深度學習專題:水果分類

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引用資料集


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預期更新頻率

算法:CNN

```
class FruitCnnModel(nn.Module):
    def __init__(self):
        super().__init__()
        self.network = nn.Sequential(

            nn.Conv2d(3, 16, kernel_size=2, padding=1), #99
            nn.BatchNorm2d(16),
            nn.ReLU(),
            nn.MaxPool2d(2, 2), #99/2=50


            nn.Conv2d(16, 32, kernel_size=2, stride=1, padding=1), #49
            nn.BatchNorm2d(32),
            nn.ReLU(),
            nn.MaxPool2d(2, 2), #49/2=25


            nn.Conv2d(32, 64, kernel_size=2, stride=1, padding=1),#24
            nn.BatchNorm2d(64),
            nn.ReLU(),
            nn.MaxPool2d(5, 5), #24/5=5


            nn.Flatten(),
            nn.Dropout(0.5),
            nn.ReLU(),
            nn.Linear(64*5*5, 131))

    def forward(self, xb):
      return self.network(xb)
```

訓練

```
criterion = nn.CrossEntropyLoss()
optimizer = optim.Adam(model.parameters(), lr=0.001)
n_epochs = 4
valid_loss_min = np.Inf
```

```
running epoch: 1
        Training Loss: 1.306246         Validation Loss: 0.146474
Validation loss decreased (inf --> 0.146474).  Saving model ...
running epoch: 2
        Training Loss: 0.137370         Validation Loss: 0.041651
Validation loss decreased (0.146474 --> 0.041651).  Saving model ...
running epoch: 3
        Training Loss: 0.060066         Validation Loss: 0.013181
Validation loss decreased (0.041651 --> 0.013181).  Saving model ...
running epoch: 4
        Training Loss: 0.035998         Validation Loss: 0.007642
Validation loss decreased (0.013181 --> 0.007642).  Saving model ...
```

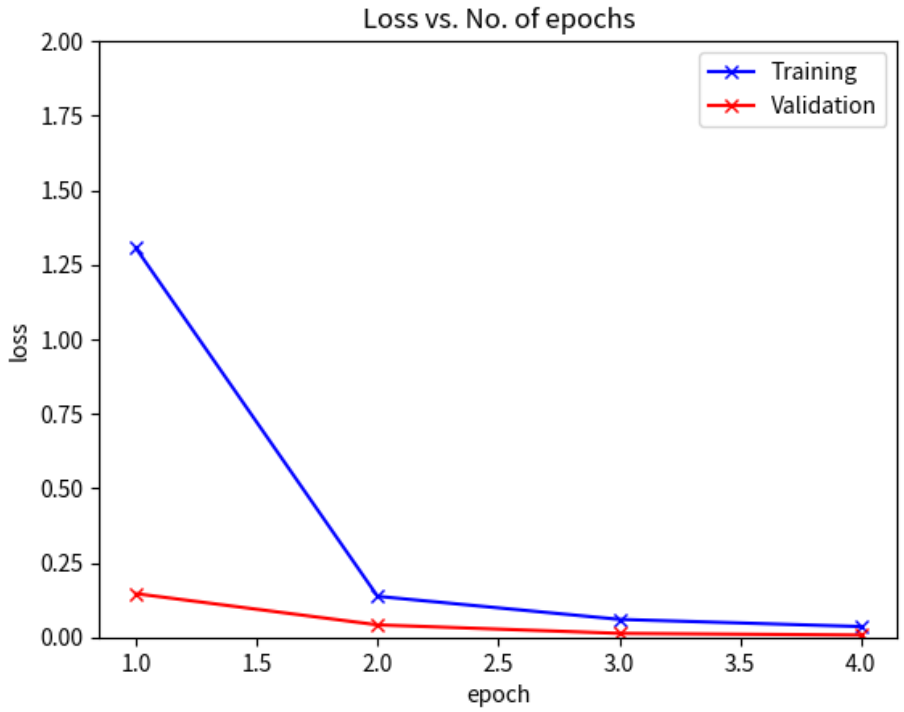
測試結果

```
def test(loaders, model, criterion, use_cuda):


    test_loss = 0.
    correct = 0.
    total = 0.
    model.eval()
    for batch_idx, (data, target) in enumerate(loaders):

        if use_cuda:
            data, target = data.cuda(), target.cuda()

        output = model(data)

        loss = criterion(output, target)

        test_loss = test_loss + ((1 / (batch_idx + 1)) * (loss.data - test_loss))

        pred = output.data.max(1, keepdim=True)[1]

        correct += np.sum(pred.eq(target.data.view_as(pred)).cpu().numpy())
        total += data.size(0)

    print('Test Loss: {:.6f}'.format(test_loss))
    print('Test Accuracy: %2d%% (%2d/%2d)' % (100. * correct / total, correct, total))


use_cuda = torch.cuda.is_available()
test(test_loader, model, criterion, use_cuda)
```

```
Test Loss: 0.077323
Test Accuracy: 98% (22305/22688)
```

損失值曲線圖

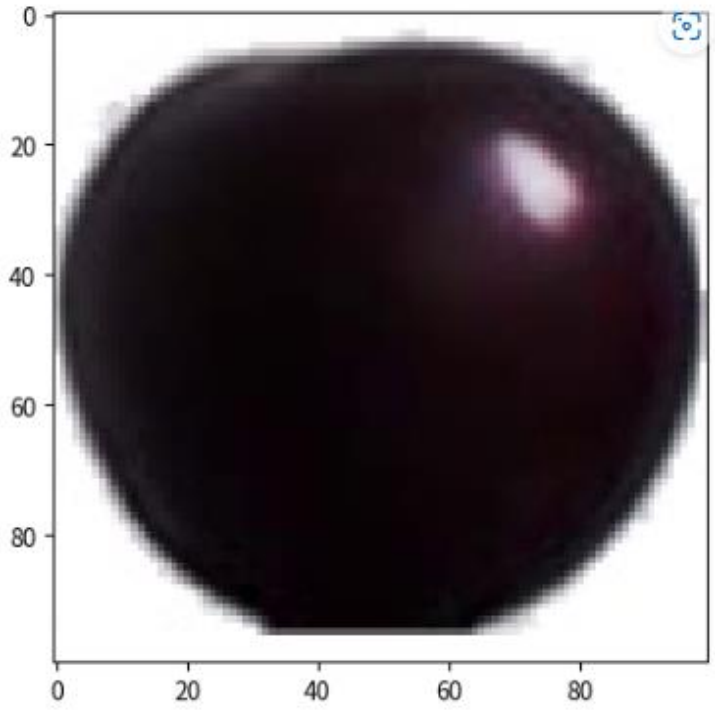
```
train_losses = [x for x in train_losses]
epochs=[1,2,3,4]
val_losses = [x for x in valid_losses]
plt.plot(epochs,train_losses, '-bx')
plt.plot(epochs,val_losses, '-rx')
plt.xlabel('epoch')
plt.ylabel('loss')
plt.ylim(0,2)
plt.legend(['Training', 'Validation'])
plt.title('Loss vs. No. of epochs');

plt.show()
```



模型測試

```
In [11]: img, label = test_data[5000]
         plt.imshow(img.permute(1, 2, 0))
         print('Label:', train_data.classes[label], 'Predicted:', predict_image(img, model))
```

```
Label: Cherry Wax Black Predicted: Cherry Wax Black
```



蝴蝶和飛蛾圖像分類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算法:CNN

```
class Butterfly_vs_Classifier_CnnModel(nn.Module):
    def __init__(self):
        super().__init__()
        self.network = nn.Sequential(

            nn.Conv2d(3, 16, kernel_size=5, padding=0),
            nn.BatchNorm2d(16),
            nn.ReLU(),
            nn.MaxPool2d(2, 2),


            nn.Conv2d(16, 32, kernel_size=5, stride=1, padding=0),
            nn.BatchNorm2d(32),
            nn.ReLU(),
            nn.MaxPool2d(2, 2),


            nn.Conv2d(32, 16, kernel_size=3, stride=1, padding=0),
            nn.BatchNorm2d(16),
            nn.ReLU(),
            nn.MaxPool2d(2, 2),

            nn.Conv2d(16, 8, kernel_size=3, stride=1, padding=0),
            nn.BatchNorm2d(8),
            nn.ReLU(),
            nn.MaxPool2d(2, 2),


            nn.Flatten(),
            nn.Dropout(0.5),
            nn.ReLU(),
            nn.Linear(8*11*11, 100))

    def forward(self, xb):
      return self.network(xb)


model = FruitCnnModel()
model
```

訓練

```python
criterion = nn.CrossEntropyLoss()
optimizer = optim.Adam(model.parameters(), lr=0.0001)


n_epochs = 50

valid_loss_min = np.Inf
```

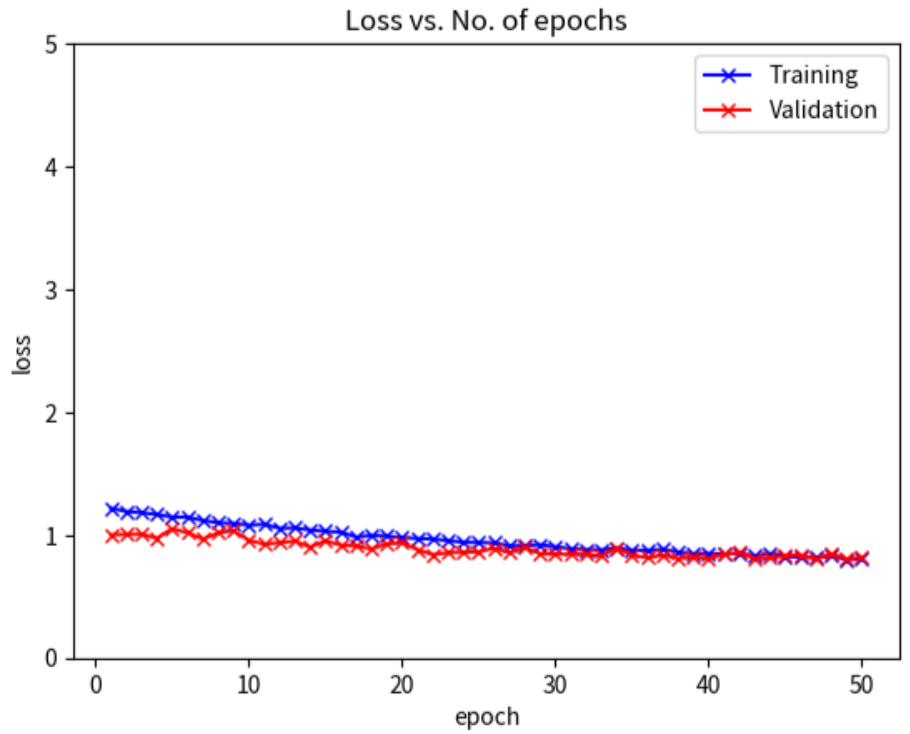
```
running epoch: 1
        Training Loss: 1.219365         Validation Loss: 1.002321
Validation loss decreased (inf --> 1.002321).  Saving model ...
running epoch: 2
        Training Loss: 1.191668         Validation Loss: 1.005435
running epoch: 3
        Training Loss: 1.182129         Validation Loss: 1.006855
running epoch: 4
        Training Loss: 1.167862         Validation Loss: 0.974304
Validation loss decreased (1.002321 --> 0.974304).  Saving model ...
running epoch: 5
        Training Loss: 1.146752         Validation Loss: 1.051923
running epoch: 6
        Training Loss: 1.145451         Validation Loss: 1.018808
running epoch: 7
        Training Loss: 1.119549         Validation Loss: 0.967221
Validation loss decreased (0.974304 --> 0.967221).  Saving model ...
running epoch: 8
        Training Loss: 1.100453         Validation Loss: 1.018015
running epoch: 9
        Training Loss: 1.095090         Validation Loss: 1.034428
running epoch: 10
        Training Loss: 1.080947         Validation Loss: 0.958184
Validation loss decreased (0.967221 --> 0.958184).  Saving model ...
running epoch: 11
        Training Loss: 1.087827         Validation Loss: 0.925947
Validation loss decreased (0.958184 --> 0.925947).  Saving model ...
running epoch: 12
        Training Loss: 1.055455         Validation Loss: 0.938659
running epoch: 13
        Training Loss: 1.058292         Validation Loss: 0.950806
running epoch: 14
        Training Loss: 1.041591         Validation Loss: 0.902710
Validation loss decreased (0.925947 --> 0.902710).  Saving model ...
running epoch: 15
        Training Loss: 1.031274         Validation Loss: 0.952339
running epoch: 16
        Training Loss: 1.024050         Validation Loss: 0.918353
running epoch: 17
        Training Loss: 0.984280         Validation Loss: 0.911466
running epoch: 18
        Training Loss: 0.997803         Validation Loss: 0.887306
Validation loss decreased (0.902710 --> 0.887306).  Saving model ...
running epoch: 19
        Training Loss: 0.991826         Validation Loss: 0.928942
running epoch: 20
        Training Loss: 0.979805         Validation Loss: 0.937860
running epoch: 21
        Training Loss: 0.972732         Validation Loss: 0.881339
Validation loss decreased (0.887306 --> 0.881339).  Saving model ...
running epoch: 22
        Training Loss: 0.967737         Validation Loss: 0.840881
Validation loss decreased (0.881339 --> 0.840881).  Saving model ...
running epoch: 23
        Training Loss: 0.955617         Validation Loss: 0.857133
running epoch: 24
        Training Loss: 0.941583         Validation Loss: 0.860032
running epoch: 25
        Training Loss: 0.939470         Validation Loss: 0.863752
running epoch: 26
        Training Loss: 0.936656         Validation Loss: 0.892765
running epoch: 27
        Training Loss: 0.912217         Validation Loss: 0.859003
running epoch: 28
        Training Loss: 0.913842         Validation Loss: 0.899580
running epoch: 29
        Training Loss: 0.922358         Validation Loss: 0.848848
running epoch: 30
        Training Loss: 0.905812         Validation Loss: 0.843210
running epoch: 31
        Training Loss: 0.889700         Validation Loss: 0.845844
running epoch: 32
        Training Loss: 0.881824         Validation Loss: 0.845093
running epoch: 33
        Training Loss: 0.879473         Validation Loss: 0.829454
Validation loss decreased (0.840881 --> 0.829454).  Saving model ...
running epoch: 34
        Training Loss: 0.894274         Validation Loss: 0.895647
running epoch: 35
        Training Loss: 0.877130         Validation Loss: 0.834756
running epoch: 36
        Training Loss: 0.875628         Validation Loss: 0.817081
Validation loss decreased (0.829454 --> 0.817081).  Saving model ...
running epoch: 37
        Training Loss: 0.883569         Validation Loss: 0.836547
running epoch: 38
        Training Loss: 0.863131         Validation Loss: 0.810686
Validation loss decreased (0.817081 --> 0.810686).  Saving model ...
running epoch: 39
        Training Loss: 0.848675         Validation Loss: 0.826044
running epoch: 40
        Training Loss: 0.851950         Validation Loss: 0.809089
Validation loss decreased (0.810686 --> 0.809089).  Saving model ...
running epoch: 41
        Training Loss: 0.844693         Validation Loss: 0.843245
running epoch: 42
        Training Loss: 0.852901         Validation Loss: 0.859733
running epoch: 43
        Training Loss: 0.829086         Validation Loss: 0.808046
Validation loss decreased (0.809089 --> 0.808046).  Saving model ...
running epoch: 44
        Training Loss: 0.850447         Validation Loss: 0.815440
running epoch: 45
        Training Loss: 0.824561         Validation Loss: 0.831608
running epoch: 46
        Training Loss: 0.820571         Validation Loss: 0.837813
running epoch: 47
        Training Loss: 0.814792         Validation Loss: 0.805094
Validation loss decreased (0.808046 --> 0.805094).  Saving model ...
running epoch: 48
        Training Loss: 0.828432         Validation Loss: 0.848318
running epoch: 49
        Training Loss: 0.801110         Validation Loss: 0.806240
running epoch: 50
        Training Loss: 0.804431         Validation Loss: 0.819413
Test Loss: 0.752096
Test Accuracy: 80% (403/500)
```

測試結果

```
Test Loss: 0.752096
Test Accuracy: 80% (403/500)
```

•損失值曲線圖

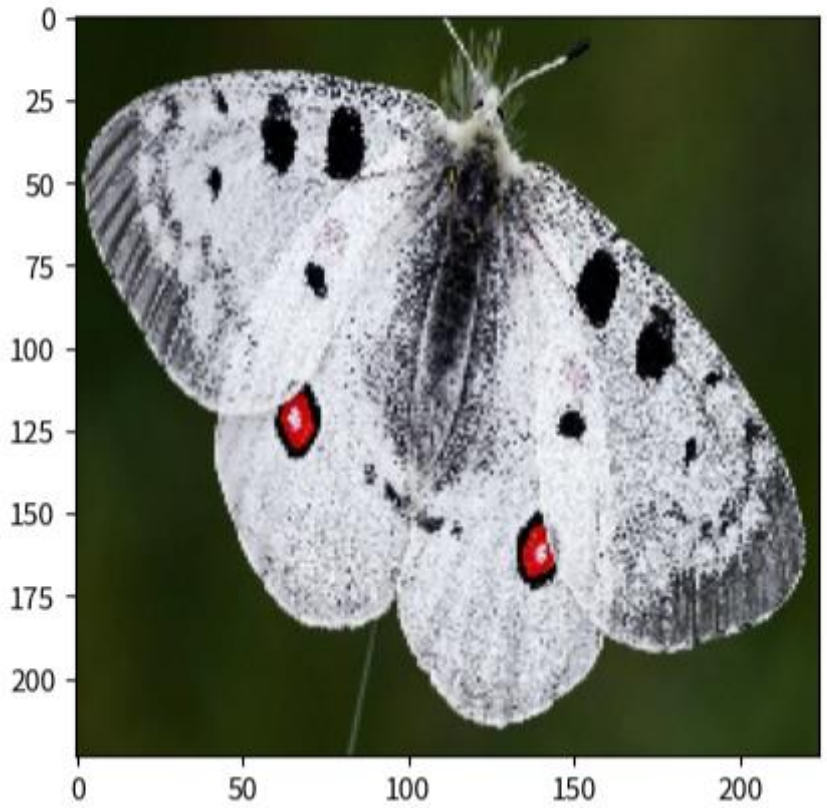
```
train_losses = [x for x in train_losses]
epochs=[i for i in range(1,51)]
val_losses = [x for x in valid_losses]
plt.plot(epochs,train_losses, '-bx')
plt.plot(epochs,val_losses, '-rx')
plt.xlabel('epoch')
plt.ylabel('loss')
plt.ylim(0,5)
plt.legend(['Training', 'Validation'])
plt.title('Loss vs. No. of epochs');

plt.show()
```



模型測試

```
img, label = test_data[20]
plt.imshow(img.permute(1, 2, 0))
print('Label:', train_data.classes[label], 'Predicted:', predict_image(img, model))
```

```
Label: APPOLLO Predicted: APPOLLO
```



謝謝觀看