COSC4337_107-Regression-Exercise-Solutions-Final

1 Regression Exercise - Solutions

California Housing Data

This data set contains information about all the block groups in California from the 1990 Census. In this sample a block group on average includes 1425.5 individuals living in a geographically compact area.

The task is to aproximate the median house value of each block from the values of the rest of the variables.

It has been obtained from the LIACC repository. The original page where the data set can be found is: http://www.liaad.up.pt/~ltorgo/Regression/DataSets.html.

The Features:

- housingMedianAge: continuous.
- totalRooms: continuous.
- totalBedrooms: continuous.
- population: continuous.
- households: continuous.
- medianIncome: continuous.
- medianHouseValue: continuous.

1.1 The Data

** Import the cal_housing.csv file with pandas. Separate it into a training (70%) and testing set(30%).**

[1]:
```
import pandas as pd
```

[2]:
```
housing = pd.read_csv('cal_housing_clean.csv')
```

[3]:
```
housing.head()
```

[3]:

	housingMedianAge	totalRooms	totalBedrooms	population	households	\
0	41.0	880.0	129.0	322.0	126.0	
1	21.0	7099.0	1106.0	2401.0	1138.0	
2	52.0	1467.0	190.0	496.0	177.0	
3	52.0	1274.0	235.0	558.0	219.0	
4	52.0	1627.0	280.0	565.0	259.0	

```
   medianIncome  medianHouseValue
0        8.3252          452600.0
1        8.3014          358500.0
2        7.2574          352100.0
3        5.6431          341300.0
4        3.8462          342200.0
```

[4]:
```
housing.describe().transpose()
```

[4]:
```
                    count           mean            std         min  \
housingMedianAge  20640.0      28.639486      12.585558      1.0000
totalRooms        20640.0    2635.763081    2181.615252      2.0000
totalBedrooms     20640.0     537.898014     421.247906      1.0000
population        20640.0    1425.476744    1132.462122      3.0000
households        20640.0     499.539680     382.329753      1.0000
medianIncome      20640.0       3.870671       1.899822      0.4999
medianHouseValue  20640.0  206855.816909  115395.615874  14999.0000

                          25%          50%          75%          max
housingMedianAge      18.0000      29.0000      37.00000      52.0000
totalRooms          1447.7500    2127.0000    3148.00000   39320.0000
totalBedrooms        295.0000     435.0000     647.00000    6445.0000
population           787.0000    1166.0000    1725.00000   35682.0000
households           280.0000     409.0000     605.00000    6082.0000
medianIncome           2.5634       3.5348       4.74325      15.0001
medianHouseValue  119600.0000  179700.0000  264725.00000  500001.0000
```

[5]:
```
x_data = housing.drop(['medianHouseValue'],axis=1)
```

[6]:
```
y_val = housing['medianHouseValue']
```

[7]:
```
from sklearn.model_selection import train_test_split
```

[8]:
```
X_train, X_test, y_train, y_test = train_test_split(x_data,y_val,test_size=0.
↪3,random_state=101)
```

1.1.1 Scale the Feature Data

** Use sklearn preprocessing to create a MinMaxScaler for the feature data. Fit this scaler only to the training data. Then use it to transform X_test and X_train. Then use the scaled X_test and X_train along with pd.Dataframe to re-create two dataframes of scaled data.**

[9]:
```
from sklearn.preprocessing import MinMaxScaler
```

[10]:
```
scaler = MinMaxScaler()
```

[11]:
```
scaler.fit(X_train)
```

[11]:
```
MinMaxScaler(copy=True, feature_range=(0, 1))
```

[12]:
```
X_train = pd.DataFrame(data=scaler.transform(X_train),columns = X_train.
↪columns,index=X_train.index)
```

[13]:
```
X_test = pd.DataFrame(data=scaler.transform(X_test),columns = X_test.
↪columns,index=X_test.index)
```

1.1.2 Create Feature Columns

** Create the necessary tf.feature_column objects for the estimator. They should all be trated as continuous numeric_columns. **

[14]:
```
housing.columns
```

[14]:
```
Index(['housingMedianAge', 'totalRooms', 'totalBedrooms', 'population',
       'households', 'medianIncome', 'medianHouseValue'],
      dtype='object')
```

[15]:
```
import tensorflow as tf
```

[16]:
```
age = tf.feature_column.numeric_column('housingMedianAge')
rooms = tf.feature_column.numeric_column('totalRooms')
bedrooms = tf.feature_column.numeric_column('totalBedrooms')
pop = tf.feature_column.numeric_column('population')
households = tf.feature_column.numeric_column('households')
income = tf.feature_column.numeric_column('medianIncome')
```

[17]:
```
feat_cols = [ age,rooms,bedrooms,pop,households,income]
```

** Create the input function for the estimator object. (play around with batch_size and num_epochs)**

[18]:
```
input_func = tf.estimator.inputs.pandas_input_fn(x=X_train,y=y_train␣
↪,batch_size=10,num_epochs=1000,
                                                 shuffle=True)
```

** Create the estimator model. Use a DNNRegressor. Play around with the hidden units! **

[19]:
```
model = tf.estimator.
↪DNNRegressor(hidden_units=[6,6,6],feature_columns=feat_cols)
```

```
INFO:tensorflow:Using default config.
WARNING:tensorflow:Using temporary folder as model directory:
C:\Users\RizkN\AppData\Local\Temp\tmp44vipjto
INFO:tensorflow:Using config: {'_model_dir':
'C:\\Users\\RizkN\\AppData\\Local\\Temp\\tmp44vipjto', '_tf_random_seed': None,
'_save_summary_steps': 100, '_save_checkpoints_steps': None,
'_save_checkpoints_secs': 600, '_session_config': allow_soft_placement: true
graph_options {
```

```
  rewrite_options {
    meta_optimizer_iterations: ONE
  }
}
, '_keep_checkpoint_max': 5, '_keep_checkpoint_every_n_hours': 10000,
'_log_step_count_steps': 100, '_train_distribute': None, '_device_fn': None,
'_protocol': None, '_eval_distribute': None, '_experimental_distribute': None,
'_experimental_max_worker_delay_secs': None, '_session_creation_timeout_secs':
7200, '_service': None, '_cluster_spec':
<tensorflow.python.training.server_lib.ClusterSpec object at
0x000001D854791CC8>, '_task_type': 'worker', '_task_id': 0,
'_global_id_in_cluster': 0, '_master': '', '_evaluation_master': '',
'_is_chief': True, '_num_ps_replicas': 0, '_num_worker_replicas': 1}
```

**** Train the model for ~1,000 steps. (Later come back to this and train it for more and check for improvement) ****

[20]:
```
model.train(input_fn=input_func,steps=25000)
```

```
WARNING:tensorflow:From C:\Users\RizkN\.conda\envs\tf1\lib\site-
packages\tensorflow_core\python\training\training_util.py:236:
Variable.initialized_value (from tensorflow.python.ops.variables) is deprecated
and will be removed in a future version.
Instructions for updating:
Use Variable.read_value. Variables in 2.X are initialized automatically both in
eager and graph (inside tf.defun) contexts.
WARNING:tensorflow:From C:\Users\RizkN\.conda\envs\tf1\lib\site-packages\tensorf
low_estimator\python\estimator\inputs\queues\feeding_queue_runner.py:62:
QueueRunner.__init__ (from tensorflow.python.training.queue_runner_impl) is
deprecated and will be removed in a future version.
Instructions for updating:
To construct input pipelines, use the `tf.data` module.
WARNING:tensorflow:From C:\Users\RizkN\.conda\envs\tf1\lib\site-packages\tensorf
low_estimator\python\estimator\inputs\queues\feeding_functions.py:500:
add_queue_runner (from tensorflow.python.training.queue_runner_impl) is
deprecated and will be removed in a future version.
Instructions for updating:
To construct input pipelines, use the `tf.data` module.
INFO:tensorflow:Calling model_fn.
WARNING:tensorflow:From C:\Users\RizkN\.conda\envs\tf1\lib\site-
packages\tensorflow_core\python\ops\resource_variable_ops.py:1630: calling
BaseResourceVariable.__init__ (from tensorflow.python.ops.resource_variable_ops)
with constraint is deprecated and will be removed in a future version.
Instructions for updating:
If using Keras pass *_constraint arguments to layers.
WARNING:tensorflow:From C:\Users\RizkN\.conda\envs\tf1\lib\site-
packages\tensorflow_estimator\python\estimator\canned\head.py:437: to_float
(from tensorflow.python.ops.math_ops) is deprecated and will be removed in a
future version.
```

```
Instructions for updating:
Use `tf.cast` instead.
WARNING:tensorflow:From C:\Users\RizkN\.conda\envs\tf1\lib\site-
packages\tensorflow_core\python\training\adagrad.py:76: calling
Constant.__init__ (from tensorflow.python.ops.init_ops) with dtype is deprecated
and will be removed in a future version.
Instructions for updating:
Call initializer instance with the dtype argument instead of passing it to the
constructor
INFO:tensorflow:Done calling model_fn.
INFO:tensorflow:Create CheckpointSaverHook.
WARNING:tensorflow:From C:\Users\RizkN\.conda\envs\tf1\lib\site-
packages\tensorflow_core\python\ops\array_ops.py:1475: where (from
tensorflow.python.ops.array_ops) is deprecated and will be removed in a future
version.
Instructions for updating:
Use tf.where in 2.0, which has the same broadcast rule as np.where
INFO:tensorflow:Graph was finalized.
INFO:tensorflow:Running local_init_op.
INFO:tensorflow:Done running local_init_op.
WARNING:tensorflow:From C:\Users\RizkN\.conda\envs\tf1\lib\site-
packages\tensorflow_core\python\training\monitored_session.py:882:
start_queue_runners (from tensorflow.python.training.queue_runner_impl) is
deprecated and will be removed in a future version.
Instructions for updating:
To construct input pipelines, use the `tf.data` module.
INFO:tensorflow:Saving checkpoints for 0 into
C:\Users\RizkN\AppData\Local\Temp\tmp44vipjto\model.ckpt.
INFO:tensorflow:loss = 243472680000.0, step = 1
INFO:tensorflow:global_step/sec: 277.477
INFO:tensorflow:loss = 219208290000.0, step = 101 (0.364 sec)
INFO:tensorflow:global_step/sec: 315.2
INFO:tensorflow:loss = 677735700000.0, step = 201 (0.317 sec)
INFO:tensorflow:global_step/sec: 304.101
INFO:tensorflow:loss = 795663500000.0, step = 301 (0.328 sec)
INFO:tensorflow:global_step/sec: 314.533
INFO:tensorflow:loss = 437880030000.0, step = 401 (0.320 sec)
INFO:tensorflow:global_step/sec: 299.364
INFO:tensorflow:loss = 518701650000.0, step = 501 (0.334 sec)
INFO:tensorflow:global_step/sec: 306.995
INFO:tensorflow:loss = 197753910000.0, step = 601 (0.325 sec)
INFO:tensorflow:global_step/sec: 292.345
INFO:tensorflow:loss = 520903070000.0, step = 701 (0.342 sec)
INFO:tensorflow:global_step/sec: 286.939
INFO:tensorflow:loss = 486572360000.0, step = 801 (0.348 sec)
INFO:tensorflow:global_step/sec: 306.698
INFO:tensorflow:loss = 138922250000.0, step = 901 (0.325 sec)
INFO:tensorflow:global_step/sec: 373.078
```

```
INFO:tensorflow:loss = 192473070000.0, step = 1001 (0.268 sec)
INFO:tensorflow:global_step/sec: 262.433
INFO:tensorflow:loss = 198289230000.0, step = 1101 (0.382 sec)
INFO:tensorflow:global_step/sec: 286.267
INFO:tensorflow:loss = 128933990000.0, step = 1201 (0.349 sec)
INFO:tensorflow:global_step/sec: 304.131
INFO:tensorflow:loss = 278796100000.0, step = 1301 (0.329 sec)
INFO:tensorflow:global_step/sec: 296.433
INFO:tensorflow:loss = 247893280000.0, step = 1401 (0.337 sec)
INFO:tensorflow:global_step/sec: 293.82
INFO:tensorflow:loss = 28766090000.0, step = 1501 (0.340 sec)
INFO:tensorflow:global_step/sec: 291.969
INFO:tensorflow:loss = 122988820000.0, step = 1601 (0.343 sec)
INFO:tensorflow:global_step/sec: 301.843
INFO:tensorflow:loss = 52215243000.0, step = 1701 (0.331 sec)
INFO:tensorflow:global_step/sec: 313.11
INFO:tensorflow:loss = 41163640000.0, step = 1801 (0.319 sec)
INFO:tensorflow:global_step/sec: 323.748
INFO:tensorflow:loss = 65396410000.0, step = 1901 (0.307 sec)
INFO:tensorflow:global_step/sec: 507.055
INFO:tensorflow:loss = 53460963000.0, step = 2001 (0.199 sec)
INFO:tensorflow:global_step/sec: 315.45
INFO:tensorflow:loss = 84922786000.0, step = 2101 (0.317 sec)
INFO:tensorflow:global_step/sec: 324.909
INFO:tensorflow:loss = 136397550000.0, step = 2201 (0.308 sec)
INFO:tensorflow:global_step/sec: 287.275
INFO:tensorflow:loss = 83071975000.0, step = 2301 (0.349 sec)
INFO:tensorflow:global_step/sec: 333.023
INFO:tensorflow:loss = 101608020000.0, step = 2401 (0.298 sec)
INFO:tensorflow:global_step/sec: 368.791
INFO:tensorflow:loss = 137674570000.0, step = 2501 (0.271 sec)
INFO:tensorflow:global_step/sec: 347.598
INFO:tensorflow:loss = 52602470000.0, step = 2601 (0.288 sec)
INFO:tensorflow:global_step/sec: 332.872
INFO:tensorflow:loss = 75715510000.0, step = 2701 (0.299 sec)
INFO:tensorflow:global_step/sec: 328.492
INFO:tensorflow:loss = 168815460000.0, step = 2801 (0.306 sec)
INFO:tensorflow:global_step/sec: 320.372
INFO:tensorflow:loss = 115102870000.0, step = 2901 (0.310 sec)
INFO:tensorflow:global_step/sec: 350.737
INFO:tensorflow:loss = 48363920000.0, step = 3001 (0.287 sec)
INFO:tensorflow:global_step/sec: 282.686
INFO:tensorflow:loss = 91728036000.0, step = 3101 (0.354 sec)
INFO:tensorflow:global_step/sec: 265.554
INFO:tensorflow:loss = 232263600000.0, step = 3201 (0.377 sec)
INFO:tensorflow:global_step/sec: 301.18
INFO:tensorflow:loss = 87519270000.0, step = 3301 (0.332 sec)
INFO:tensorflow:global_step/sec: 310.524
```

```
INFO:tensorflow:loss = 110378330000.0, step = 3401 (0.322 sec)
INFO:tensorflow:global_step/sec: 273.318
INFO:tensorflow:loss = 80336310000.0, step = 3501 (0.366 sec)
INFO:tensorflow:global_step/sec: 325.642
INFO:tensorflow:loss = 59597720000.0, step = 3601 (0.308 sec)
INFO:tensorflow:global_step/sec: 293.04
INFO:tensorflow:loss = 165363740000.0, step = 3701 (0.341 sec)
INFO:tensorflow:global_step/sec: 260.55
INFO:tensorflow:loss = 83814530000.0, step = 3801 (0.384 sec)
INFO:tensorflow:global_step/sec: 280.064
INFO:tensorflow:loss = 65443967000.0, step = 3901 (0.358 sec)
INFO:tensorflow:global_step/sec: 418.748
INFO:tensorflow:loss = 55153525000.0, step = 4001 (0.236 sec)
INFO:tensorflow:global_step/sec: 352.029
INFO:tensorflow:loss = 125993660000.0, step = 4101 (0.284 sec)
INFO:tensorflow:global_step/sec: 315.396
INFO:tensorflow:loss = 113110550000.0, step = 4201 (0.319 sec)
INFO:tensorflow:global_step/sec: 288.248
INFO:tensorflow:loss = 23269315000.0, step = 4301 (0.346 sec)
INFO:tensorflow:global_step/sec: 287.277
INFO:tensorflow:loss = 66440430000.0, step = 4401 (0.349 sec)
INFO:tensorflow:global_step/sec: 295.721
INFO:tensorflow:loss = 129921120000.0, step = 4501 (0.339 sec)
INFO:tensorflow:global_step/sec: 280.116
INFO:tensorflow:loss = 84059450000.0, step = 4601 (0.356 sec)
INFO:tensorflow:global_step/sec: 290.654
INFO:tensorflow:loss = 54379037000.0, step = 4701 (0.344 sec)
INFO:tensorflow:global_step/sec: 282.52
INFO:tensorflow:loss = 64548073000.0, step = 4801 (0.353 sec)
INFO:tensorflow:global_step/sec: 281.229
INFO:tensorflow:loss = 107921460000.0, step = 4901 (0.356 sec)
INFO:tensorflow:global_step/sec: 283.484
INFO:tensorflow:loss = 251672440000.0, step = 5001 (0.352 sec)
INFO:tensorflow:global_step/sec: 274.582
INFO:tensorflow:loss = 48813793000.0, step = 5101 (0.365 sec)
INFO:tensorflow:global_step/sec: 275.728
INFO:tensorflow:loss = 69695070000.0, step = 5201 (0.363 sec)
INFO:tensorflow:global_step/sec: 275.235
INFO:tensorflow:loss = 132733340000.0, step = 5301 (0.363 sec)
INFO:tensorflow:global_step/sec: 273.592
INFO:tensorflow:loss = 77834084000.0, step = 5401 (0.366 sec)
INFO:tensorflow:global_step/sec: 276.991
INFO:tensorflow:loss = 101460040000.0, step = 5501 (0.360 sec)
INFO:tensorflow:global_step/sec: 306.682
INFO:tensorflow:loss = 65464787000.0, step = 5601 (0.326 sec)
INFO:tensorflow:global_step/sec: 357.456
INFO:tensorflow:loss = 62534935000.0, step = 5701 (0.279 sec)
INFO:tensorflow:global_step/sec: 349.429
```

```
INFO:tensorflow:loss = 231911230000.0, step = 5801 (0.287 sec)
INFO:tensorflow:global_step/sec: 300.37
INFO:tensorflow:loss = 87857560000.0, step = 5901 (0.333 sec)
INFO:tensorflow:global_step/sec: 297.081
INFO:tensorflow:loss = 98581650000.0, step = 6001 (0.338 sec)
INFO:tensorflow:global_step/sec: 265.929
INFO:tensorflow:loss = 90306675000.0, step = 6101 (0.376 sec)
INFO:tensorflow:global_step/sec: 265.816
INFO:tensorflow:loss = 112135370000.0, step = 6201 (0.376 sec)
INFO:tensorflow:global_step/sec: 315.353
INFO:tensorflow:loss = 104392380000.0, step = 6301 (0.315 sec)
INFO:tensorflow:global_step/sec: 318.47
INFO:tensorflow:loss = 75765120000.0, step = 6401 (0.318 sec)
INFO:tensorflow:global_step/sec: 307.397
INFO:tensorflow:loss = 162563670000.0, step = 6501 (0.322 sec)
INFO:tensorflow:global_step/sec: 322.964
INFO:tensorflow:loss = 104757576000.0, step = 6601 (0.312 sec)
INFO:tensorflow:global_step/sec: 264.776
INFO:tensorflow:loss = 49787814000.0, step = 6701 (0.376 sec)
INFO:tensorflow:global_step/sec: 354.553
INFO:tensorflow:loss = 103949410000.0, step = 6801 (0.281 sec)
INFO:tensorflow:global_step/sec: 363.204
INFO:tensorflow:loss = 31046894000.0, step = 6901 (0.275 sec)
INFO:tensorflow:global_step/sec: 275.187
INFO:tensorflow:loss = 181325330000.0, step = 7001 (0.366 sec)
INFO:tensorflow:global_step/sec: 272.013
INFO:tensorflow:loss = 70764225000.0, step = 7101 (0.367 sec)
INFO:tensorflow:global_step/sec: 265.891
INFO:tensorflow:loss = 72111700000.0, step = 7201 (0.376 sec)
INFO:tensorflow:global_step/sec: 289.842
INFO:tensorflow:loss = 185960800000.0, step = 7301 (0.346 sec)
INFO:tensorflow:global_step/sec: 265.648
INFO:tensorflow:loss = 141927330000.0, step = 7401 (0.377 sec)
INFO:tensorflow:global_step/sec: 280.11
INFO:tensorflow:loss = 154755890000.0, step = 7501 (0.355 sec)
INFO:tensorflow:global_step/sec: 308.103
INFO:tensorflow:loss = 174747270000.0, step = 7601 (0.325 sec)
INFO:tensorflow:global_step/sec: 260.288
INFO:tensorflow:loss = 22716133000.0, step = 7701 (0.384 sec)
INFO:tensorflow:global_step/sec: 288.775
INFO:tensorflow:loss = 19625222000.0, step = 7801 (0.344 sec)
INFO:tensorflow:global_step/sec: 337.836
INFO:tensorflow:loss = 225983270000.0, step = 7901 (0.298 sec)
INFO:tensorflow:global_step/sec: 266.913
INFO:tensorflow:loss = 28904899000.0, step = 8001 (0.375 sec)
INFO:tensorflow:global_step/sec: 266.187
INFO:tensorflow:loss = 105038120000.0, step = 8101 (0.376 sec)
INFO:tensorflow:global_step/sec: 364.825
```

```
INFO:tensorflow:loss = 100809560000.0, step = 8201 (0.275 sec)
INFO:tensorflow:global_step/sec: 278.548
INFO:tensorflow:loss = 115422600000.0, step = 8301 (0.358 sec)
INFO:tensorflow:global_step/sec: 273.181
INFO:tensorflow:loss = 67857777000.0, step = 8401 (0.366 sec)
INFO:tensorflow:global_step/sec: 353.627
INFO:tensorflow:loss = 82655260000.0, step = 8501 (0.281 sec)
INFO:tensorflow:global_step/sec: 304.972
INFO:tensorflow:loss = 75833870000.0, step = 8601 (0.328 sec)
INFO:tensorflow:global_step/sec: 297.856
INFO:tensorflow:loss = 60380058000.0, step = 8701 (0.338 sec)
INFO:tensorflow:global_step/sec: 268.565
INFO:tensorflow:loss = 142863000000.0, step = 8801 (0.373 sec)
INFO:tensorflow:global_step/sec: 282.986
INFO:tensorflow:loss = 100067434000.0, step = 8901 (0.353 sec)
INFO:tensorflow:global_step/sec: 274.02
INFO:tensorflow:loss = 138789290000.0, step = 9001 (0.365 sec)
INFO:tensorflow:global_step/sec: 317.395
INFO:tensorflow:loss = 122522520000.0, step = 9101 (0.314 sec)
INFO:tensorflow:global_step/sec: 318.842
INFO:tensorflow:loss = 38739200000.0, step = 9201 (0.315 sec)
INFO:tensorflow:global_step/sec: 276.536
INFO:tensorflow:loss = 117310230000.0, step = 9301 (0.361 sec)
INFO:tensorflow:global_step/sec: 310.721
INFO:tensorflow:loss = 119191370000.0, step = 9401 (0.323 sec)
INFO:tensorflow:global_step/sec: 293.966
INFO:tensorflow:loss = 50963410000.0, step = 9501 (0.338 sec)
INFO:tensorflow:global_step/sec: 273.484
INFO:tensorflow:loss = 40725963000.0, step = 9601 (0.368 sec)
INFO:tensorflow:global_step/sec: 298.205
INFO:tensorflow:loss = 82145436000.0, step = 9701 (0.334 sec)
INFO:tensorflow:global_step/sec: 237.743
INFO:tensorflow:loss = 28646440000.0, step = 9801 (0.424 sec)
INFO:tensorflow:global_step/sec: 239.624
INFO:tensorflow:loss = 86753580000.0, step = 9901 (0.416 sec)
INFO:tensorflow:global_step/sec: 268.306
INFO:tensorflow:loss = 115788610000.0, step = 10001 (0.371 sec)
INFO:tensorflow:global_step/sec: 274.808
INFO:tensorflow:loss = 128331860000.0, step = 10101 (0.364 sec)
INFO:tensorflow:global_step/sec: 280.893
INFO:tensorflow:loss = 124223230000.0, step = 10201 (0.357 sec)
INFO:tensorflow:global_step/sec: 284.264
INFO:tensorflow:loss = 144918680000.0, step = 10301 (0.352 sec)
INFO:tensorflow:global_step/sec: 264.023
INFO:tensorflow:loss = 48468836000.0, step = 10401 (0.379 sec)
INFO:tensorflow:global_step/sec: 270.263
INFO:tensorflow:loss = 142388670000.0, step = 10501 (0.370 sec)
INFO:tensorflow:global_step/sec: 278.998
```

```
INFO:tensorflow:loss = 152316220000.0, step = 10601 (0.358 sec)
INFO:tensorflow:global_step/sec: 275.491
INFO:tensorflow:loss = 85682280000.0, step = 10701 (0.363 sec)
INFO:tensorflow:global_step/sec: 280.204
INFO:tensorflow:loss = 96886270000.0, step = 10801 (0.357 sec)
INFO:tensorflow:global_step/sec: 282.666
INFO:tensorflow:loss = 56008900000.0, step = 10901 (0.353 sec)
INFO:tensorflow:global_step/sec: 274.094
INFO:tensorflow:loss = 70400795000.0, step = 11001 (0.365 sec)
INFO:tensorflow:global_step/sec: 268.094
INFO:tensorflow:loss = 92642850000.0, step = 11101 (0.372 sec)
INFO:tensorflow:global_step/sec: 276.243
INFO:tensorflow:loss = 90336700000.0, step = 11201 (0.362 sec)
INFO:tensorflow:global_step/sec: 326.8
INFO:tensorflow:loss = 163573740000.0, step = 11301 (0.305 sec)
INFO:tensorflow:global_step/sec: 349.494
INFO:tensorflow:loss = 155318830000.0, step = 11401 (0.289 sec)
INFO:tensorflow:global_step/sec: 274.815
INFO:tensorflow:loss = 186741210000.0, step = 11501 (0.364 sec)
INFO:tensorflow:global_step/sec: 273.324
INFO:tensorflow:loss = 120733010000.0, step = 11601 (0.365 sec)
INFO:tensorflow:global_step/sec: 293.72
INFO:tensorflow:loss = 39163208000.0, step = 11701 (0.340 sec)
INFO:tensorflow:global_step/sec: 277.181
INFO:tensorflow:loss = 90479040000.0, step = 11801 (0.362 sec)
INFO:tensorflow:global_step/sec: 284.83
INFO:tensorflow:loss = 121837494000.0, step = 11901 (0.351 sec)
INFO:tensorflow:global_step/sec: 277.539
INFO:tensorflow:loss = 61108960000.0, step = 12001 (0.360 sec)
INFO:tensorflow:global_step/sec: 278.334
INFO:tensorflow:loss = 32942860000.0, step = 12101 (0.358 sec)
INFO:tensorflow:global_step/sec: 308.847
INFO:tensorflow:loss = 89024650000.0, step = 12201 (0.325 sec)
INFO:tensorflow:global_step/sec: 262.101
INFO:tensorflow:loss = 173272860000.0, step = 12301 (0.382 sec)
INFO:tensorflow:global_step/sec: 268.627
INFO:tensorflow:loss = 65387127000.0, step = 12401 (0.372 sec)
INFO:tensorflow:global_step/sec: 274.239
INFO:tensorflow:loss = 36299735000.0, step = 12501 (0.365 sec)
INFO:tensorflow:global_step/sec: 275.639
INFO:tensorflow:loss = 87664755000.0, step = 12601 (0.363 sec)
INFO:tensorflow:global_step/sec: 278.197
INFO:tensorflow:loss = 105773880000.0, step = 12701 (0.360 sec)
INFO:tensorflow:global_step/sec: 300.106
INFO:tensorflow:loss = 125884740000.0, step = 12801 (0.333 sec)
INFO:tensorflow:global_step/sec: 302.922
INFO:tensorflow:loss = 58055487000.0, step = 12901 (0.329 sec)
INFO:tensorflow:global_step/sec: 333.938
```

```
INFO:tensorflow:loss = 54887367000.0, step = 13001 (0.300 sec)
INFO:tensorflow:global_step/sec: 289.85
INFO:tensorflow:loss = 93165780000.0, step = 13101 (0.345 sec)
INFO:tensorflow:global_step/sec: 276.413
INFO:tensorflow:loss = 93854474000.0, step = 13201 (0.362 sec)
INFO:tensorflow:global_step/sec: 278.194
INFO:tensorflow:loss = 49975296000.0, step = 13301 (0.359 sec)
INFO:tensorflow:global_step/sec: 275.735
INFO:tensorflow:loss = 150646640000.0, step = 13401 (0.363 sec)
INFO:tensorflow:global_step/sec: 280.47
INFO:tensorflow:loss = 79565730000.0, step = 13501 (0.357 sec)
INFO:tensorflow:global_step/sec: 259.77
INFO:tensorflow:loss = 93977650000.0, step = 13601 (0.386 sec)
INFO:tensorflow:global_step/sec: 287.734
INFO:tensorflow:loss = 142666810000.0, step = 13701 (0.348 sec)
INFO:tensorflow:global_step/sec: 302.938
INFO:tensorflow:loss = 41873998000.0, step = 13801 (0.327 sec)
INFO:tensorflow:global_step/sec: 283.949
INFO:tensorflow:loss = 137448060000.0, step = 13901 (0.353 sec)
INFO:tensorflow:global_step/sec: 278.66
INFO:tensorflow:loss = 119836700000.0, step = 14001 (0.359 sec)
INFO:tensorflow:global_step/sec: 279.517
INFO:tensorflow:loss = 95346885000.0, step = 14101 (0.359 sec)
INFO:tensorflow:global_step/sec: 297.388
INFO:tensorflow:loss = 62791623000.0, step = 14201 (0.336 sec)
INFO:tensorflow:global_step/sec: 238.637
INFO:tensorflow:loss = 61995647000.0, step = 14301 (0.421 sec)
INFO:tensorflow:global_step/sec: 320.967
INFO:tensorflow:loss = 74327745000.0, step = 14401 (0.308 sec)
INFO:tensorflow:global_step/sec: 467.285
INFO:tensorflow:loss = 62250414000.0, step = 14501 (0.215 sec)
INFO:tensorflow:global_step/sec: 264.062
INFO:tensorflow:loss = 109475410000.0, step = 14601 (0.380 sec)
INFO:tensorflow:global_step/sec: 274.208
INFO:tensorflow:loss = 68228137000.0, step = 14701 (0.366 sec)
INFO:tensorflow:global_step/sec: 294.466
INFO:tensorflow:loss = 29434130000.0, step = 14801 (0.339 sec)
INFO:tensorflow:global_step/sec: 267.879
INFO:tensorflow:loss = 164885120000.0, step = 14901 (0.372 sec)
INFO:tensorflow:global_step/sec: 266.112
INFO:tensorflow:loss = 74730996000.0, step = 15001 (0.377 sec)
INFO:tensorflow:global_step/sec: 251.719
INFO:tensorflow:loss = 51825906000.0, step = 15101 (0.397 sec)
INFO:tensorflow:global_step/sec: 265.468
INFO:tensorflow:loss = 76317930000.0, step = 15201 (0.378 sec)
INFO:tensorflow:global_step/sec: 265.231
INFO:tensorflow:loss = 89075410000.0, step = 15301 (0.376 sec)
INFO:tensorflow:global_step/sec: 268.35
```

```
INFO:tensorflow:loss = 44092100000.0, step = 15401 (0.373 sec)
INFO:tensorflow:global_step/sec: 266.67
INFO:tensorflow:loss = 79070446000.0, step = 15501 (0.375 sec)
INFO:tensorflow:global_step/sec: 276.213
INFO:tensorflow:loss = 50406740000.0, step = 15601 (0.362 sec)
INFO:tensorflow:global_step/sec: 283.598
INFO:tensorflow:loss = 63589528000.0, step = 15701 (0.352 sec)
INFO:tensorflow:global_step/sec: 284.083
INFO:tensorflow:loss = 63665648000.0, step = 15801 (0.353 sec)
INFO:tensorflow:global_step/sec: 283.982
INFO:tensorflow:loss = 69142815000.0, step = 15901 (0.352 sec)
INFO:tensorflow:global_step/sec: 279.453
INFO:tensorflow:loss = 106314380000.0, step = 16001 (0.358 sec)
INFO:tensorflow:global_step/sec: 370.372
INFO:tensorflow:loss = 71111610000.0, step = 16101 (0.270 sec)
INFO:tensorflow:global_step/sec: 328.89
INFO:tensorflow:loss = 165231700000.0, step = 16201 (0.304 sec)
INFO:tensorflow:global_step/sec: 285.652
INFO:tensorflow:loss = 115727155000.0, step = 16301 (0.350 sec)
INFO:tensorflow:global_step/sec: 286.962
INFO:tensorflow:loss = 46475973000.0, step = 16401 (0.348 sec)
INFO:tensorflow:global_step/sec: 555.622
INFO:tensorflow:loss = 71956230000.0, step = 16501 (0.177 sec)
INFO:tensorflow:global_step/sec: 508.235
INFO:tensorflow:loss = 147078250000.0, step = 16601 (0.199 sec)
INFO:tensorflow:global_step/sec: 290.085
INFO:tensorflow:loss = 92634790000.0, step = 16701 (0.345 sec)
INFO:tensorflow:global_step/sec: 291.436
INFO:tensorflow:loss = 31952327000.0, step = 16801 (0.343 sec)
INFO:tensorflow:global_step/sec: 289.97
INFO:tensorflow:loss = 159459100000.0, step = 16901 (0.344 sec)
INFO:tensorflow:global_step/sec: 319.962
INFO:tensorflow:loss = 71008715000.0, step = 17001 (0.314 sec)
INFO:tensorflow:global_step/sec: 304.8
INFO:tensorflow:loss = 99766125000.0, step = 17101 (0.328 sec)
INFO:tensorflow:global_step/sec: 287.245
INFO:tensorflow:loss = 210663460000.0, step = 17201 (0.347 sec)
INFO:tensorflow:global_step/sec: 292.907
INFO:tensorflow:loss = 69743690000.0, step = 17301 (0.341 sec)
INFO:tensorflow:global_step/sec: 291.006
INFO:tensorflow:loss = 162434580000.0, step = 17401 (0.344 sec)
INFO:tensorflow:global_step/sec: 289.807
INFO:tensorflow:loss = 60223857000.0, step = 17501 (0.346 sec)
INFO:tensorflow:global_step/sec: 294.772
INFO:tensorflow:loss = 49845555000.0, step = 17601 (0.339 sec)
INFO:tensorflow:global_step/sec: 293.993
INFO:tensorflow:loss = 83113080000.0, step = 17701 (0.340 sec)
INFO:tensorflow:global_step/sec: 288.246
```

```
INFO:tensorflow:loss = 92259700000.0, step = 17801 (0.347 sec)
INFO:tensorflow:global_step/sec: 289.356
INFO:tensorflow:loss = 88515174000.0, step = 17901 (0.345 sec)
INFO:tensorflow:global_step/sec: 290.683
INFO:tensorflow:loss = 71314110000.0, step = 18001 (0.345 sec)
INFO:tensorflow:global_step/sec: 303.337
INFO:tensorflow:loss = 119092850000.0, step = 18101 (0.330 sec)
INFO:tensorflow:global_step/sec: 290.478
INFO:tensorflow:loss = 58178327000.0, step = 18201 (0.343 sec)
INFO:tensorflow:global_step/sec: 290.615
INFO:tensorflow:loss = 172585420000.0, step = 18301 (0.344 sec)
INFO:tensorflow:global_step/sec: 297.462
INFO:tensorflow:loss = 68455105000.0, step = 18401 (0.336 sec)
INFO:tensorflow:global_step/sec: 306.18
INFO:tensorflow:loss = 88222474000.0, step = 18501 (0.327 sec)
INFO:tensorflow:global_step/sec: 292.557
INFO:tensorflow:loss = 39028390000.0, step = 18601 (0.343 sec)
INFO:tensorflow:global_step/sec: 287.675
INFO:tensorflow:loss = 50595946000.0, step = 18701 (0.348 sec)
INFO:tensorflow:global_step/sec: 315.414
INFO:tensorflow:loss = 69324940000.0, step = 18801 (0.316 sec)
INFO:tensorflow:global_step/sec: 291.796
INFO:tensorflow:loss = 64237870000.0, step = 18901 (0.344 sec)
INFO:tensorflow:global_step/sec: 291.505
INFO:tensorflow:loss = 111502066000.0, step = 19001 (0.342 sec)
INFO:tensorflow:global_step/sec: 286.969
INFO:tensorflow:loss = 196416140000.0, step = 19101 (0.350 sec)
INFO:tensorflow:global_step/sec: 289.62
INFO:tensorflow:loss = 127144985000.0, step = 19201 (0.345 sec)
INFO:tensorflow:global_step/sec: 291.439
INFO:tensorflow:loss = 164530100000.0, step = 19301 (0.343 sec)
INFO:tensorflow:global_step/sec: 292.379
INFO:tensorflow:loss = 79299600000.0, step = 19401 (0.341 sec)
INFO:tensorflow:global_step/sec: 290.001
INFO:tensorflow:loss = 74719340000.0, step = 19501 (0.347 sec)
INFO:tensorflow:global_step/sec: 291.597
INFO:tensorflow:loss = 50799202000.0, step = 19601 (0.341 sec)
INFO:tensorflow:global_step/sec: 291.738
INFO:tensorflow:loss = 23369910000.0, step = 19701 (0.344 sec)
INFO:tensorflow:global_step/sec: 422.065
INFO:tensorflow:loss = 118444190000.0, step = 19801 (0.234 sec)
INFO:tensorflow:global_step/sec: 813.081
INFO:tensorflow:loss = 124817110000.0, step = 19901 (0.123 sec)
INFO:tensorflow:global_step/sec: 729.919
INFO:tensorflow:loss = 63025990000.0, step = 20001 (0.137 sec)
INFO:tensorflow:global_step/sec: 729.92
INFO:tensorflow:loss = 77625280000.0, step = 20101 (0.137 sec)
INFO:tensorflow:global_step/sec: 529.48
```

```
INFO:tensorflow:loss = 57283590000.0, step = 20201 (0.191 sec)
INFO:tensorflow:global_step/sec: 339.959
INFO:tensorflow:loss = 102442380000.0, step = 20301 (0.295 sec)
INFO:tensorflow:global_step/sec: 298.992
INFO:tensorflow:loss = 40440470000.0, step = 20401 (0.335 sec)
INFO:tensorflow:global_step/sec: 289.708
INFO:tensorflow:loss = 25065930000.0, step = 20501 (0.344 sec)
INFO:tensorflow:global_step/sec: 288.27
INFO:tensorflow:loss = 28938293000.0, step = 20601 (0.347 sec)
INFO:tensorflow:global_step/sec: 292.669
INFO:tensorflow:loss = 90632450000.0, step = 20701 (0.343 sec)
INFO:tensorflow:global_step/sec: 287.273
INFO:tensorflow:loss = 48657523000.0, step = 20801 (0.347 sec)
INFO:tensorflow:global_step/sec: 292.797
INFO:tensorflow:loss = 163529570000.0, step = 20901 (0.342 sec)
INFO:tensorflow:global_step/sec: 373.992
INFO:tensorflow:loss = 110832026000.0, step = 21001 (0.269 sec)
INFO:tensorflow:global_step/sec: 291.527
INFO:tensorflow:loss = 90887310000.0, step = 21101 (0.342 sec)
INFO:tensorflow:global_step/sec: 292.869
INFO:tensorflow:loss = 84296780000.0, step = 21201 (0.341 sec)
INFO:tensorflow:global_step/sec: 291.372
INFO:tensorflow:loss = 54235394000.0, step = 21301 (0.342 sec)
INFO:tensorflow:global_step/sec: 290.381
INFO:tensorflow:loss = 45180252000.0, step = 21401 (0.345 sec)
INFO:tensorflow:global_step/sec: 292.881
INFO:tensorflow:loss = 52754490000.0, step = 21501 (0.341 sec)
INFO:tensorflow:global_step/sec: 290.873
INFO:tensorflow:loss = 81164130000.0, step = 21601 (0.344 sec)
INFO:tensorflow:global_step/sec: 287.88
INFO:tensorflow:loss = 71899910000.0, step = 21701 (0.346 sec)
INFO:tensorflow:global_step/sec: 289.593
INFO:tensorflow:loss = 91079680000.0, step = 21801 (0.346 sec)
INFO:tensorflow:global_step/sec: 293.98
INFO:tensorflow:loss = 67071270000.0, step = 21901 (0.340 sec)
INFO:tensorflow:global_step/sec: 292.231
INFO:tensorflow:loss = 48490095000.0, step = 22001 (0.342 sec)
INFO:tensorflow:global_step/sec: 291.409
INFO:tensorflow:loss = 53921280000.0, step = 22101 (0.343 sec)
INFO:tensorflow:global_step/sec: 340.151
INFO:tensorflow:loss = 54891740000.0, step = 22201 (0.292 sec)
INFO:tensorflow:global_step/sec: 425.622
INFO:tensorflow:loss = 72540635000.0, step = 22301 (0.236 sec)
INFO:tensorflow:global_step/sec: 291.778
INFO:tensorflow:loss = 200112000000.0, step = 22401 (0.343 sec)
INFO:tensorflow:global_step/sec: 288.162
INFO:tensorflow:loss = 126486320000.0, step = 22501 (0.347 sec)
INFO:tensorflow:global_step/sec: 321.749
```

```
INFO:tensorflow:loss = 173554810000.0, step = 22601 (0.308 sec)
INFO:tensorflow:global_step/sec: 301.068
INFO:tensorflow:loss = 67686550000.0, step = 22701 (0.334 sec)
INFO:tensorflow:global_step/sec: 301.554
INFO:tensorflow:loss = 67664867000.0, step = 22801 (0.333 sec)
INFO:tensorflow:global_step/sec: 298.99
INFO:tensorflow:loss = 90584515000.0, step = 22901 (0.334 sec)
INFO:tensorflow:global_step/sec: 294.886
INFO:tensorflow:loss = 103826100000.0, step = 23001 (0.338 sec)
INFO:tensorflow:global_step/sec: 291.172
INFO:tensorflow:loss = 82557180000.0, step = 23101 (0.343 sec)
INFO:tensorflow:global_step/sec: 294.919
INFO:tensorflow:loss = 144116100000.0, step = 23201 (0.340 sec)
INFO:tensorflow:global_step/sec: 290.465
INFO:tensorflow:loss = 116785185000.0, step = 23301 (0.345 sec)
INFO:tensorflow:global_step/sec: 286.712
INFO:tensorflow:loss = 126739880000.0, step = 23401 (0.347 sec)
INFO:tensorflow:global_step/sec: 293.054
INFO:tensorflow:loss = 102194660000.0, step = 23501 (0.342 sec)
INFO:tensorflow:global_step/sec: 286.688
INFO:tensorflow:loss = 40392552000.0, step = 23601 (0.349 sec)
INFO:tensorflow:global_step/sec: 290.517
INFO:tensorflow:loss = 50791522000.0, step = 23701 (0.344 sec)
INFO:tensorflow:global_step/sec: 292.747
INFO:tensorflow:loss = 97987970000.0, step = 23801 (0.342 sec)
INFO:tensorflow:global_step/sec: 290.32
INFO:tensorflow:loss = 84691214000.0, step = 23901 (0.344 sec)
INFO:tensorflow:global_step/sec: 288.439
INFO:tensorflow:loss = 42730205000.0, step = 24001 (0.347 sec)
INFO:tensorflow:global_step/sec: 311.481
INFO:tensorflow:loss = 44425540000.0, step = 24101 (0.319 sec)
INFO:tensorflow:global_step/sec: 295.345
INFO:tensorflow:loss = 67691600000.0, step = 24201 (0.340 sec)
INFO:tensorflow:global_step/sec: 285.421
INFO:tensorflow:loss = 72208510000.0, step = 24301 (0.349 sec)
INFO:tensorflow:global_step/sec: 292.079
INFO:tensorflow:loss = 187973860000.0, step = 24401 (0.343 sec)
INFO:tensorflow:global_step/sec: 309.822
INFO:tensorflow:loss = 117373970000.0, step = 24501 (0.323 sec)
INFO:tensorflow:global_step/sec: 290.502
INFO:tensorflow:loss = 54080373000.0, step = 24601 (0.344 sec)
INFO:tensorflow:global_step/sec: 288.931
INFO:tensorflow:loss = 62374887000.0, step = 24701 (0.346 sec)
INFO:tensorflow:global_step/sec: 290.693
INFO:tensorflow:loss = 120994040000.0, step = 24801 (0.344 sec)
INFO:tensorflow:global_step/sec: 290.976
INFO:tensorflow:loss = 104035880000.0, step = 24901 (0.344 sec)
INFO:tensorflow:Saving checkpoints for 25000 into
```

```
C:\Users\RizkN\AppData\Local\Temp\tmp44vipjto\model.ckpt.
INFO:tensorflow:Loss for final step: 70469706000.0.
```

[20]:
```
<tensorflow_estimator.python.estimator.canned.dnn.DNNRegressor at 0x1d854791488>
```

** Create a prediction input function and then use the .predict method off your estimator model to create a list or predictions on your test data. **

[21]:
```
predict_input_func = tf.estimator.inputs.pandas_input_fn(
      x=X_test,
      batch_size=10,
      num_epochs=1,
      shuffle=False)
```

[22]:
```
pred_gen = model.predict(predict_input_func)
```

[23]:
```
predictions = list(pred_gen)
```

```
INFO:tensorflow:Calling model_fn.
INFO:tensorflow:Done calling model_fn.
INFO:tensorflow:Graph was finalized.
INFO:tensorflow:Restoring parameters from
C:\Users\RizkN\AppData\Local\Temp\tmp44vipjto\model.ckpt-25000
INFO:tensorflow:Running local_init_op.
INFO:tensorflow:Done running local_init_op.
```

** Calculate the RMSE. Do this manually or use sklearn.metrics **

[24]:
```
final_preds = []
for pred in predictions:
    final_preds.append(pred['predictions'])
```

[25]:
```
from sklearn.metrics import mean_squared_error
```

[26]:
```
mean_squared_error(y_test,final_preds)**0.5
```

[26]:
```
95338.64636301823
```

2 Great Job!

[ ]:
```

```