```
1 # Best model from problem 2 + DropOut
2 # Replace the average pooling with max-pooling.
3 # Replace the softmax layer with ReLU.
4 # Adjust the number of output channels (width of each layer).
```

```
1 import torch
2 !pip install d2l==1.0.0a0
```

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Successfully installed d2l-1.0.0a0 jedi-0.18.2 jupyter-1.0.0 qtconsole-5.4.0 qtpy-2.3.0
```

```
1 !pip install matplotlib
2 %matplotlib inline
3 !pip install matplotlib-inline
4 import sys
5 !{sys.executable} -m pip install matplotlib
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: matplotlib in /usr/local/lib/python3.8/dist-packages (3.2.2)
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Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.8/dist-packages (from python-dateutil>=2.1->matplotlib) (1.15.0)
```

```python
1 import time
2 import numpy as np
3 import torch
4 import torchvision
5 from torchvision import transforms
6 from torch import nn
7 from d2l import torch as d2l
8 from torch.optim import lr_scheduler
```

```python
1 def LeNet(num_classes=10):
2     net = nn.Sequential(nn.LazyConv2d(30, kernel_size=5, padding=2),
3             nn.ReLU(),
4             nn.MaxPool2d(kernel_size=2, stride=2),
5             nn.LazyConv2d(60, kernel_size=5),
6             nn.ReLU(),
7             nn.MaxPool2d(kernel_size=2, stride=2),
8             nn.Flatten(),
9             nn.Linear(1500, 120),
10            nn.ReLU(),
11            nn.Dropout(p=0.1),
12            nn.Linear(120, 84),
13            nn.ReLU(),
14            nn.Dropout(p=0.1),
15            nn.Linear(84, num_classes))
16    return net
```

```python
1 def train(model, train_loader, test_loader, num_epochs, loss_fn, trainer):
2
3     animator = d2l.Animator(xlabel='epoch', xlim=[0, num_epochs], legend=['train loss', 'train accuracy', 'test accuracy'])
4     for epoch in range(num_epochs):
5         metric = d2l.Accumulator(3)
6         for i, (X, y) in enumerate(train_loader):
7             net.train()
8             trainer.zero_grad()
9             y_hat = net(X)
10            l = loss_fn(y_hat, y)
11            l.backward()
12            trainer.step()
13            with torch.no_grad():
14                metric.add(l * X.shape[0], d2l.accuracy(y_hat, y), X.shape[0])
15            train_loss = metric[0] / metric[2]
16            train_acc = metric[1] / metric[2]
17            if (i + 1) % 50 == 0:
18                animator.add(epoch + i / len(train_loader),
19                          (train_loss, train_acc, None))
20
21         test_acc = d2l.evaluate_accuracy_gpu(model, test_loader)
22         animator.add(epoch+1, (None, None, test_acc))
23
24     print(f'train loss {train_loss:.3f}, train accuracy {train_acc:.3f}, 'f'test accuracy {test_acc:.3f}')
```

```python
1 loss = nn.CrossEntropyLoss()
2 batch_size = 256
3 num_epochs = 10
4 lr=0.01
```

```
1 train_loader, test_loader = d2l.load_data_fashion_mnist(batch_size=batch_size)
2 net= LeNet(num_classes=10)
3 trainer = torch.optim.Adam(net.parameters(), lr=lr)
```

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Downloading http://fashion-mnist.s3-website.eu-central-1.amazonaws.com/train-images-idx3-ubyte.gz to ../data/FashionMNIST/raw/train-imag
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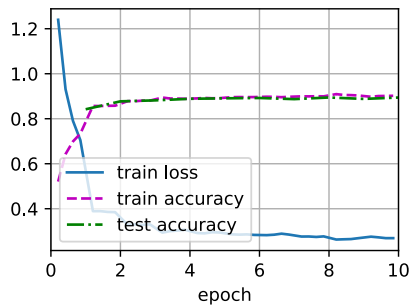Extracting ../data/FashionMNIST/raw/train-labels-idx1-ubyte.gz to ../data/FashionMNIST/raw

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/usr/local/lib/python3.8/dist-packages/torch/utils/data/dataloader.py:554: UserWarning: This DataLoader will create 4 worker processes i
  warnings.warn(_create_warning_msg(
/usr/local/lib/python3.8/dist-packages/torch/nn/modules/lazy.py:180: UserWarning: Lazy modules are a new feature under heavy development
  warnings.warn('Lazy modules are a new feature under heavy development '

```
1   train(net, train_loader, test_loader, num_epochs, loss, trainer)
```

train loss 0.269, train accuracy 0.902, test accuracy 0.894

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