- 这个模型用所有特征进行训练，训练结果可以，预测结果较为准确。

In [1]:

```
%matplotlib inline
import torch
from torch.utils import data
from torch import nn
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_spli
```

0. 判断GPU是否可用

In [2]:

```
device = torch.device("cuda:0" if torch.cuda.is_avai
```

1. 数据预处理

In [3]:

```
data_path = './BostonHousingData.xlsx'
df = pd.read_excel(data_path)

print("数据维度:", df.shape)
print(df.head())
```

```
数据维度： (506, 14)
      CRIM    ZN  INDUS  CHAS    NOX     RM   AGE
DIS  RAD  TAX  PTRATIO  \
0  0.00632  18.0   2.31     0  0.538  6.575  65.2  4.
0900     1  296       15.3
1  0.02731   0.0   7.07     0  0.469  6.421  78.9  4.
9671     2  242       17.8
2  0.02729   0.0   7.07     0  0.469  7.185  61.1  4.
9671     2  242       17.8
3  0.03237   0.0   2.18     0  0.458  6.998  45.8  6.
0622     3  222       18.7
4  0.06905   0.0   2.18     0  0.458  7.147  54.2  6.
0622     3  222       18.7

        B  LSTAT  MEDV
0  396.90   4.98  24.0
1  396.90   9.14  21.6
2  392.83   4.03  34.7
3  394.63   2.94  33.4
4  396.90   5.33  36.2
```

In [4]:

```
x_data = df.iloc[:, :13].values
y_data = df.MEDV.values
print(x_data.shape)
print(y_data.shape)
```

```
(506, 13)
(506,)
```

In [5]:

```
# 数据标准化
scaler = StandardScaler()
scaler.fit(x_data)
x_data = scaler.transform(x_data)
x_data
```

Out[5]:

```
array([[-0.41978194,  0.28482986, -1.2879095 , ...,
-1.45900038,
         0.44105193, -1.0755623 ],
       [-0.41733926, -0.48772236, -0.59338101, ...,
-0.30309415,
         0.44105193, -0.49243937],
       [-0.41734159, -0.48772236, -0.59338101, ...,
-0.30309415,
         0.39642699, -1.2087274 ],
       ...,
       [-0.41344658, -0.48772236,  0.11573841, ...,
1.17646583,
         0.44105193, -0.98304761],
       [-0.40776407, -0.48772236,  0.11573841, ...,
1.17646583,
         0.4032249 , -0.86530163],
       [-0.41500016, -0.48772236,  0.11573841, ...,
1.17646583,
         0.44105193, -0.66905833]])
```

In [6]:

```
# 数据集划分
X_train, X_test, y_train, y_test = train_test_split(
```

In [7]:

```
X_train.shape
```

Out[7]:

```
(455, 13)
```

In [8]:

```
# 转换为张量
X_train_tensor = torch.from_numpy(X_train.astype(np.
y_train_tensor = torch.from_numpy(y_train.astype(np.
X_test_tensor  = torch.from_numpy(X_test.astype(np.f
y_test_tensor  = torch.from_numpy(y_test.astype(np.f
```

In [9]:

```
y_train_tensor.shape
```

Out[9]:

```
torch.Size([455])
```

In [10]:

```
# 构造数据集与 DataLoader
train_dataset = data.TensorDataset(X_train_tensor, y
# test_dataset = data.TensorDataset(X_test_tensor, y

batch_size = 32
train_loader = data.DataLoader(train_dataset, batch_
# test_loader = data.DataLoader(test_dataset, batch_
```

2. 网络模型搭建

In [11]:

```
class Model(nn.Module):
    def __init__(self):
        super().__init__()
        self.fc = nn.Sequential(
            nn.Linear(in_features=13, out_features=6
            nn.ReLU(),
            nn.Linear(in_features=64, out_features=3
            nn.ReLU(),
            nn.Linear(in_features=32, out_features=1
            nn.ReLU(),
            nn.Linear(in_features=16, out_features=1
        )

    def forward(self, X):
        return self.fc(X)
```

In [12]:

```
model = Model().to(device)
model
```

Out[12]:

```
Model(
  (fc): Sequential(
    (0): Linear(in_features=13, out_features=64, bi
as=True)
    (1): ReLU()
    (2): Linear(in_features=64, out_features=32, bi
as=True)
    (3): ReLU()
    (4): Linear(in_features=32, out_features=16, bi
as=True)
    (5): ReLU()
    (6): Linear(in_features=16, out_features=1, bia
s=True)
  )
)
```

3. 训练

In [ ]:

```
def train():
    loss_fun = nn.MSELoss()
    optimizer = torch.optim.SGD(model.parameters(),
    num_epochs = 100
    model.train()
    epoch_losses = []

    for epoch in range(num_epochs):
        for step, (X, y) in enumerate(train_dataset)
            X = X.to(device)
            y = y.to(device)
            out = model(X)
            loss = loss_fun(out.to(device), y)
            loss.backward()
            optimizer.step()
            optimizer.zero_grad()

        epoch_losses.append(loss.item())
        if epoch % 20 == 0:
            print(f'epoch: {epoch}, loss: {loss.iten
    torch.save(model, "./BostonHousingTest3.model")
    return epoch_losses
```

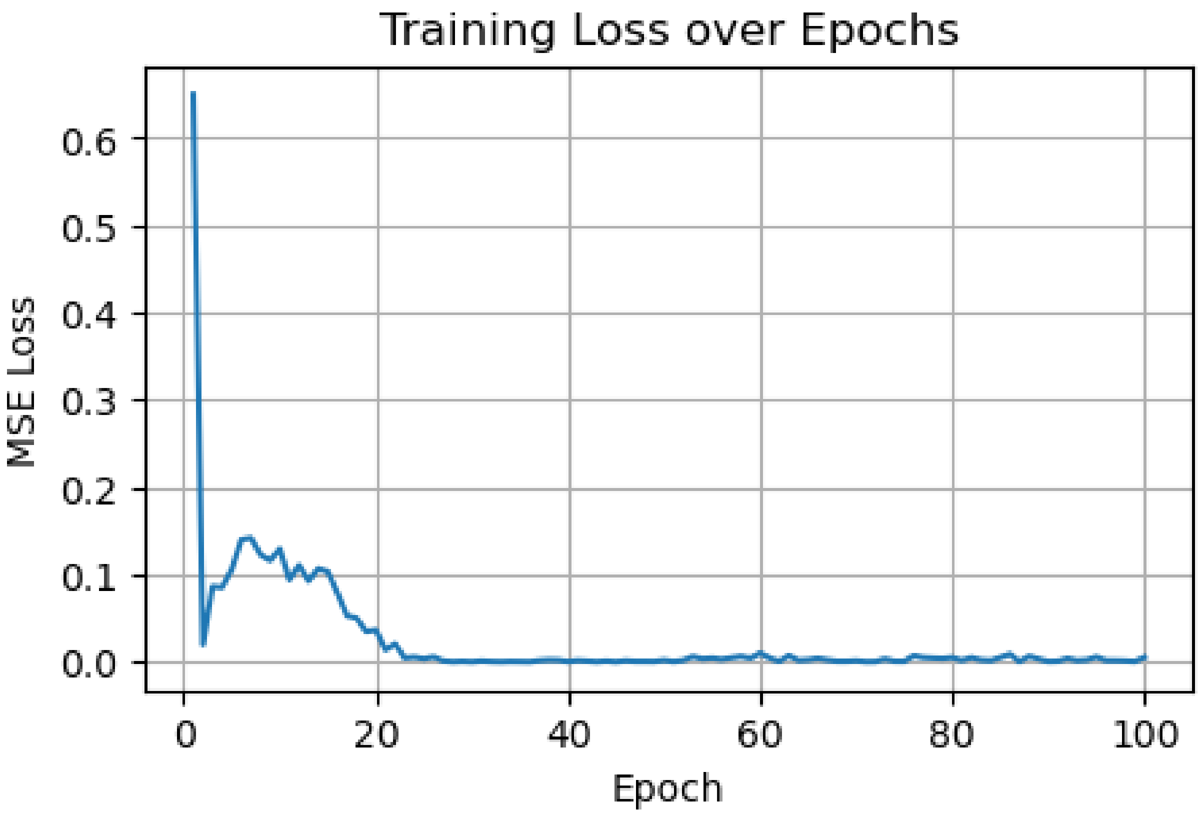
In [14]:

```
# train()
loss_history = train()
```

```
e:\APP\TechSoftware\Anaconda\anaconda3\envs\neural-ne
twork\lib\site-packages\torch\nn\modules\loss.py:610:
UserWarning: Using a target size (torch.Size([])) tha
t is different to the input size (torch.Size([1])). T
his will likely lead to incorrect results due to broa
dcasting. Please ensure they have the same size.
  return F.mse_loss(input, target, reduction=self.red
uction)
epoch: 0, loss: 0.6503491401672363
epoch: 20, loss: 0.013397031463682652
epoch: 40, loss: 0.0014176024124026299
epoch: 60, loss: 0.004161584656685591
epoch: 80, loss: 0.0015703050885349512
```

In [ ]:

```
# 损失函数可视化
plt.figure(figsize=(5, 3))
plt.plot(range(1, len(loss_history) + 1), loss_histo
plt.xlabel("Epoch")
plt.ylabel("MSE Loss")
plt.title("Training Loss over Epochs")
plt.grid(True)
plt.show()
```



4. 测试

In [16]:

```
@torch.no_grad()
def test(X_test_tensor):
    model = torch.load("./BostonHousingTest3.model",
    model.eval()
    X_test_tensor = X_test_tensor.to(device)
    out = model(X_test_tensor)
    return out
```

In [17]:

```
predictions = test(X_test_tensor)
```

In [18]:

```
predictions[10], y_test_tensor[10]
```

Out[18]:

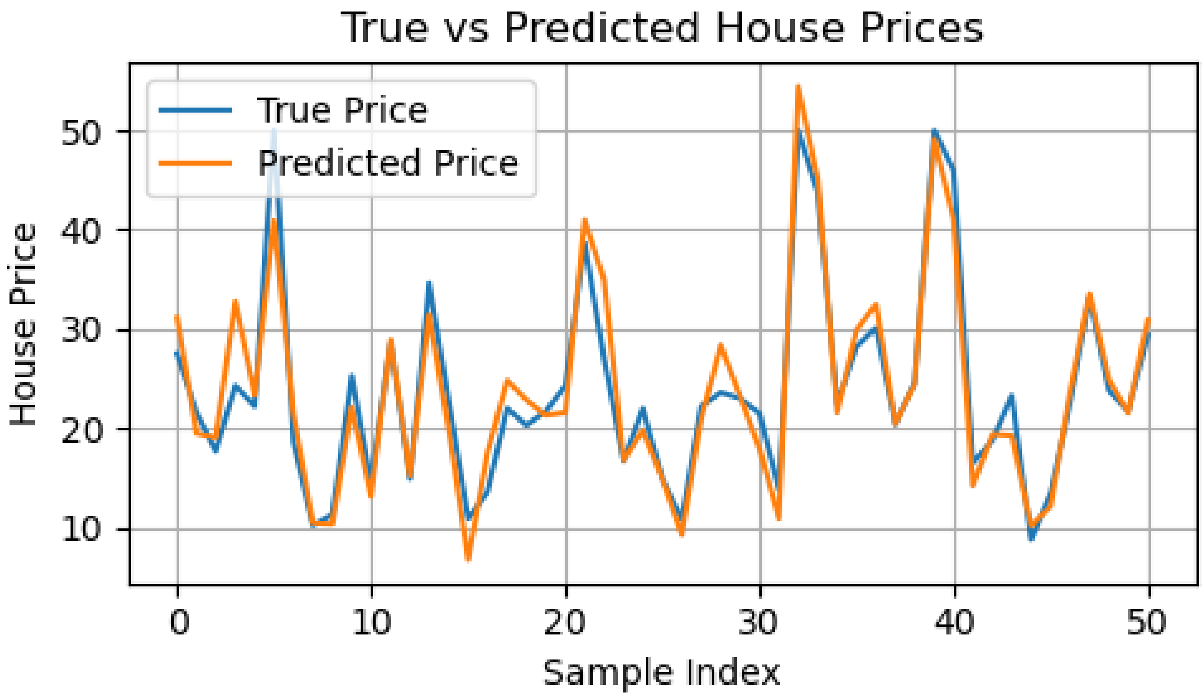
```
(tensor([13.1588], device='cuda:0'), tensor(14.500
0))
```

In [ ]:

```
# 预测结果可视化
predictions_np = predictions.cpu().numpy().flatten()
y_test_np = y_test_tensor.numpy().flatten()

plt.figure(figsize=(5, 3))
```

```python
plt.plot(y_test_np, label='True Price')
plt.plot(predictions_np, label='Predicted Price')
plt.title("True vs Predicted House Prices")
plt.xlabel("Sample Index")
plt.ylabel("House Price")
plt.legend()
plt.grid(True)
plt.tight_layout()
plt.show()
```



In [20]:

```python
from sklearn.metrics import mean_squared_error

# 预测值和真实值（注意 flatten 以确保形状一致）
predictions_np = predictions.cpu().numpy().flatten()
y_test_np = y_test_tensor.numpy().flatten()

# 计算均方误差
mse = mean_squared_error(y_test_np, predictions_np)
print(f"Mean Squared Error (MSE): {mse:.4f}")
```

```
Mean Squared Error (MSE): 9.3566
```

- 在选择所有特征作为有效特征时，模型训练较好，预测结果较为准确。