = pd.read_csv(csv_path)
11
12 # التأكد من الفئات وعددها
13 print("الفئات المتوفرة:", df_ck['emotion'].unique())
14 num_classes_ck = df_ck['emotion'].nunique()
15 print("عدد الفئات:", num_classes_ck)
16
17 # تصحيح: إزالة أي فئة خارج النطاق إذا وجدت
18 df_ck = df_ck[df_ck['emotion'] < num_classes_ck].reset_index(drop=True)
19

```

 الفئات المتوفرة: [5 2 4 1 0 7 3 6]
 عدد الفئات: 8

```

1 class CKPlusDataset(Dataset):
2     def __init__(self, dataframe, transform=None):
3         self.df = dataframe
4         self.transform = transform
5
6     def __len__(self):

```

```

7         return len(self.df)
8
9     def __getitem__(self, idx):
10         pixel_values = [int(p) for p in self.df.iloc[idx]['pixels'].split()]
11         image = np.array(pixel_values, dtype='uint8').reshape(48, 48)
12         image = cv2.cvtColor(image, cv2.COLOR_GRAY2RGB)
13         image = cv2.resize(image, (128,128))
14         image = Image.fromarray(image)
15         label = self.df.iloc[idx]['emotion']
16         if self.transform:
17             image = self.transform(image)
18         return image, label
19
20 transform = transforms.Compose([
21     transforms.RandomHorizontalFlip(),
22     transforms.RandomVerticalFlip(),
23     transforms.RandomRotation(10),
24     transforms.Resize((128,128)),
25     transforms.ToTensor()
26 ])
27
28 ck_dataset = CKPlusDataset(df_ck, transform=transform)
29 ck_loader = DataLoader(ck_dataset, batch_size=8, shuffle=True)
30
31
32 1 device = torch.device('cuda' if torch.cuda.is_available() else 'cpu')
33 2
34 3 model = models.efficientnet_b0(pretrained=False)
35 4 model.classifier[1] = torch.nn.Linear(model.classifier[1].in_features, num_classes_ck)
36 5 model = model.to(device)
37 6
38 7 criterion = torch.nn.CrossEntropyLoss()
39 8 optimizer = torch.optim.AdamW(model.parameters(), lr=0.001)
40 9 scheduler = torch.optim.lr_scheduler.StepLR(optimizer, step_size=3, gamma=0.97)
41 10
42
43 1 def train_model(model, criterion, optimizer, scheduler, num_epochs=2):
44 2     for epoch in range(num_epochs):
45 3         print(f"\nEpoch {epoch+1}/{num_epochs}")
46 4         model.train()
47 5         running_loss, correct = 0.0, 0
48 6
49 7         for inputs, labels in ck_loader:
50 8             inputs, labels = inputs.to(device), labels.to(device)
51 9
52 10            optimizer.zero_grad()
53 11            outputs = model(inputs)
54 12            loss = criterion(outputs, labels)
55 13            loss.backward()
56 14            optimizer.step()
57 15
58 16            _, preds = torch.max(outputs, 1)
59 17            correct += torch.sum(preds == labels.data)
60 18            running_loss += loss.item() * inputs.size(0)
61 19
62 20            scheduler.step()
63 21            epoch_loss = running_loss / len(ck_dataset)
64 22            epoch_acc = correct.double() / len(ck_dataset)
65 23            print(f"Loss: {epoch_loss:.4f}, Accuracy: {epoch_acc:.4f}")
66 24         return model
67 25
68
69 1 model = train_model(model, criterion, optimizer, scheduler, num_epochs=2)
70 2

```



Epoch 1/2
Loss: 1.5492, Accuracy: 0.6033

Epoch 2/2

Loss: 1.3721, Accuracy: 0.6391

```

1 from sklearn.metrics import accuracy_score, precision_score, recall_score, f1_score, confusion_matrix, classification_r
2 import seaborn as sns
3 import matplotlib.pyplot as plt
4
5 y_true, y_pred = [], []
6
7 model.eval()
8 with torch.no_grad():
9     for inputs, labels in ck_loader:
10         inputs = inputs.to(device)
11         outputs = model(inputs)
12         _, preds = torch.max(outputs, 1)
13
14         y_true.extend(labels.numpy())
15         y_pred.extend(preds.cpu().numpy())
16
17 cm = confusion_matrix(y_true, y_pred)
18 print("Classification Report:\n", classification_report(y_true, y_pred))
19
20 plt.figure(figsize=(6,5))
21 sns.heatmap(cm, annot=True, fmt='d', cmap='Blues')
22 plt.title('Confusion Matrix')
23 plt.xlabel('Predicted')
24 plt.ylabel('True')
25 plt.show()
26

```

↗ Classification Report:

	precision	recall	f1-score	support
0	0.00	0.00	0.00	45
1	0.00	0.00	0.00	59
2	0.00	0.00	0.00	25
3	0.00	0.00	0.00	69
4	0.00	0.00	0.00	28
5	0.00	0.00	0.00	83
6	0.64	1.00	0.78	593
7	0.00	0.00	0.00	18
accuracy			0.64	920
macro avg	0.08	0.12	0.10	920
weighted avg	0.42	0.64	0.51	920