人工智能实践：Tensorflow笔记

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本讲目标：使用八股搭建神经网络

- 神经网络搭建八股
- iris代码复现
- MNIST数据集　手写数字识别数据集
- 训练MNIST数据集
- Fashion数据集　训练衣服、裤子等图片的识别模型

用Tensorflow API：tf.keras搭建网络八股

六步法

import

train, test

model = tf.keras.models.Sequential

model.compile

model.fit

model.summary

model = tf.keras.models.Sequential ([网络结构])　　#描述各层网络

网络结构举例：

拉直层： **tf.keras.layers.Flatten( )**

全连接层： **tf.keras.layers.Dense(神经元个数, activation= "激活函数“ ,**
kernel_regularizer=哪种正则化)

activation（字符串给出）可选: relu、 softmax、 sigmoid 、 tanh
kernel_regularizer可选: tf.keras.regularizers.l1()、tf.keras.regularizers.l2()

卷积层： **tf.keras.layers.Conv2D(filters = 卷积核个数, kernel_size = 卷积核尺寸,**
strides = 卷积步长， padding = " valid" or "same")

LSTM层： tf.keras.layers.LSTM()

model.compile(optimizer = 优化器,

loss = 损失函数

metrics = [“准确率”])

Optimizer可选:

‘sgd’ or tf.keras.optimizers.SGD (lr=学习率,momentum=动量参数)

‘adagrad’ or tf.keras.optimizers.Adagrad (lr=学习率)

‘adadelta’ or tf.keras.optimizers.Adadelta (lr=学习率)

‘adam’ or tf.keras.optimizers.Adam (lr=学习率, beta_1=0.9, beta_2=0.999)

loss可选:

‘mse’ or tf.keras.losses.MeanSquaredError()

‘sparse_categorical_crossentropy’ or tf.keras.losses.SparseCategoricalCrossentropy(from_logits=False)

Metrics可选:

‘accuracy’ ：y_和y都是数值，如y_=[1] y=[1]

‘categorical_accuracy’ ：y_和y都是独热码(概率分布)，如y_=[0,1,0] y=[0.256,0.695,0.048]

‘sparse_categorical_accuracy’ ：y_是数值，y是独热码(概率分布),如y_=[1] y=[0.256,0.695,0.048]

model.fit (训练集的输入特征， 训练集的标签,

batch_size= ， epochs= ，

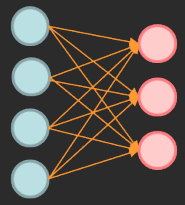
validation_data=(测试集的输入特征，测试集的标签),

validation_split=从训练集划分多少比例给测试集，

validation_freq = 多少次epoch测试一次)

model.summary（）

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense (Dense)                multiple                  15
=================================================================
Total params: 15
Trainable params: 15
Non-trainable params: 0
_________________________________________________________________
```



源码：p8_iris_sequential.py

import

train test

models.Sequential

model.compile

model.fit

model.summary

```python
import tensorflow as tf
from sklearn import datasets
import numpy as np

x_train = datasets.load_iris().data
y_train = datasets.load_iris().target

np.random.seed(116)
np.random.shuffle(x_train)
np.random.seed(116)
np.random.shuffle(y_train)
tf.random.set_seed(116)

model = tf.keras.models.Sequential([
    tf.keras.layers.Dense(3, activation='softmax', kernel_regularizer=tf.keras.regularizers.l2())
])

model.compile(optimizer=tf.keras.optimizers.SGD(lr=0.1),
              loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=False),
              metrics=['sparse_categorical_accuracy'])

model.fit(x_train, y_train, batch_size=32, epochs=500, validation_split=0.2, validation_freq=20)

model.summary()
```

用Tensorflow API：tf.keras搭建网络八股

六步法

import

train, test

class MyModel(Model) model=MyModel

model.compile

model.fit

model.summary

class MyModel(Model)　model = MyModel

```
class MyModel(Model):
    def __init__(self):
        super(MyModel, self).__init__()
        定义网络结构块
    def call(self, x):
        调用网络结构块，实现前向传播
        return y
model = MyModel()
```

```
class IrisModel(Model):
    def __init__(self):
        super(IrisModel, self).__init__()
        self.d1 = Dense(3)

    def call(self, x):
        y = self.d1(x)
        return y

model = IrisModel()
```

__init__( )	定义所需网络结构块
call( )	写出前向传播

import

train test

class MyModel

model.compile

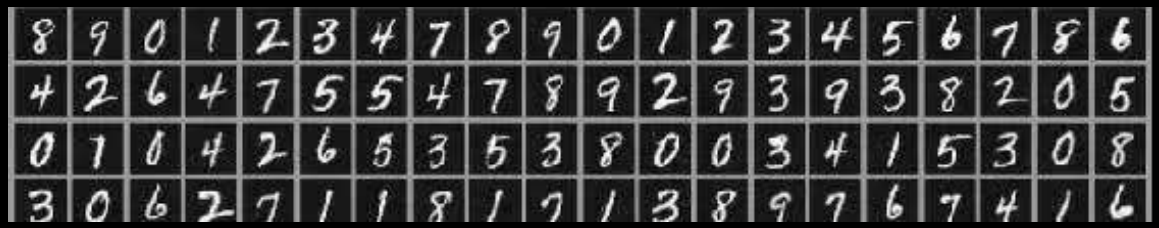
model.fit

model.summary

源码：p11_iris_class.py

```
1  import tensorflow as tf
2  from tensorflow.keras.layers import Dense
3  from tensorflow.keras import Model
4  from sklearn import datasets
5  import numpy as np
6
7  x_train = datasets.load_iris().data
8  y_train = datasets.load_iris().target
9
10 np.random.seed(116)
11 np.random.shuffle(x_train)
12 np.random.seed(116)
13 np.random.shuffle(y_train)
14 tf.random.set_seed(116)
15
16 class IrisModel(Model):
17     def __init__(self):
18         super(IrisModel, self).__init__()
19         self.d1 = Dense(3, activation='softmax', kernel_regularizer=tf.keras.regularizers.l2())
20
21     def call(self, x):
22         y = self.d1(x)
23         return y
24
25 model = IrisModel()
26
27 model.compile(optimizer=tf.keras.optimizers.SGD(lr=0.1),
28               loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=False),
29               metrics=['sparse_categorical_accuracy'])
30
31 model.fit(x_train, y_train, batch_size=32, epochs=500, validation_split=0.2, validation_freq=20)
32 model.summary()
```

- **MNIST数据集：**
  提供 6万张 28*28 像素点的0~9手写数字图片和标签，用于训练。
  提供 1万张 28*28 像素点的0~9手写数字图片和标签，用于测试。



- 导入MNIST数据集：

```
mnist = tf.keras.datasets.mnist

(x_train, y_train) ,  (x_test, y_test) = mnist.load_data()
```

- 作为输入特征，输入神经网络时，将数据拉伸为**一维数组**：

```
tf.keras.layers.Flatten( )
```

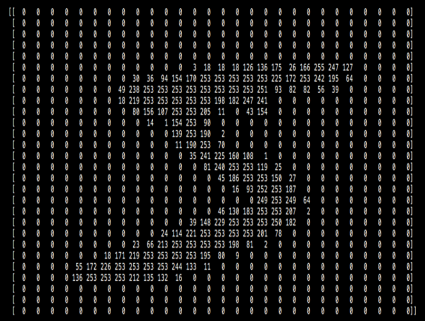
[0 0 0 48 238 252 252 .... 253 186 12 0 0 0 0 0]

✓ `plt.imshow(x_train[0], cmap='gray')#绘制灰度图`

`plt.show()`

✓ `print("x_train[0]:\n" , x_train[0])`

x_train[0]：



✓ `print("y_train[0]:", y_train[0])`

y_train[0]：5

✓ `print("x_test.shape:", x_test.shape`

x_test.shape： (10000, 28, 28)

源码：p13_mnist_datasets.py

源码：p14_mnist_sequential.py

import

train test

models.Sequential

model.compile

model.fit

model.summary

```python
import tensorflow as tf

mnist = tf.keras.datasets.mnist
(x_train, y_train), (x_test, y_test) = mnist.load_data()
x_train, x_test = x_train / 255.0, x_test / 255.0

model = tf.keras.models.Sequential([
    tf.keras.layers.Flatten(),
    tf.keras.layers.Dense(128, activation='relu'),
    tf.keras.layers.Dense(10, activation='softmax')
])

model.compile(optimizer='adam',
              loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=False),
              metrics=['sparse_categorical_accuracy'])

model.fit(x_train, y_train, batch_size=32, epochs=5, validation_data=(x_test, y_test), validation_freq=1)
model.summary()
```

import

train test

class MyModel

model.compile

model.fit

model.summary

源码：p15_mnist_class.py

```python
import tensorflow as tf
from tensorflow.keras.layers import Dense, Flatten
from tensorflow.keras import Model

mnist = tf.keras.datasets.mnist
(x_train, y_train), (x_test, y_test) = mnist.load_data()
x_train, x_test = x_train / 255.0, x_test / 255.0

class MnistModel(Model):
    def __init__(self):
        super(MnistModel, self).__init__()
        self.flatten = Flatten()
        self.d1 = Dense(128, activation='relu')
        self.d2 = Dense(10, activation='softmax')

    def call(self, x):
        x = self.flatten(x)
        x = self.d1(x)
        y = self.d2(x)
        return y

model = MnistModel()

model.compile(optimizer='adam',
              loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=False),
              metrics=['sparse_categorical_accuracy'])

model.fit(x_train, y_train, batch_size=32, epochs=5, validation_data=(x_test, y_test), validation_freq=1)
model.summary()
```

- ✓ **FASHION数据集：**
  提供 6万张 28*28 像素点的衣裤等图片和标签，用于训练。
  提供 1万张 28*28 像素点的衣裤等图片和标签，用于测试。

Label	Description
0	T恤（T-shirt/top）
1	裤子（Trouser）
2	套头衫（Pullover）
3	连衣裙（Dress）
4	外套（Coat）
5	凉鞋（Sandal）
6	衬衫（Shirt）
7	运动鞋（Sneaker）
8	包（Bag）
9	靴子（Ankle boot）

- ✓ 导入FASHION数据集：

```
fashion = tf.keras.datasets.fashion_mnist
(x_train, y_train),(x_test, y_test) = fashion.load_data()
```

参考源码： p16_fashion_sequential.py　　p16_fashion_class.py