Deep Learning Workshop

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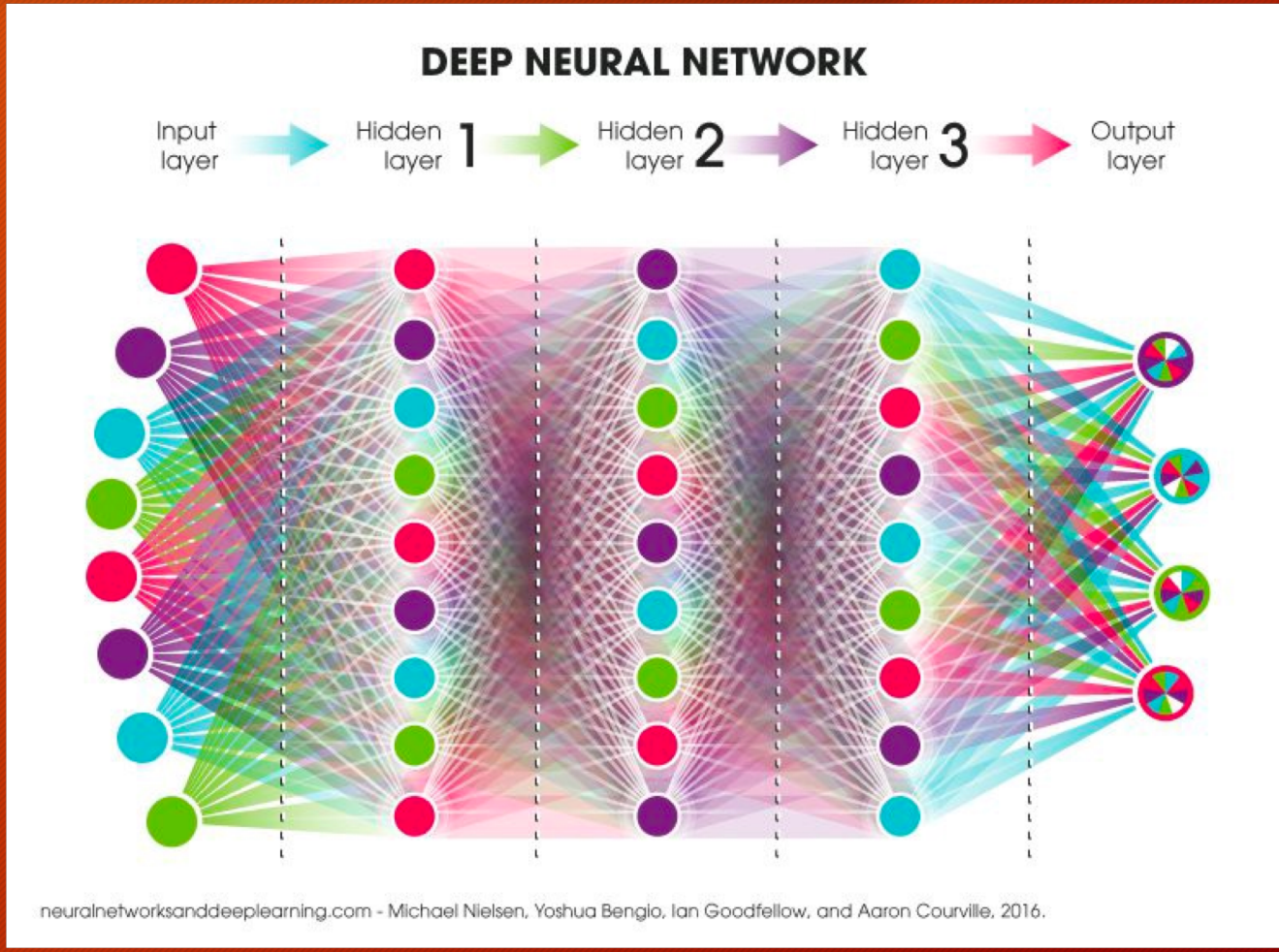
https://github.com/tolaw/dl-tutorial

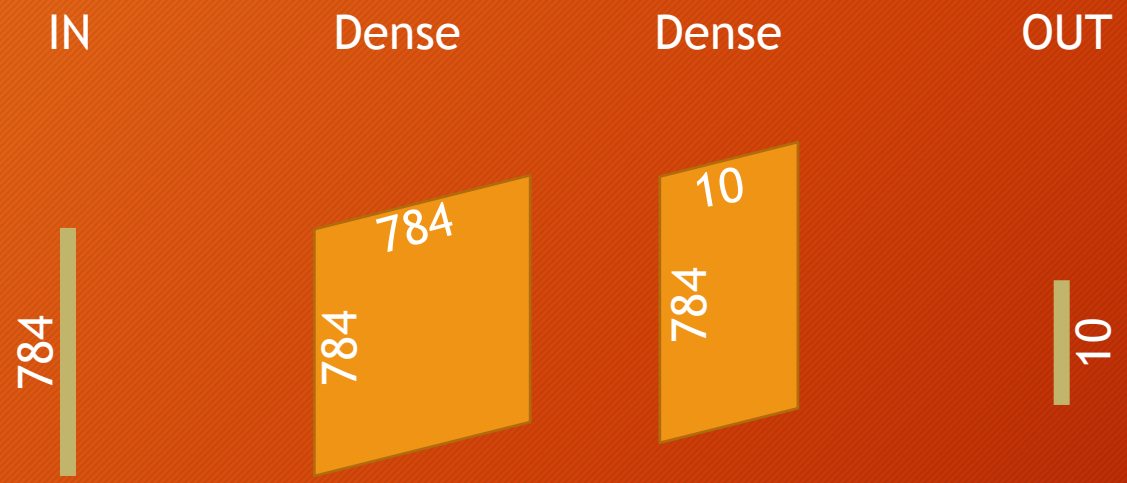
Simple Model

$$\begin{bmatrix} 1.2 \\ -3 \\ 14 \end{bmatrix} \times \begin{bmatrix} 12 & 0 & -0.4 \\ 6 & 6 & 6 \\ \vdots & \vdots & \vdots \end{bmatrix}$$

$$X_i W^i{}_j$$



Simple Model



Simple Model

- Sequential model
- Layers
  - Dense
- Activation
  - Softmax
  - ReLU

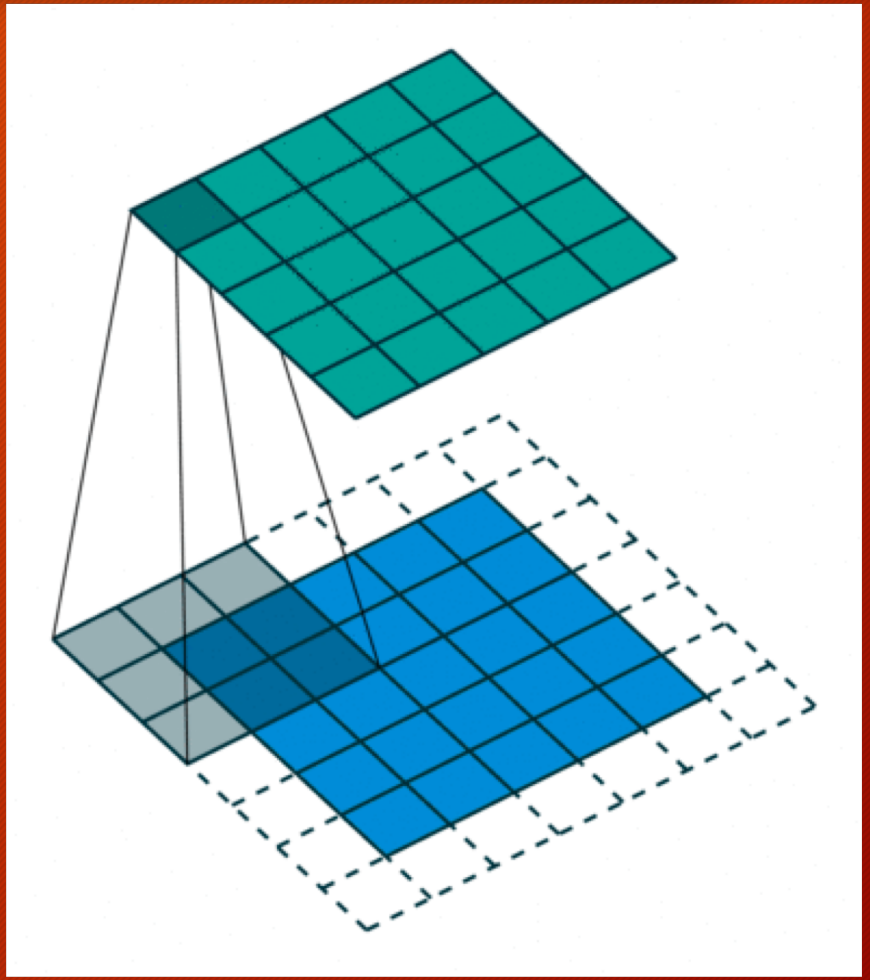
```
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense_1 (Dense)              (None, 784)               615440
_________________________________________________________________
dense_2 (Dense)              (None, 10)                7850
=================================================================
Total params: 623,290
Trainable params: 623,290
Non-trainable params: 0
```

```
model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])
```

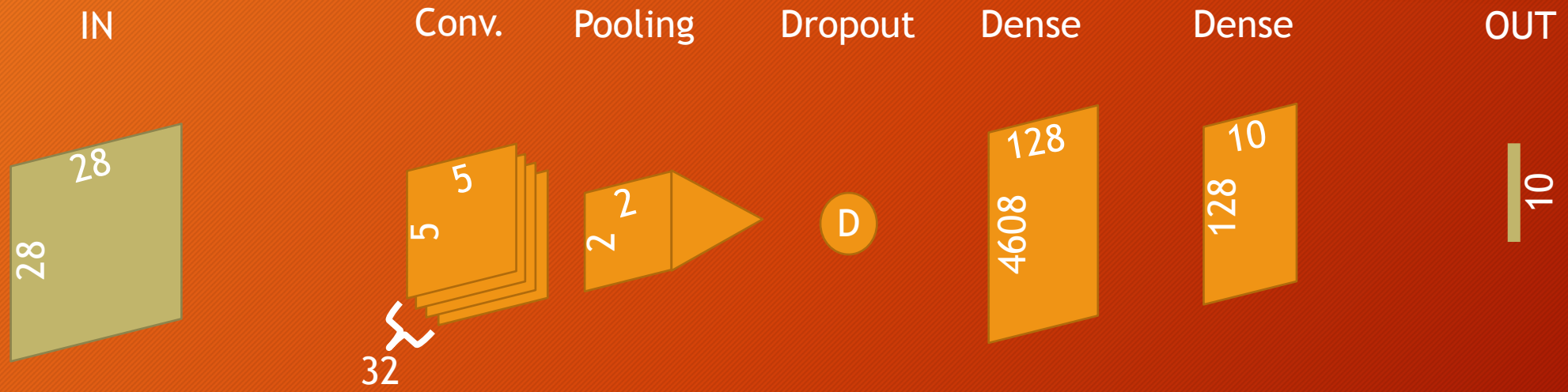
```
history = model.fit(X_train, y_train, validation_data=(X_test, y_test), epochs=10, batch_size=200, verbose=2)
```

CNN Model

$$X_{whc} W^{whc}{}_{c`}$$



CNN Model


IN
Conv.
Pooling
Dropout
Dense
Dense
OUT
28
28
5
5
32
2
2
D
128
4608
10
128
10

CNN Model

- Layers
  - Conv2D
  - MaxPooling2D
  - Flatten
  - Dense
  - Dropout

Layer (type)	Output Shape	Param #
conv2d_1 (Conv2D)	(None, 24, 24, 32)	832
max_pooling2d_1 (MaxPooling2	(None, 12, 12, 32)	0
dropout_1 (Dropout)	(None, 12, 12, 32)	0
flatten_1 (Flatten)	(None, 4608)	0
dense_5 (Dense)	(None, 128)	589952
	10)	1290

Layer (type)	Output Shape	Param #
conv2d_2 (Conv2D)	(None, 24, 24, 30)	780
max_pooling2d_2 (MaxPooling2	(None, 12, 12, 30)	0
conv2d_3 (Conv2D)	(None, 10, 10, 15)	4065
max_pooling2d_3 (MaxPooling2	(None, 5, 5, 15)	0
dropout_2 (Dropout)	(None, 5, 5, 15)	0
flatten_2 (Flatten)	(None, 375)	0
dense_7 (Dense)	(None, 128)	48128
dense_8 (Dense)	(None, 50)	6450
dense_9 (Dense)	(None, 10)	510

Total params: 59,933
Trainable params: 59,933
Non-trainable params: 0

Finetuning

- Pop layer
- Add layer
- layer.trainable = False
- Compile

Layer (type)	Output Shape	Param #
conv2d_2 (Conv2D)	(None, 24, 24, 30)	780
max_pooling2d_2 (MaxPooling2	(None, 12, 12, 30)	0
conv2d_3 (Conv2D)	(None, 10, 10, 15)	4065
max_pooling2d_3 (MaxPooling2	(None, 5, 5, 15)	0
dropout_2 (Dropout)	(None, 5, 5, 15)	0
flatten_2 (Flatten)	(None, 375)	0
dense_7 (Dense)	(None, 128)	48128
dense_10 (Dense)	(None, 50)	6450
dense_11 (Dense)	(None, 10)	510

Total params: 59,933
Trainable params: 6,960
Non-trainable params: 52,973

```
# flip
X_train = X_train[:, ::-1, :]
X_test = X_test[:, ::-1, :]
```