

# Creating a keras model

INTRODUCTION TO DEEP LEARNING IN PYTHON



**Dan Becker**

Data Scientist and contributor to Keras  
and TensorFlow libraries

# Model building steps

- Specify Architecture
- Compile
- Fit
- Predict

# Model specification

```
import numpy as np
from keras.layers import Dense
from keras.models import Sequential

predictors = np.loadtxt('predictors_data.csv', delimiter=',')
n_cols = predictors.shape[1]

model = Sequential()
model.add(Dense(100, activation='relu', input_shape = (n_cols,)))
model.add(Dense(100, activation='relu'))
model.add(Dense(1))
```

# Let's practice!

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# Compiling and fitting a model

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# Why you need to compile your model

- Specify the optimizer
  - Many options and mathematically complex
  - "Adam" is usually a good choice
- Loss function
  - "mean\_squared\_error" common for regression

# Compiling a model

```
n_cols = predictors.shape[1]
model = Sequential()
model.add(Dense(100, activation='relu', input_shape=(n_cols,)))
model.add(Dense(100, activation='relu'))
model.add(Dense(1))
model.compile(optimizer='adam', loss='mean_squared_error')
```

# What is fitting a model

- Applying backpropagation and gradient descent with your data to update the weights
- Scaling data before fitting can ease optimization



# Fitting a model

```
n_cols = predictors.shape[1]
model = Sequential()
model.add(Dense(100, activation='relu', input_shape=(n_cols,)))
model.add(Dense(100, activation='relu'))
model.add(Dense(1))
model.compile(optimizer='adam', loss='mean_squared_error')
model.fit(predictors, target)
```

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# Classification models

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# Classification

- `'categorical_crossentropy'` loss function
- Similar to log loss: Lower is better
- Add `metrics = ['accuracy']` to compile step for easy-to-understand diagnostics
- Output layer has separate node for each possible outcome, and uses `'softmax'` activation

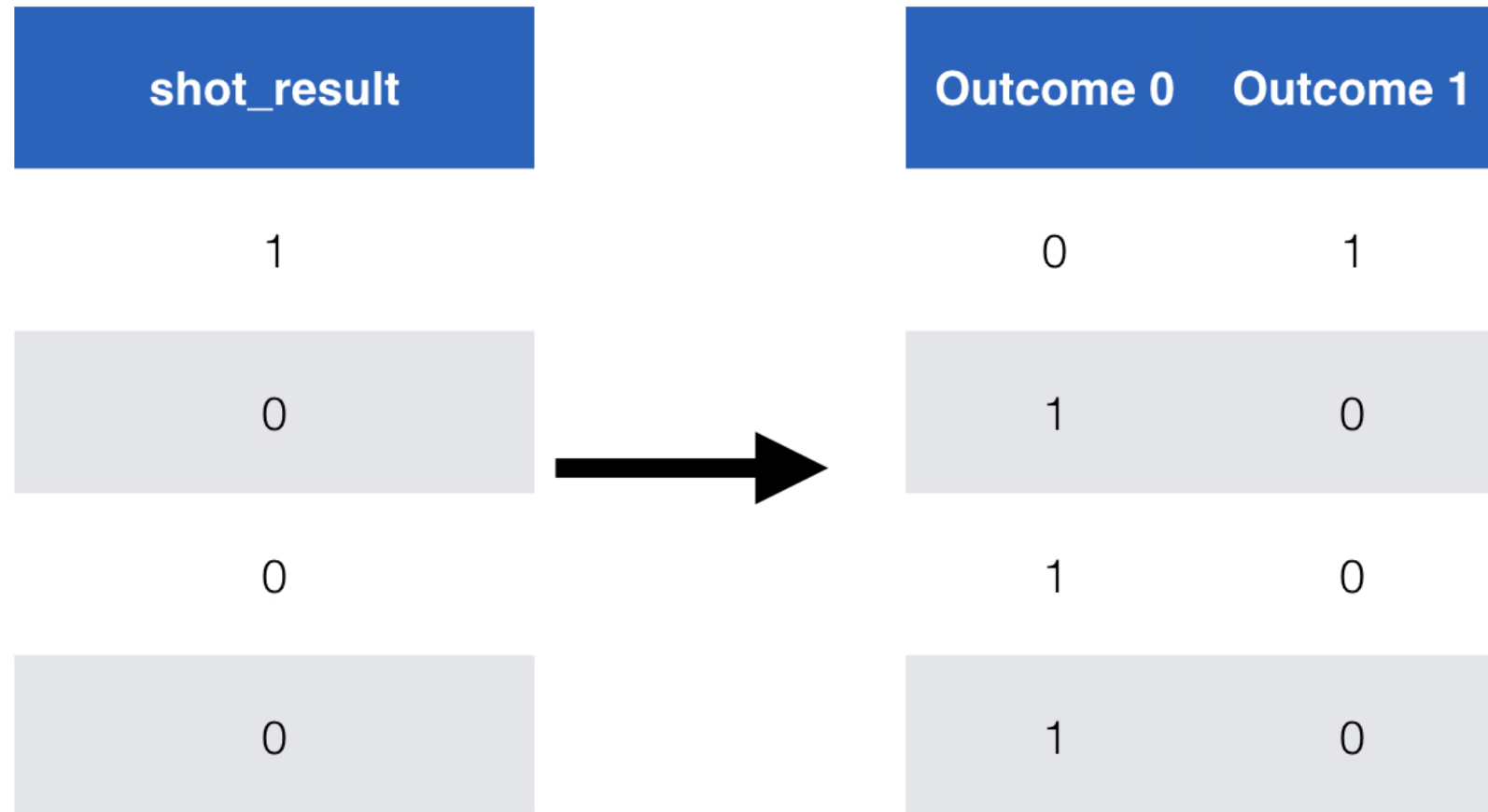
# Quick look at the data

| shot_clock | dribbles | touch_time | shot_dis | close_def_dis | shot_result |
|------------|----------|------------|----------|---------------|-------------|
| 10.8       | 2        | 1.9        | 7.7      | 1.3           | 1           |
| 3.4        | 0        | 0.8        | 28.2     | 6.1           | 0           |
| 0          | 3        | 2.7        | 10.1     | 0.9           | 0           |
| 10.3       | 2        | 1.9        | 17.2     | 3.4           | 0           |

# Quick look at the data

| shot_clock | dribbles | touch_time | shot_dis | close_def_dis | shot_result |
|------------|----------|------------|----------|---------------|-------------|
| 10.8       | 2        | 1.9        | 7.7      | 1.3           | 1           |
| 3.4        | 0        | 0.8        | 28.2     | 6.1           | 0           |
| 0          | 3        | 2.7        | 10.1     | 0.9           | 0           |
| 10.3       | 2        | 1.9        | 17.2     | 3.4           | 0           |

# Transforming to categorical



# Classification

```
from keras.utils.np_utils import to_categorical

data = pd.read_csv('basketball_shot_log.csv')
predictors = data.drop(['shot_result'], axis=1).as_matrix()
target = to_categorical(data.shot_result)

model = Sequential()
model.add(Dense(100, activation='relu', input_shape = (n_cols,)))
model.add(Dense(100, activation='relu'))
model.add(Dense(100, activation='relu'))
model.add(Dense(2, activation='softmax'))
model.compile(optimizer='adam', loss='categorical_crossentropy',
              metrics=['accuracy'])
model.fit(predictors, target)
```



# Classification

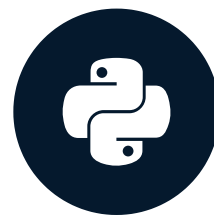
```
Epoch 1/10
128069/128069 [=====] - 4s - loss: 0.7706 - acc: 0.5759
Epoch 2/10
128069/128069 [=====] - 5s - loss: 0.6656 - acc: 0.6003
Epoch 3/10
128069/128069 [=====] - 6s - loss: 0.6611 - acc: 0.6094
Epoch 4/10
128069/128069 [=====] - 7s - loss: 0.6584 - acc: 0.6106
Epoch 5/10
128069/128069 [=====] - 7s - loss: 0.6561 - acc: 0.6150
Epoch 6/10
128069/128069 [=====] - 9s - loss: 0.6553 - acc: 0.6158
Epoch 7/10
128069/128069 [=====] - 9s - loss: 0.6543 - acc: 0.6162
Epoch 8/10
128069/128069 [=====] - 9s - loss: 0.6538 - acc: 0.6158
Epoch 9/10
128069/128069 [=====] - 10s - loss: 0.6535 - acc: 0.6157
Epoch 10/10
128069/128069 [=====] - 10s - loss: 0.6531 - acc: 0.6166
```

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# Using models

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# Using models

- Save
- Reload
- Make predictions

# Saving, reloading and using your Model

```
from keras.models import load_model
model.save('model_file.h5')
my_model = load_model('my_model.h5')
predictions = my_model.predict(data_to_predict_with)
probability_true = predictions[:,1]
```

# Verifying model structure

```
my_model.summary()
```

| Layer (type)             | Output Shape | Param # | Connected to        |
|--------------------------|--------------|---------|---------------------|
| dense_1 (Dense)          | (None, 100)  | 1100    | dense_input_1[0][0] |
| dense_2 (Dense)          | (None, 100)  | 10100   | dense_1[0][0]       |
| dense_3 (Dense)          | (None, 100)  | 10100   | dense_2[0][0]       |
| dense_4 (Dense)          | (None, 2)    | 202     | dense_3[0][0]       |
| Total params: 21,502     |              |         |                     |
| Trainable params: 21,502 |              |         |                     |
| Non-trainable params: 0  |              |         |                     |

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