



# TensorFlow

## 维度变换

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# Outline

- `shape, ndim`
  - `reshape`
  
  - `expand_dims/squeeze`
  - `transpose`
  - `broadcast_to`
-

# View

- $[b, 28, 28]$
- $\rightarrow [b, 28^*28]$
- $\rightarrow [b, 2, 14^*28]$
- $\rightarrow [b, 28, 28, 1]$



# Reshape

```
● ● ●  
In [80]: a=tf.random.normal([4,28,28,3])  
Out[81]: TensorShape([4, 28, 28, 3])  
  
In [82]: a.shape, a.ndim  
Out[82]: (TensorShape([4, 28, 28, 3]), 4)  
  
In [83]: tf.reshape(a,[4,784,3]).shape  
Out[83]: TensorShape([4, 784, 3])  
  
In [84]: tf.reshape(a,[4,-1,3]).shape  
Out[84]: TensorShape([4, 784, 3])  
  
In [85]: tf.reshape(a,[4,784*3]).shape  
Out[85]: TensorShape([4, 2352])  
  
In [86]: tf.reshape(a,[4,-1]).shape  
Out[86]: TensorShape([4, 2352])
```

# Reshape is flexible



```
In [80]: a=tf.random.normal([4,28,28,3])
```

```
Out[81]: TensorShape([4, 28, 28, 3])
```

```
In [87]: tf.reshape(tf.reshape(a,[4,-1]),[4,28,28,3]).shape
```

```
Out[87]: TensorShape([4, 28, 28, 3])
```

```
In [88]: tf.reshape(tf.reshape(a,[4,-1]),[4,14,56,3]).shape
```

```
Out[88]: TensorShape([4, 14, 56, 3])
```

```
In [89]: tf.reshape(tf.reshape(a,[4,-1]),[4,1,784,3]).shape
```

```
Out[89]: TensorShape([4, 1, 784, 3])
```

# Reshape could lead to potential bugs!

- images: [4, 28, 28, 3]

- [b, h, w, 3]

- reshape to: [4, 784, 3]

- [b, pixel, 3]



- [4, 784, 3]  $\xrightarrow{\text{height: 28, width: 28}}$  [4, 28, 28, 3]

- [4, 784, 3]  $\xrightarrow{\text{height: 14, width: 56}}$  [4, 14, 56, 3]

- [4, 784, 3]  $\xrightarrow{\text{width: 28, height: 28}}$  [4, 28, 28, 3]

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# tf.transpose



```
In [93]: a=tf.random.normal((4,3,2,1))
```

```
In [94]: a.shape
```

```
Out[94]: TensorShape([4, 3, 2, 1])
```

```
In [95]: tf.transpose(a).shape
```

```
Out[95]: TensorShape([1, 2, 3, 4])
```

```
In [97]: tf.transpose(a,perm=[0,1,3,2]).shape
```

```
Out[97]: TensorShape([4, 3, 1, 2])
```

→ [b, 3, h, w]



```
In [98]: a=tf.random.normal([4,28,28,3])
```

```
In [99]: tf.transpose(a,[0,2,1,3]).shape
```

```
Out[99]: TensorShape([4, 28, 28, 3])
```

```
In [101]: tf.transpose(a,[0,3,2,1]).shape
```

```
Out[101]: TensorShape([4, 3, 28, 28])
```

```
In [102]: tf.transpose(a,[0,3,1,2]).shape
```

```
Out[102]: TensorShape([4, 3, 28, 28])
```

---



# Squeeze VS Expand\_dims



# Expand dim

- a: [classes, students, classes]
    - [4, 35, 8]
  - add school dim
  - [1, 4, 35, 8] + [1, 4, 35, 8]
    - [2, 4, 35, 8]
-



```
In [103]: a=tf.random.normal([4,35,8])
```

```
In [105]: tf.expand_dims(a,axis=0).shape
```

```
Out[105]: TensorShape([1, 4, 35, 8])
```

```
In [106]: tf.expand_dims(a,axis=3).shape
```

```
Out[106]: TensorShape([4, 35, 8, 1])
```

---

# axis

0

1

2



```
In [103]: a=tf.random.normal([4,35,8])
```

```
In [105]: tf.expand_dims(a,axis=0).shape
```

```
Out[105]: TensorShape([1, 4, 35, 8])
```

```
In [106]: tf.expand_dims(a,axis=3).shape
```

```
Out[106]: TensorShape([4, 35, 8, 1])
```

```
In [107]: tf.expand_dims(a,axis=-1).shape
```

```
Out[107]: TensorShape([4, 35, 8, 1])
```

```
In [108]: tf.expand_dims(a,axis=-4).shape
```

```
Out[108]: TensorShape([1, 4, 35, 8])
```

# Squeeze dim

- Only squeeze for shape=1 dim
  - [4, 35, 8, 1]
  - [1, 4, 35, 8]
  - [1, 4, 35, 1]
-



```
In [115]: tf.squeeze(tf.zeros([1,2,1,1,3])).shape
```

```
Out[115]: TensorShape([2, 3])
```

```
In [116]: a=tf.zeros([1,2,1,3])
```

```
In [117]: tf.squeeze(a,axis=0).shape
```

```
Out[117]: TensorShape([2, 1, 3])
```

```
In [118]: tf.squeeze(a,axis=2).shape
```

```
Out[118]: TensorShape([1, 2, 3])
```

```
In [119]: tf.squeeze(a,axis=-2).shape
```

```
Out[119]: TensorShape([1, 2, 3])
```

```
In [120]: tf.squeeze(a,axis=-4).shape
```

```
Out[120]: TensorShape([2, 1, 3])
```

# 下一课时

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Broadcasting

**Thank You.**

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