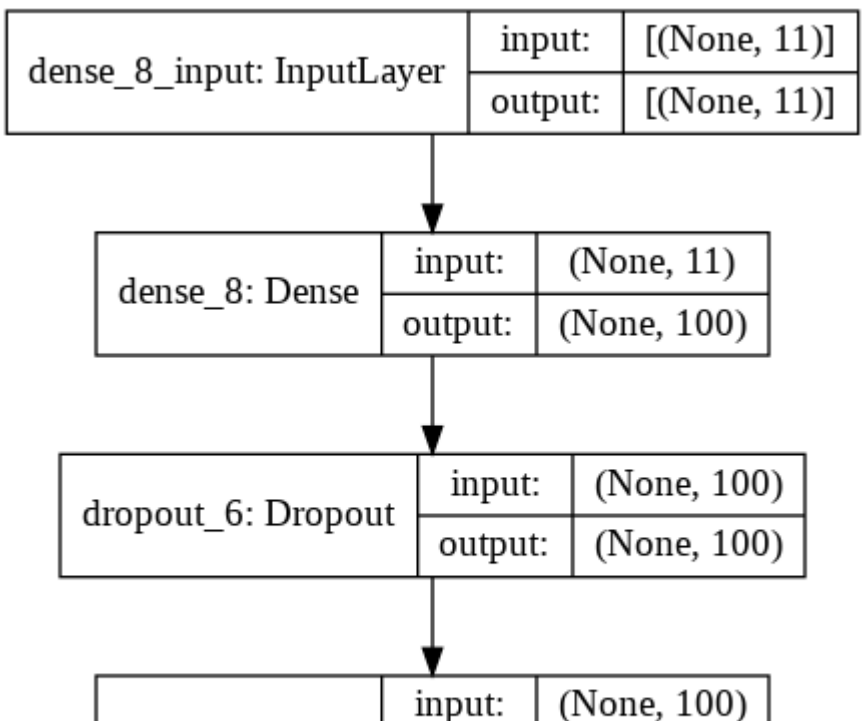
```
import seaborn as sns
import pandas as pd
import numpy as np
from tensorflow.keras.layers import Dense, Dropout, Activation
from tensorflow.keras.models import Model, Sequential
from tensorflow.keras.optimizers import Adam
wine_quality = pd.read_csv('https://raw.githubusercontent.com/shrikant-temburwar/Wine-Quality-Dataset/master/winequality-white.csv', sep=';')
wine_quality.head()
```

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	alcohol	quality
0	7.0	0.27	0.36	20.7	0.045	45.0	170.0	1.0010	3.00	0.45	8.8	6
1	6.3	0.30	0.34	1.6	0.049	14.0	132.0	0.9940	3.30	0.49	9.5	6
2	8.1	0.28	0.40	6.9	0.050	30.0	97.0	0.9951	3.26	0.44	10.1	6
3	7.2	0.23	0.32	8.5	0.058	47.0	186.0	0.9956	3.19	0.40	9.9	6
4	7.2	0.23	0.32	8.5	0.058	47.0	186.0	0.9956	3.19	0.40	9.9	6

```
X = wine_quality.drop(['quality'], axis=1).values
y = wine_quality[['quality']].values
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.20, random_state=42)
```

```
from sklearn.preprocessing import StandardScaler
sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)
```

```
def create_model_regression(learning_rate, dropout_rate):
  model = Sequential()
  model.add(Dense(100, input_dim=X_train. shape[1], activation='relu'))
  model.add(Dropout(dropout_rate))
  model.add(Dense(50, activation='relu'))
  model.add(Dropout(dropout_rate))
  model.add(Dense(25, activation='relu'))
  model.add(Dropout(dropout_rate))
  model.add(Dense(1))
  adam = Adam(lr=learning_rate)
  model.compile(loss='mean_squared_error', optimizer=adam, metrics=['mae'])
  return model
dropout_rate = 0.1
epochs = 50
batch_size = 1
learn_rate = 0.001
model = create_model_regression(learn_rate, dropout_rate)
from tensorflow.keras.utils import plot_model
plot_model(model, to_file='model_plot1.png', show_shapes=True, show_layer_names=True)
```




```
model_history = model.fit(X_train, y_train, batch_size=batch_size, epochs=epochs, validation_split=0.2, verbose=1)
```

```
Epoch 1/50
3134/3134 [==============================] - 5s 1ms/step - loss: 5.4308 - mae: 1.6737 - val_loss: 0.6364 - val_mae: 0.6080
Epoch 2/50
3134/3134 [==============================] - 4s 1ms/step - loss: 1.0957 - mae: 0.8279 - val_loss: 0.5881 - val_mae: 0.5909
Epoch 3/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.9402 - mae: 0.7606 - val_loss: 0.6170 - val_mae: 0.6050
Epoch 4/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.8466 - mae: 0.7266 - val_loss: 0.5558 - val_mae: 0.5704
Epoch 5/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.7268 - mae: 0.6684 - val_loss: 0.6244 - val_mae: 0.6052
Epoch 6/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.6829 - mae: 0.6465 - val_loss: 0.6833 - val_mae: 0.6317
Epoch 7/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.6873 - mae: 0.6534 - val_loss: 0.5296 - val_mae: 0.5560
Epoch 8/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.6713 - mae: 0.6425 - val_loss: 0.5467 - val_mae: 0.5707
Epoch 9/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.6224 - mae: 0.6188 - val_loss: 0.5274 - val_mae: 0.5598
Epoch 10/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.5986 - mae: 0.6053 - val_loss: 0.5347 - val_mae: 0.5589
Epoch 11/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.5938 - mae: 0.6031 - val_loss: 0.5176 - val_mae: 0.5507
Epoch 12/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.6035 - mae: 0.6056 - val_loss: 0.5011 - val_mae: 0.5445
Epoch 13/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.6005 - mae: 0.6115 - val_loss: 0.5377 - val_mae: 0.5600
Epoch 14/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.5812 - mae: 0.5955 - val_loss: 0.5344 - val_mae: 0.5612
Epoch 15/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.5583 - mae: 0.5898 - val_loss: 0.5083 - val_mae: 0.5422
Epoch 16/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.5455 - mae: 0.5807 - val_loss: 0.5115 - val_mae: 0.5539
Epoch 17/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.5246 - mae: 0.5765 - val_loss: 0.5190 - val_mae: 0.5569
Epoch 18/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.5576 - mae: 0.5887 - val_loss: 0.5107 - val_mae: 0.5466
Epoch 19/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.5127 - mae: 0.5625 - val_loss: 0.5101 - val_mae: 0.5465
Epoch 20/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.5288 - mae: 0.5647 - val_loss: 0.5039 - val_mae: 0.5492
Epoch 21/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.4708 - mae: 0.5380 - val_loss: 0.5003 - val_mae: 0.5480
Epoch 22/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.4729 - mae: 0.5361 - val_loss: 0.4991 - val_mae: 0.5483
Epoch 23/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.4594 - mae: 0.5311 - val_loss: 0.4916 - val_mae: 0.5425
Epoch 24/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.4509 - mae: 0.5266 - val_loss: 0.5241 - val_mae: 0.5586
Epoch 25/50
3134/3134 [==============================] - 5s 1ms/step - loss: 0.4510 - mae: 0.5246 - val_loss: 0.5060 - val_mae: 0.5513
Epoch 26/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.4373 - mae: 0.5214 - val_loss: 0.4913 - val_mae: 0.5407
Epoch 27/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.4311 - mae: 0.5128 - val_loss: 0.5320 - val_mae: 0.5580
Epoch 28/50
3134/3134 [==============================] - 5s 1ms/step - loss: 0.4146 - mae: 0.5005 - val_loss: 0.4965 - val_mae: 0.5498
Epoch 29/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.4149 - mae: 0.4930 - val_loss: 0.4936 - val_mae: 0.5480
Epoch 30/50
3134/3134 [==============================] - 4s 1ms/step - loss: 0.3940 - mae: 0.4905 - val_loss: 0.4854 - val_mae: 0.5380
```

```
accuracies = model.evaluate(X_test, y_test, verbose=1)
print('Test Score:', accuracies[0])
print('Test MAE:', accuracies[1])
```

```
31/31 [==============================] - 0s 1ms/step - loss: 0.4585 - mae: 0.5135
Test Score: 0.4585132300853729
Test MAE: 0.5134637355804443
```

```
1  import matplotlib.pyplot as plt
2  plt.plot(model_history.history['mae'], label = 'mae')
3  plt.plot(model_history.history['val_mae'], label = 'val_mae')
4  plt.legend(['train','test'], loc='lowerleft')
5
```

```
/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:4: MatplotlibDeprecationWarning: Unrecognized location 'lowerleft'. Falling back on 'best'; valid loca
        best
        upper right
        upper left
        lower left
        lower right
        right
        center left
        center right
        lower center
        upper center
        center
This will raise an exception in 3.3.
  after removing the cwd from sys.path.
<matplotlib.legend.Legend at 0x7f0057d5e588>
```