Deep Learning Project: Creating Artificial Neural Nework using Tensorflow & Keras

Import the required libraries

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [2]:
```
import tensorflow as tf
```

In [3]:
```
tf.__version__
```

Out[3]:
```
'2.0.0'
```

In [50]:
```
%matplotlib inline
```

Read Dataset to a Pandas DataFrame

In [5]:
```
df = pd.read_csv('E:\\Tensorflow-Projects\\Training-Data\\TF_2_Notebooks_and_Data\\DATA
```

In [6]:
```
df.head()
```

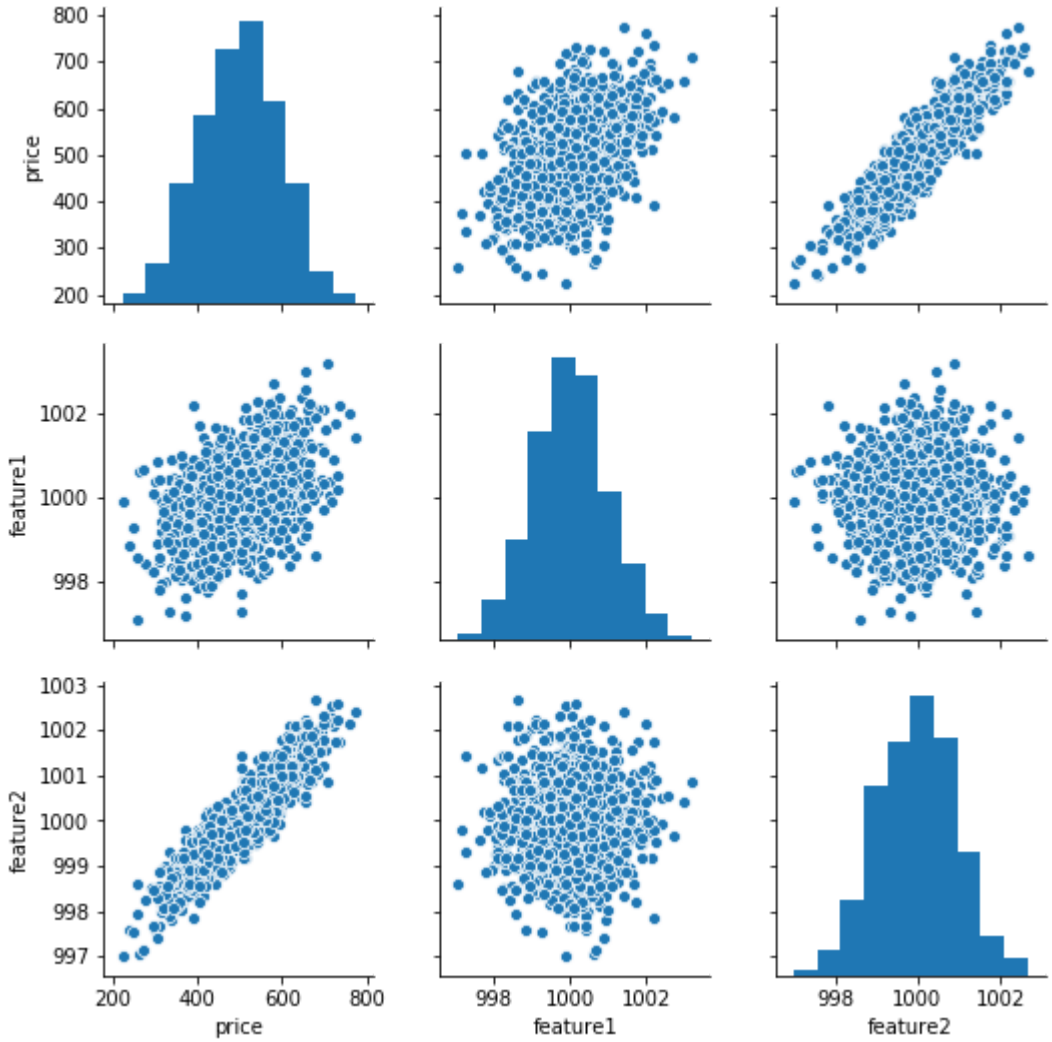
Out[6]:

	price	feature1	feature2
0	461.527929	999.787558	999.766096
1	548.130011	998.861615	1001.042403
2	410.297162	1000.070267	998.844015
3	540.382220	999.952251	1000.440940
4	546.024553	1000.446011	1000.338531

Visualize Data using Seaborn

In [7]:
```
sns.pairplot(df)
```

Out[7]:
```
<seaborn.axisgrid.PairGrid at 0x2c25e1a7888>
```



Split dataset into training & testing data using Skit-Learn

In [8]:
```
from sklearn.model_selection import train_test_split
```

In [9]:
```
X = df[['feature1', 'feature2']].values
```

In [10]:
```
y = df['price'].values
```

In [11]:
```
X
```

Out[11]:
```
array([[ 999.78755752,  999.7660962 ],
       [ 998.86161491, 1001.04240315],
       [1000.07026691,  998.84401463],
       ...,
       [1001.45164617,  998.84760554],
       [1000.77102275,  998.56285086],
       [ 999.2322436 , 1001.45140713]])
```

In [12]:
```
y
```

Out[12]:
```
array([461.52792939, 548.13001146, 410.29716167, 540.38221981,
       546.02455292, 542.9836716 , 555.48566416, 417.56972453,
       373.14653122, 633.35029248, 624.24709206, 475.37241721,
       600.36844486, 532.83295175, 472.8353628 , 506.31229096,
       508.414406  , 610.4553519 , 323.65776198, 446.21230389,
       362.12270299, 433.41064026, 562.00257647, 637.30962074,
```

```
522.80800754, 469.8028243 , 543.10992778, 565.43416994,
530.03285381, 610.58016503, 482.55641188, 327.56004052,
579.73083872, 448.42981468, 628.97709187, 536.79737216,
570.06729543, 357.82557519, 612.08492732, 444.67970846,
600.1186364 , 523.53312776, 512.94994495, 614.8813169 ,
404.35303251, 643.68851807, 488.95660398, 443.20468572,
514.47906638, 514.88174058, 325.05852217, 554.6620585 ,
451.39140001, 587.67887726, 477.73749721, 574.51560687,
548.9107991 , 528.69088356, 443.21100482, 397.88209319,
355.79535223, 460.69478138, 534.7673737 , 537.6067329 ,
603.66990347, 547.27579153, 567.30862153, 454.32901321,
492.60451447, 643.13593178, 477.4305163 , 497.41251837,
559.04378534, 576.67843837, 292.1917811 , 542.99539996,
547.73198239, 507.43439141, 408.12200074, 595.43348561,
463.3552036 , 468.35698045, 462.00480189, 410.35912407,
467.46059552, 497.23978613, 411.63794464, 583.06598409,
441.95036691, 536.04090915, 530.98717439, 364.50842093,
626.06865169, 434.62971003, 523.02344198, 484.10880902,
411.57560703, 722.26394433, 519.46299177, 558.50321048,
526.24297782, 531.27754687, 470.89067007, 459.92494538,
577.58298501, 599.90573138, 584.92843756, 357.34223391,
392.04726871, 515.77844597, 390.2092368 , 497.49148239,
506.74032509, 395.51477512, 239.65626376, 507.6052943 ,
628.84940437, 468.07324688, 444.9447339 , 527.31719596,
415.44298463, 363.4303791 , 591.86909195, 391.12466656,
526.1019196 , 402.00959595, 563.67781737, 362.24018346,
514.31349869, 322.31435197, 513.519732  , 340.05814212,
560.79471778, 489.79459784, 381.07367881, 558.34939279,
451.8041724 , 451.79140134, 442.17202786, 488.78691774,
433.09376956, 518.00709658, 511.69454654, 334.89459622,
490.78489309, 510.46356567, 565.02540892, 542.30140508,
655.42619806, 433.51753016, 373.06190748, 517.32199998,
609.96955536, 401.28033698, 540.74381886, 410.53824963,
441.7417974 , 448.70138654, 377.57042607, 450.85178618,
695.08064351, 548.94851249, 479.70887661, 345.01181992,
576.85255167, 337.95129476, 466.8394786 , 429.91541295,
567.88189283, 422.77852605, 559.7847254 , 503.75687251,
355.35228879, 622.37147383, 450.9760715 , 591.71413509,
522.42993416, 474.08634639, 423.05243386, 466.70445806,
481.92547045, 362.91867606, 566.05763935, 457.05958811,
580.88060484, 497.33921897, 519.17237518, 640.40485258,
477.25839763, 506.50370548, 634.2482933 , 311.87137765,
556.61215428, 446.36031515, 543.83027912, 617.61509904,
491.55128715, 441.90522674, 418.45717839, 524.47348399,
483.13482709, 622.99764305, 424.60840775, 515.14753991,
496.89047668, 534.23436696, 627.3802761 , 460.02329028,
338.13384172, 397.62059618, 562.05793604, 504.69389644,
490.99787402, 361.42640522, 608.12804021, 625.07938608,
461.38078609, 533.07210805, 438.26540597, 404.14239475,
458.52789767, 455.13953399, 521.87959462, 507.09798982,
480.80694031, 539.68399729, 376.32625533, 449.458484  ,
457.77794629, 531.16341758, 599.81185581, 526.67361757,
512.1515175 , 510.02950867, 391.26547583, 593.6677957 ,
415.60708684, 469.07283863, 485.22477592, 354.92884232,
316.63684801, 464.44494809, 649.39591652, 474.02501346,
551.56006043, 631.88915741, 597.71257172, 532.62879772,
445.58282142, 599.92382612, 375.95938044, 581.90748483,
464.9944057 , 417.23887206, 570.6460653 , 414.754452  ,
578.22402034, 405.92898949, 626.6797543 , 484.01952653,
275.33337527, 531.66193891, 223.34679276, 637.77896908,
553.87999612, 487.7379163 , 439.09025956, 378.04069831,
379.23669121, 537.12524033, 553.12387811, 505.69270877,
421.53806534, 510.88504979, 567.19470601, 697.70715802,
388.74663225, 578.32901814, 734.2765031 , 449.32814488,
512.04904895, 357.29591446, 360.23212493, 395.12045332,
```

```
423.70001699, 443.80983891, 595.96581968, 515.56181283,
531.9290881 , 530.13508628, 448.63240577, 527.61587693,
453.45829752, 417.54122635, 656.97308566, 546.23137991,
492.93591939, 379.90913372, 511.36670783, 503.51419982,
519.46055247, 611.14763688, 411.05157782, 403.41301547,
496.75415064, 466.00440866, 528.12861343, 633.45125327,
567.04497795, 435.09849106, 537.92888483, 452.71044444,
609.3840753 , 396.1965711 , 504.43137263, 626.69427794,
493.01201779, 724.47187575, 713.46667346, 565.19184559,
551.57372795, 451.89764782, 565.96723066, 367.7919044 ,
576.32144345, 579.42843094, 489.09760772, 487.18793877,
621.11885596, 481.90704139, 700.98368025, 599.99118092,
522.35888373, 646.8239136 , 568.61318745, 511.29824533,
760.65101669, 304.43261518, 543.32064222, 399.86651896,
585.16821441, 484.229812  , 425.84365096, 550.47494925,
325.79480263, 364.03501381, 439.49653517, 518.26312427,
693.9884929 , 512.59570173, 257.71199724, 524.32438029,
402.1955134 , 579.85178649, 476.07122974, 411.18423872,
367.76354239, 400.63495186, 609.58070746, 612.47025609,
366.3818868 , 485.50390003, 443.39703561, 479.56906767,
559.69848911, 432.82161991, 328.20550401, 524.37119547,
552.77893509, 630.61363933, 424.81078609, 375.13754715,
338.93370122, 574.74001083, 355.81485125, 378.79339707,
555.99978702, 642.3708192 , 347.87631327, 330.08230225,
392.70436827, 519.32640956, 612.7537015 , 469.24686052,
460.31999098, 646.25928592, 452.73449935, 446.6617038 ,
392.57787377, 419.11235041, 485.67140382, 533.55074599,
558.68796948, 433.41514433, 572.67843212, 474.34929884,
587.45566743, 603.60488162, 679.89502292, 454.02841184,
641.29636111, 523.12643425, 451.86441942, 369.91451298,
602.12024979, 589.28379767, 552.35874313, 497.82077751,
645.7084402 , 299.39441419, 416.37530318, 371.22410361,
305.42221221, 476.19497523, 718.25653986, 481.64581321,
449.79721212, 423.13089618, 487.23276805, 486.74414447,
333.08087339, 560.13543661, 711.65777328, 424.61108821,
367.88499002, 502.8467149 , 661.16436862, 422.44243544,
612.72791033, 526.44751951, 462.88163084, 574.57837765,
477.80625993, 431.18869681, 596.27161677, 367.04561733,
610.29650189, 573.83826959, 561.6815936 , 316.9505926 ,
353.78339461, 462.24239731, 395.74531349, 461.17944502,
265.31883491, 516.28603756, 495.54358534, 655.0298841 ,
361.96928555, 383.93441552, 339.21223298, 438.97699136,
518.36039543, 587.06918986, 513.58851064, 541.1289475 ,
318.2422866 , 407.41050587, 401.53996228, 530.27625921,
421.52951149, 509.05805746, 460.1838563 , 387.89272462,
560.93779062, 586.55980649, 426.36278463, 479.91915661,
525.70465661, 555.42087135, 530.68301453, 469.87238663,
606.31505182, 364.85210784, 360.16078118, 425.10615848,
365.56087755, 480.23012282, 533.48426265, 477.32136011,
685.07306529, 595.85363797, 510.87857855, 403.69954917,
493.96420737, 368.9200954 , 549.84762007, 601.76780838,
508.20389135, 418.93004519, 564.36822362, 604.11066099,
599.28050672, 527.88077226, 547.07286694, 576.8926402 ,
491.80281223, 518.70630218, 532.62653164, 685.21654079,
441.38724011, 315.51892903, 581.51143808, 585.15669192,
481.20614899, 470.46051802, 535.54367583, 489.05755196,
731.50955837, 539.7932304 , 421.26795581, 480.59911503,
530.21039882, 464.11587006, 633.4727288 , 449.41611879,
635.34706613, 537.24922805, 572.38065064, 553.90462877,
616.51060101, 402.29631873, 456.89995237, 505.74726413,
601.63849578, 510.88661196, 556.83209711, 379.10982057,
453.49681218, 594.68664574, 567.46368769, 498.9283394 ,
413.10071452, 437.18179741, 699.73384102, 351.42908062,
593.23051938, 544.18131004, 438.76371594, 446.87698755,
471.99435967, 461.14062423, 689.1734889 , 521.79699247,
```

```
603.88757737, 655.39140319, 369.78582541, 509.84188626,
475.17585767, 338.0902386 , 480.80616796, 587.30777032,
503.39000141, 518.12788339, 506.33929863, 647.36155957,
453.13824142, 396.04998476, 612.50533943, 618.93363459,
524.56895456, 666.06222545, 657.95491426, 496.06904958,
524.38393835, 461.49048992, 433.99838446, 572.31305385,
451.92641532, 362.68807582, 514.89474416, 427.36956977,
435.51362445, 566.27172557, 452.37238329, 375.62302356,
466.49020065, 465.17802914, 405.40016562, 427.74126221,
358.85061321, 481.53346268, 358.68011197, 375.31180205,
550.14246248, 556.54397565, 595.38094652, 512.58377753,
665.04739236, 549.29054549, 569.87336031, 550.29340062,
607.41940296, 617.37737732, 613.42662915, 604.57261409,
516.98581378, 401.89505573, 448.55357219, 475.94699622,
501.89188819, 498.6284209 , 474.2054026 , 568.60477798,
698.41041396, 550.89673991, 481.52436972, 498.46359085,
515.90099007, 478.08030334, 562.84736681, 578.52385723,
564.9556813 , 497.46472684, 526.34259721, 568.73205922,
439.65054024, 624.99250404, 370.74177754, 553.07681733,
414.85687715, 448.51914416, 347.1911182 , 631.56069392,
527.05754159, 553.32419751, 514.40564086, 444.05469284,
341.68789552, 565.24995494, 436.55494972, 548.61436053,
501.62206015, 362.24928105, 309.35587863, 435.26155328,
428.31614877, 308.22343125, 536.59066876, 774.40785445,
428.84321279, 552.88912902, 297.29389413, 637.85870827,
564.11153791, 648.01014932, 404.12928655, 508.82552564,
539.54049318, 467.66852221, 489.12458007, 571.18829179,
497.72274826, 396.92876859, 414.11072814, 406.28845394,
579.55848998, 406.6160671 , 515.21520276, 564.18681488,
578.58860646, 408.28620182, 581.54252662, 667.4812481 ,
622.86551828, 500.13304581, 379.13131207, 502.71948002,
343.73541799, 441.48474021, 499.21235117, 542.36204897,
547.62404325, 535.92947542, 461.52076712, 529.4394398 ,
521.61588724, 547.71292837, 584.38110772, 465.99980649,
489.99646515, 634.5322379 , 639.81836225, 500.7218448 ,
514.69378589, 380.13984916, 402.78860922, 507.44318662,
516.66204986, 246.73972006, 345.85149947, 728.54158643,
593.47480723, 623.05449555, 466.78702434, 524.96702947,
695.77282817, 498.19000033, 420.23890075, 449.25967508,
518.34877268, 608.64466352, 476.08427344, 425.4599912 ,
388.0260642 , 595.54443191, 606.21795936, 502.35831316,
470.9635849 , 565.07689035, 570.16851237, 505.63188399,
443.18691766, 387.64605588, 592.7579165 , 528.1454695 ,
610.09170764, 543.3237843 , 651.39612886, 552.91452026,
662.92504623, 571.70626262, 521.7744574 , 565.9362005 ,
526.29247961, 525.55617773, 547.12901446, 556.38156913,
643.55257205, 310.19085317, 316.97373493, 581.24757434,
675.76026898, 637.27161099, 503.27065876, 386.83158001,
449.22797293, 624.15619847, 708.0181058 , 436.66965907,
582.4550663 , 523.15977914, 454.01363039, 458.33002662,
553.13406068, 575.68656759, 399.74690881, 479.03778184,
377.13616236, 611.84754884, 457.69568614, 320.68694051,
607.66473078, 431.47987323, 536.00593624, 487.25310045,
357.11605236, 406.97496006, 367.88456147, 352.28258718,
428.43268624, 674.31102047, 455.03533539, 493.53818767,
323.74660823, 570.87438588, 522.35358676, 512.37078567,
344.445388  , 603.44292484, 494.19769248, 623.10445015,
615.5627227 , 501.09520221, 460.4308638 , 511.19375671,
619.10478486, 425.20422156, 439.38667763, 609.7226948 ,
520.97315983, 564.91022293, 574.57307473, 273.43263798,
416.57967214, 414.00400534, 602.54914671, 501.81396346,
657.25888889, 545.58520276, 363.11433585, 587.10134867,
535.98312568, 357.044414  , 543.91850962, 487.46952396,
491.03773416, 618.12341696, 442.93357949, 528.44015453,
492.87327105, 497.04387645, 606.29736199, 368.90204456,
```

```
463.83315596, 411.35636173, 670.21237633, 408.52236362,
484.43638366, 492.6419263 , 381.85298995, 613.95995262,
327.36024129, 491.79240663, 585.44412785, 380.3945669 ,
554.7626666 , 493.85668075, 526.2107462 , 385.39655988,
484.46159148, 332.22764352, 564.67207171, 649.44006825,
424.72778986, 618.08695111, 511.89276394, 331.12168828,
558.16409431, 493.56964948, 396.05573683, 631.37140169,
478.44486619, 628.54499456, 499.75474684, 506.8234736 ,
258.64403747, 478.35823792, 460.54250824, 552.62665953,
519.60816751, 456.98761551, 562.62597526, 560.98721013,
588.24268147, 579.43065472, 490.68891134, 372.77743562,
677.27628686, 420.76621323, 478.08636807, 608.79918051,
498.40036414, 351.09008918, 604.7965235 , 584.29415078,
552.36859639, 514.85636404, 324.75278473, 551.65009963,
646.42137115, 412.01627785, 542.05581314, 376.82027575,
485.65542199, 530.00104432, 531.48237221, 502.90170221,
320.22783441, 410.17228689, 307.49262471, 414.32154328,
429.47259522, 611.37280691, 579.49800824, 645.84815363,
528.21987259, 487.29933081, 530.99314592, 374.19760282,
453.82582684, 535.04562659, 381.36832678, 657.71868008,
403.06256371, 502.40592148, 612.48716221, 473.14373027,
648.49853653, 477.59301587, 478.85719007, 469.11310605,
558.87741587, 560.67805186, 484.56010504, 602.9701103 ,
501.88831717, 296.98984675, 409.95257743, 429.21452014,
529.71971585, 503.21614081, 656.65474461, 378.81430465,
627.64016416, 420.35676968, 347.19521436, 559.96108847,
437.90401436, 382.48198573, 446.61250992, 578.94348317,
427.85700338, 563.58363749, 603.55869587, 445.94046658,
577.31665049, 453.9716661 , 367.16096642, 591.50358214,
404.90316218, 403.90327413, 425.48260511, 657.80019814,
664.50877632, 503.05044876, 518.66756145, 544.49878325,
409.67675815, 338.5727094 , 427.48699506, 349.71799435,
434.38654316, 549.93636627, 524.5896561 , 502.90947332,
342.05906592, 622.03205011, 654.83912076, 434.69375374,
470.5546375 , 380.47707861, 560.3817655 , 549.2573511 ,
494.25163915, 450.42484415, 594.84047708, 412.90687671,
433.42313493, 512.04979227, 478.04811801, 413.29973991,
415.84564074, 511.58583419, 472.89142434, 657.93173622,
560.66409232, 587.74308283, 472.06766427, 390.86267833,
329.06703513, 526.72673086, 452.10238608, 413.87226234,
666.44170815, 487.7692307 , 560.63785511, 449.81047626,
499.94830987, 429.26772106, 508.91176483, 546.20393322,
621.59703226, 413.84178036, 449.02606966, 447.05319043,
595.48648065, 480.87733296, 667.70856487, 594.60958875,
600.04329091, 508.19978205, 359.19507992, 365.88328071,
576.73842525, 515.32519058, 423.65453319, 543.49227764,
577.29292367, 421.05894642, 625.08018462, 434.27528283,
657.73425067, 518.35614426, 481.86280607, 476.52607826,
457.31318609, 456.72099249, 403.31557562, 599.36709348])
```

In [13]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=4
```

In [14]:
```
X_train.shape
```

Out[14]:
```
(700, 2)
```

In [15]:
```
X_test.shape
```

Out[15]:
```
(300, 2)
```

In [16]:
```
y_train.shape
```

Out[16]:
```
(700,)
```

In [17]:
```
y_test.shape
```

Out[17]:
```
(300,)
```

Normalize data and do model fitting

In [18]:
```
from sklearn.preprocessing import MinMaxScaler
```

In [19]:
```
scaler = MinMaxScaler()
```

In [20]:
```
scaler.fit(X_train)
```

Out[20]:
```
MinMaxScaler(copy=True, feature_range=(0, 1))
```

In [21]:
```
X_train = scaler.transform(X_train)
```

In [22]:
```
X_train
```

Out[22]:
```
array([[0.74046017, 0.32583248],
       [0.43166001, 0.2555088 ],
       [0.18468554, 0.70500664],
       ...,
       [0.54913363, 0.79933822],
       [0.2834197 , 0.38818708],
       [0.56282703, 0.42371827]])
```

In [23]:
```
#scaler.fit(X_test)
```

In [24]:
```
X_test = scaler.transform(X_test)
```

In [25]:
```
X_test
```

Out[25]:
```
array([[ 0.39533339,  0.38540671],
       [ 0.57300502,  0.74070924],
       [ 0.61294076,  0.65734264],
       [ 0.38169528,  0.73076311],
       [ 0.07776591,  0.46323644],
       [ 0.49421971,  0.68949258],
       [ 0.2065742 ,  0.70096247],
       [ 0.55141988,  0.41776773],
       [ 0.36812191,  0.69082394],
       [ 0.56465724,  0.3877465 ],
       [ 0.57048029,  0.71810824],
       [ 0.79569525,  0.47979901],
       [ 0.38488235,  0.41856516],
       [ 0.33142545,  0.42411972],
       [ 0.89361377,  0.63912775],
       [ 0.50191166,  0.39789174],
       [ 0.7159808 ,  0.43688384],
       [ 0.35812192,  0.92028225],
       [ 0.49989367,  0.85589311],
       [ 0.63965434,  0.59024789],
       [ 0.19053626,  0.34203634],
       [ 0.40982896,  0.45849208],
       [ 0.26844791,  0.40167269],
       [ 0.38649709,  0.33592759],
       [ 0.50654703,  0.65789843],
```

```
       [ 0.41260556,  0.79338075],
       [ 0.45631316,  0.61323307],
       [ 0.44064792,  0.40889315],
       [ 0.42963904,  0.87598452],
       [ 0.5145433 ,  0.34457637],
       [ 0.53589468,  0.39199459],
       [ 0.46139966,  0.51485328],
       [ 0.44369075,  0.42880573],
       [ 0.49063994,  0.89952766],
       [ 0.59785881,  0.32523307],
       [ 0.28446406,  0.4651156 ],
       [ 0.77957933,  0.39234978],
       [ 0.53706097,  0.61018179],
       [ 0.25989698,  0.66393142],
       [ 0.11552588,  0.50295721],
       [ 0.6318509 ,  0.70171257],
       [ 0.48801329,  0.36279903],
       [ 0.60976949,  0.68389143],
       [ 0.63095152,  0.35195791],
       [ 0.46866324,  0.54548323],
       [ 0.85019104,  0.51945821],
       [ 0.83979528,  0.70163971],
       [ 0.57599467,  0.46915954],
       [ 0.45446128,  0.18040915],
       [ 0.43326779,  0.52930506],
       [ 0.53232326,  0.54514241],
       [ 0.5104231 ,  0.28110178],
       [ 0.71924183,  0.50314927],
       [ 0.40781023,  0.38597225],
       [ 0.66211305,  0.73333352],
       [ 0.41355453,  0.55046795],
       [ 0.35345356,  0.85769268],
       [ 0.8172902 ,  0.62751444],
       [ 0.44700765,  0.44473536],
       [ 0.32173317,  0.58272804],
       [ 0.35972159,  0.57708269],
       [ 0.52777368,  0.460713  ],
       [ 0.67041025,  0.81296852],
       [ 0.2983858 ,  0.42906031],
       [ 0.65419814,  0.85816691],
       [ 0.46450637,  0.71876496],
       [ 0.56986751,  0.66026552],
       [ 0.62009871,  0.54371935],
       [ 0.44601909,  0.52130557],
       [ 0.35080251,  0.63304989],
       [ 0.39240226,  0.2974618 ],
       [ 0.50365245,  0.60690861],
       [ 0.45964199,  0.68916904],
       [ 0.77715135,  0.44736318],
       [ 0.48462568,  0.43971558],
       [ 0.57572343,  0.55193792],
       [ 0.64582759,  0.46888802],
       [ 0.27203695,  0.52327051],
       [ 0.45405772,  0.63661587],
       [ 0.77439033,  0.67652698],
       [ 0.1788543 ,  0.61512972],
       [ 0.59603014,  0.61521319],
       [ 0.81871858,  0.75616678],
       [ 0.34815992,  0.51704866],
       [ 0.48163413,  0.95886913],
       [ 0.42444325,  0.50782896],
       [ 0.59813691,  0.28152483],
       [ 0.51781834,  0.6899035 ],
       [ 0.64058053,  0.32854994],
       [ 0.5677411 ,  0.47030439],
```

```
       [ 0.62171107,  0.70355543],
       [ 0.55626093,  0.37556544],
       [ 0.28293   ,  0.54224094],
       [ 0.36850431,  0.45941315],
       [ 0.30905233,  0.63402852],
       [ 0.48920938,  0.75134084],
       [ 0.30612937,  0.25959956],
       [ 0.4893308 ,  0.40200188],
       [ 0.56898409,  0.56580728],
       [ 0.36054139,  0.63246932],
       [ 0.37715079,  0.79960251],
       [ 0.44019866,  0.60708625],
       [ 0.49132264,  0.19382744],
       [ 0.73283645,  0.56595157],
       [ 0.11913356,  0.57509245],
       [ 0.81651358,  0.49716017],
       [ 0.51386365,  0.54640496],
       [ 0.29422406,  0.40635855],
       [ 0.257302  ,  0.77987727],
       [ 0.69295744,  0.3393722 ],
       [ 0.34320142,  0.49869931],
       [ 0.60998783,  0.75785862],
       [ 0.64257897,  0.5053132 ],
       [ 0.64810558,  0.55596935],
       [ 0.39186852,  0.4122828 ],
       [ 0.40269177,  0.53079874],
       [ 0.54471161,  0.67955115],
       [ 0.48562647,  0.87264883],
       [ 0.5216583 ,  0.92203428],
       [ 0.32327745,  0.93635669],
       [ 0.51829851,  0.63989342],
       [ 0.60403744,  0.48127254],
       [ 0.19808441,  0.45219614],
       [ 0.21235677,  0.22402339],
       [ 0.52103298,  0.47432954],
       [ 0.75275881,  0.63771274],
       [ 0.56222912,  0.23841019],
       [ 0.49388902,  0.55391671],
       [ 0.26512554,  0.66400075],
       [ 0.35839536,  0.58251275],
       [ 0.46853745,  0.50187999],
       [ 0.21779058,  0.51032544],
       [ 0.40760834,  0.5582352 ],
       [ 0.47412131,  0.4808989 ],
       [ 0.7584014 ,  0.60263361],
       [ 0.80476446,  0.52531515],
       [ 0.15750364,  0.52209449],
       [ 0.62297643,  0.73054697],
       [ 0.54220998,  0.4370445 ],
       [ 0.64071817,  0.58729863],
       [ 0.37624254,  0.39561819],
       [ 0.47207617,  0.60505174],
       [ 0.50689808,  0.6699942 ],
       [ 0.25653288,  0.3559246 ],
       [ 0.43516389,  0.65904556],
       [ 0.54183606,  0.71511953],
       [ 0.31588989,  0.38194033],
       [ 0.37163359,  0.6752128 ],
       [ 0.53636781,  0.6351209 ],
       [ 0.57491804,  0.39358871],
       [ 0.60006421,  0.74498547],
       [ 0.15783876,  0.43528378],
       [ 0.31897328,  0.56290091],
       [ 0.31548972,  0.67541007],
       [ 0.45188635,  0.2906613 ],
```

```
[ 0.29686209,  0.54737882],
[ 0.27484316,  0.50765114],
[ 0.44483475,  0.55013572],
[ 0.51633816,  0.20581917],
[ 0.49875004,  0.31423739],
[ 0.632033  ,  0.67321752],
[ 0.54142042,  0.51915289],
[ 0.40612168,  0.50857201],
[ 0.57768636,  0.46826385],
[ 0.708897  ,  0.49480014],
[ 0.28950684,  0.31417882],
[ 0.82355331,  0.39180333],
[ 0.3483919 ,  0.09512343],
[ 0.48240186,  0.54299294],
[ 0.26649733,  0.7243406 ],
[ 0.42134372,  0.54318814],
[ 0.73390461,  0.35227035],
[ 0.41026323,  0.3522237 ],
[ 0.65221434,  0.28123699],
[ 0.44187649,  0.65521993],
[ 0.29028069,  0.58014879],
[ 0.39201149,  0.74137242],
[ 0.28244543,  0.61236049],
[ 0.31181604,  0.82351872],
[ 0.63279554,  0.5560242 ],
[ 0.59571019,  0.56406432],
[ 0.49307937,  0.53062721],
[ 0.52882815,  0.80770326],
[ 0.47291646,  0.66193458],
[ 0.80615232,  0.53347541],
[ 0.64767081,  0.34002497],
[ 0.5694891 ,  0.32045986],
[ 0.23316186,  0.49515027],
[ 0.66732072,  0.58391995],
[ 0.47633907,  0.75883219],
[ 0.54624806,  0.37701219],
[ 0.5280346 ,  0.48784086],
[ 0.36401195,  0.77098537],
[ 0.36172013,  0.6455878 ],
[ 0.29850817,  0.33584867],
[ 0.49565511,  0.82318014],
[ 0.37724049,  0.64332928],
[ 0.34110919,  0.27400214],
[ 0.4446484 ,  0.53845677],
[ 0.57213337,  0.3082775 ],
[ 0.60409208,  0.69106798],
[ 0.52224297,  0.20376625],
[ 0.65646516,  0.49451391],
[ 0.48175209,  0.34167122],
[-0.01410839,  0.28897307],
[ 0.59595942,  0.51917617],
[ 0.62368454,  0.14240428],
[ 0.15953323,  0.41374739],
[ 0.72472577,  0.57046806],
[ 0.58406826,  0.31562953],
[ 0.41624278,  0.67069806],
[ 0.40173754,  0.61717449],
[ 0.09025068,  0.74952807],
[ 0.39129383,  0.22402463],
[ 0.16436558,  0.49678277],
[ 0.40587128,  0.78010152],
[ 0.44487418,  0.79226894],
[ 0.24728692,  0.8599148 ],
[ 0.73246664,  0.54611238],
[ 0.29521621,  0.5729201 ],
```

```
[ 0.4639173 ,  0.46340204],
[ 0.44176873,  0.57180607],
[ 0.55467089,  0.38939173],
[ 0.68562916,  0.45763472],
[ 0.22692249,  0.66526314],
[ 0.48257754,  0.33203184],
[ 0.54078185,  0.72005117],
[ 0.23086484,  0.16784199],
[ 0.65123035,  0.71179209],
[ 0.86573192,  0.5268671 ],
[ 0.46973135,  0.19028123],
[ 0.29955478,  0.58320343],
[ 0.60286543,  0.66883838],
[ 0.41677795,  0.32030854],
[ 0.41606994,  0.48651484],
[ 0.4896751 ,  0.17612868],
[ 0.6464676 ,  0.49187803],
[ 0.61542612,  0.28588069],
[ 0.5929732 ,  0.59439439],
[ 0.66321565,  0.73356013],
[ 0.46311596,  0.61889648],
[ 0.57449099,  0.49582616],
[ 0.73591816,  0.68387827],
[ 0.57761502,  0.51876189],
[ 0.49463334,  0.59300732],
[ 0.34415736,  0.64092721],
[ 0.48787375,  0.44566992],
[ 0.63785744,  0.47001721],
[ 0.50956637,  0.44243032],
[ 0.79492857,  0.56691957],
[ 0.37979357,  0.51604759],
[ 0.27945211,  0.48686131],
[ 0.3483822 ,  0.68503624],
[ 0.42392129,  0.55090892],
[ 0.23964628,  1.01865159],
[ 0.34801238,  0.34273123],
[ 0.52591427,  0.61798747],
[ 0.5524785 ,  0.65837898],
[ 0.27627988,  0.50218421],
[ 0.42039396,  0.65250017],
[ 0.74451112,  0.58016671],
[ 0.71263669,  0.58215689],
[ 0.61991639,  0.9152325 ],
[ 0.18031634,  0.54693243],
[ 0.48381172,  0.3282921 ],
[ 0.41394375,  0.19108179],
[ 0.3364849 ,  0.50159694],
[ 0.62397331,  0.23799435],
[ 0.3890586 ,  0.66828674],
[ 0.44031289,  0.60153793],
[ 0.78430587,  0.51694283],
[ 0.4431304 ,  0.44856803],
[ 0.57356327,  0.55964003],
[ 0.42370371,  0.32378282],
[ 0.51313398,  0.52265074],
[ 0.45543037,  0.82611348],
[ 0.6987176 ,  0.42124178],
[ 0.42417444,  0.70209803],
[ 0.34096502,  0.54367395],
[ 0.5819292 ,  0.02584364],
[ 0.36897232,  0.62574984],
[ 0.5143083 ,  0.76527682],
[ 0.34456986,  0.29927801],
[ 0.22179862,  0.56242645],
[ 0.36091838,  0.59304667],
```

```
       [ 0.4921206 ,  0.61709644],
       [ 0.67907034,  0.6647662 ],
       [ 0.14766961,  0.4725882 ],
       [ 0.19296391,  0.57449626],
       [ 0.52465099,  0.47822955],
       [ 0.47737293,  0.73662192],
       [ 0.25942707,  0.64318087],
       [ 0.33331191,  0.24587449],
       [ 0.50211082,  0.63687026],
       [ 0.44485012,  0.4408569 ],
       [ 0.36842211,  0.6496984 ],
       [ 0.0178803 ,  0.79438818],
       [ 0.59413373,  0.70213846],
       [ 0.53929518,  0.33822417],
       [ 0.2903287 ,  0.44841353]])
```

In [26]:
```
X_train.max()
```

Out[26]:
```
1.0
```

In [27]:
```
X_train.min()
```

Out[27]:
```
0.0
```

Create ANN using Tensorflow & Keras

In [28]:
```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
```

In [29]:
```
#model = Sequential([Dense(4, activation = 'relu'), Dense(2, activation = 'relu'), Dens
```

In [30]:
```
model = Sequential()

model.add(Dense(4, activation = 'relu'))
model.add(Dense(4, activation = 'relu'))
model.add(Dense(4, activation = 'relu'))

model.add(Dense(1))

model.compile(optimizer = 'rmsprop', loss = 'mse')
```

In [31]:
```
model.fit(X_train, y_train, epochs=250)
```

```
Train on 700 samples
Epoch 1/250
700/700 [==============================] - 1s 2ms/sample - loss: 256557.7725
Epoch 2/250
700/700 [==============================] - 0s 63us/sample - loss: 256421.7502
Epoch 3/250
700/700 [==============================] - 0s 70us/sample - loss: 256282.3427
Epoch 4/250
700/700 [==============================] - 0s 68us/sample - loss: 256125.5980
Epoch 5/250
700/700 [==============================] - 0s 58us/sample - loss: 255951.8255
Epoch 6/250
700/700 [==============================] - 0s 58us/sample - loss: 255759.1884
Epoch 7/250
700/700 [==============================] - 0s 54us/sample - loss: 255546.2038
Epoch 8/250
700/700 [==============================] - 0s 45us/sample - loss: 255311.1220
```

```
Epoch 9/250
700/700 [==============================] - 0s 55us/sample - loss: 255054.3161
Epoch 10/250
700/700 [==============================] - 0s 57us/sample - loss: 254774.2131
Epoch 11/250
700/700 [==============================] - 0s 58us/sample - loss: 254466.6479
Epoch 12/250
700/700 [==============================] - 0s 71us/sample - loss: 254133.0237
Epoch 13/250
700/700 [==============================] - 0s 63us/sample - loss: 253771.3095
Epoch 14/250
700/700 [==============================] - 0s 63us/sample - loss: 253377.8091
Epoch 15/250
700/700 [==============================] - 0s 61us/sample - loss: 252953.4549
Epoch 16/250
700/700 [==============================] - 0s 70us/sample - loss: 252494.2045
Epoch 17/250
700/700 [==============================] - 0s 63us/sample - loss: 252001.2207
Epoch 18/250
700/700 [==============================] - 0s 66us/sample - loss: 251471.0077
Epoch 19/250
700/700 [==============================] - 0s 61us/sample - loss: 250901.0522
Epoch 20/250
700/700 [==============================] - 0s 96us/sample - loss: 250289.2633
Epoch 21/250
700/700 [==============================] - 0s 85us/sample - loss: 249637.7737
Epoch 22/250
700/700 [==============================] - 0s 72us/sample - loss: 248938.7877
Epoch 23/250
700/700 [==============================] - 0s 69us/sample - loss: 248195.8648
Epoch 24/250
700/700 [==============================] - 0s 56us/sample - loss: 247400.5395
Epoch 25/250
700/700 [==============================] - 0s 59us/sample - loss: 246564.5959
Epoch 26/250
700/700 [==============================] - 0s 52us/sample - loss: 245672.1789
Epoch 27/250
700/700 [==============================] - 0s 43us/sample - loss: 244721.1035
Epoch 28/250
700/700 [==============================] - 0s 57us/sample - loss: 243720.3393
Epoch 29/250
700/700 [==============================] - 0s 58us/sample - loss: 242654.9055
Epoch 30/250
700/700 [==============================] - 0s 46us/sample - loss: 241534.6576
Epoch 31/250
700/700 [==============================] - 0s 54us/sample - loss: 240356.4185
Epoch 32/250
700/700 [==============================] - 0s 57us/sample - loss: 239109.3000
Epoch 33/250
700/700 [==============================] - 0s 57us/sample - loss: 237798.5691
Epoch 34/250
700/700 [==============================] - 0s 43us/sample - loss: 236417.4737
Epoch 35/250
700/700 [==============================] - 0s 43us/sample - loss: 234973.8300
Epoch 36/250
700/700 [==============================] - 0s 57us/sample - loss: 233453.2707
Epoch 37/250
700/700 [==============================] - 0s 57us/sample - loss: 231854.1284
Epoch 38/250
700/700 [==============================] - 0s 49us/sample - loss: 230185.6584
Epoch 39/250
700/700 [==============================] - 0s 43us/sample - loss: 228448.7166
Epoch 40/250
700/700 [==============================] - 0s 58us/sample - loss: 226619.8066
Epoch 41/250
```

```
700/700 [==============================] - 0s 57us/sample - loss: 224716.3676
Epoch 42/250
700/700 [==============================] - 0s 43us/sample - loss: 222728.6550
Epoch 43/250
700/700 [==============================] - 0s 57us/sample - loss: 220667.4054
Epoch 44/250
700/700 [==============================] - 0s 57us/sample - loss: 218506.2359
Epoch 45/250
700/700 [==============================] - 0s 124us/sample - loss: 216264.4286
Epoch 46/250
700/700 [==============================] - 0s 138us/sample - loss: 213943.0517
Epoch 47/250
700/700 [==============================] - 0s 104us/sample - loss: 211529.2366
Epoch 48/250
700/700 [==============================] - 0s 76us/sample - loss: 209030.3458
Epoch 49/250
700/700 [==============================] - 0s 71us/sample - loss: 206432.5717
Epoch 50/250
700/700 [==============================] - 0s 79us/sample - loss: 203744.4277
Epoch 51/250
700/700 [==============================] - 0s 80us/sample - loss: 200967.3624
Epoch 52/250
700/700 [==============================] - 0s 71us/sample - loss: 198093.8687
Epoch 53/250
700/700 [==============================] - 0s 71us/sample - loss: 195124.6846
Epoch 54/250
700/700 [==============================] - 0s 70us/sample - loss: 192051.9406
Epoch 55/250
700/700 [==============================] - 0s 62us/sample - loss: 188897.8037
Epoch 56/250
700/700 [==============================] - 0s 60us/sample - loss: 185654.2579
Epoch 57/250
700/700 [==============================] - 0s 67us/sample - loss: 182302.8646
Epoch 58/250
700/700 [==============================] - 0s 66us/sample - loss: 178850.4992
Epoch 59/250
700/700 [==============================] - 0s 66us/sample - loss: 175318.4883
Epoch 60/250
700/700 [==============================] - 0s 69us/sample - loss: 171689.0949
Epoch 61/250
700/700 [==============================] - 0s 73us/sample - loss: 167976.3054
Epoch 62/250
700/700 [==============================] - 0s 74us/sample - loss: 164178.9591
Epoch 63/250
700/700 [==============================] - 0s 74us/sample - loss: 160290.1205
Epoch 64/250
700/700 [==============================] - 0s 76us/sample - loss: 156307.9005
Epoch 65/250
700/700 [==============================] - 0s 71us/sample - loss: 152232.3718
Epoch 66/250
700/700 [==============================] - 0s 69us/sample - loss: 148090.1227
Epoch 67/250
700/700 [==============================] - 0s 64us/sample - loss: 143860.1476
Epoch 68/250
700/700 [==============================] - 0s 67us/sample - loss: 139575.2025
Epoch 69/250
700/700 [==============================] - 0s 64us/sample - loss: 135178.3969
Epoch 70/250
700/700 [==============================] - 0s 69us/sample - loss: 130748.2560
Epoch 71/250
700/700 [==============================] - 0s 66us/sample - loss: 126237.5917
Epoch 72/250
700/700 [==============================] - 0s 64us/sample - loss: 121687.3222
Epoch 73/250
700/700 [==============================] - 0s 100us/sample - loss: 117068.3897
```

```
Epoch 74/250
700/700 [==============================] - 0s 69us/sample - loss: 112396.4713
Epoch 75/250
700/700 [==============================] - 0s 66us/sample - loss: 107700.2043
Epoch 76/250
700/700 [==============================] - 0s 59us/sample - loss: 102950.7469
Epoch 77/250
700/700 [==============================] - 0s 64us/sample - loss: 98158.3581
Epoch 78/250
700/700 [==============================] - 0s 66us/sample - loss: 93366.1744
Epoch 79/250
700/700 [==============================] - 0s 67us/sample - loss: 88570.5386
Epoch 80/250
700/700 [==============================] - 0s 63us/sample - loss: 83764.8217
Epoch 81/250
700/700 [==============================] - 0s 66us/sample - loss: 78970.7489
Epoch 82/250
700/700 [==============================] - 0s 61us/sample - loss: 74172.5208
Epoch 83/250
700/700 [==============================] - 0s 64us/sample - loss: 69406.9266
Epoch 84/250
700/700 [==============================] - 0s 70us/sample - loss: 64680.1171
Epoch 85/250
700/700 [==============================] - 0s 66us/sample - loss: 60025.9842
Epoch 86/250
700/700 [==============================] - 0s 63us/sample - loss: 55399.7264
Epoch 87/250
700/700 [==============================] - 0s 64us/sample - loss: 50861.1415
Epoch 88/250
700/700 [==============================] - 0s 63us/sample - loss: 46419.7815
Epoch 89/250
700/700 [==============================] - 0s 67us/sample - loss: 42084.8505
Epoch 90/250
700/700 [==============================] - 0s 61us/sample - loss: 37876.0294
Epoch 91/250
700/700 [==============================] - 0s 69us/sample - loss: 33806.4883
Epoch 92/250
700/700 [==============================] - 0s 66us/sample - loss: 29875.9888
Epoch 93/250
700/700 [==============================] - 0s 60us/sample - loss: 26126.7339
Epoch 94/250
700/700 [==============================] - 0s 64us/sample - loss: 22607.5331
Epoch 95/250
700/700 [==============================] - 0s 63us/sample - loss: 19267.8808
Epoch 96/250
700/700 [==============================] - 0s 63us/sample - loss: 16131.8753
Epoch 97/250
700/700 [==============================] - 0s 63us/sample - loss: 13243.1776
Epoch 98/250
700/700 [==============================] - 0s 59us/sample - loss: 10669.7509
Epoch 99/250
700/700 [==============================] - 0s 61us/sample - loss: 8372.6360
Epoch 100/250
700/700 [==============================] - 0s 61us/sample - loss: 6382.3847
Epoch 101/250
700/700 [==============================] - 0s 63us/sample - loss: 4751.8595
Epoch 102/250
700/700 [==============================] - 0s 64us/sample - loss: 3445.9074
Epoch 103/250
700/700 [==============================] - 0s 61us/sample - loss: 2497.4809
Epoch 104/250
700/700 [==============================] - 0s 61us/sample - loss: 1887.7772
Epoch 105/250
700/700 [==============================] - 0s 58us/sample - loss: 1597.8615
Epoch 106/250
```

```
700/700 [==============================] - 0s 64us/sample - loss: 1516.3802
Epoch 107/250
700/700 [==============================] - 0s 57us/sample - loss: 1493.9350
Epoch 108/250
700/700 [==============================] - 0s 60us/sample - loss: 1475.7048
Epoch 109/250
700/700 [==============================] - 0s 61us/sample - loss: 1453.5903
Epoch 110/250
700/700 [==============================] - 0s 58us/sample - loss: 1427.2151
Epoch 111/250
700/700 [==============================] - 0s 69us/sample - loss: 1405.2012
Epoch 112/250
700/700 [==============================] - 0s 69us/sample - loss: 1382.1222
Epoch 113/250
700/700 [==============================] - 0s 59us/sample - loss: 1360.5543
Epoch 114/250
700/700 [==============================] - 0s 60us/sample - loss: 1337.5142
Epoch 115/250
700/700 [==============================] - 0s 59us/sample - loss: 1314.7563
Epoch 116/250
700/700 [==============================] - 0s 60us/sample - loss: 1293.2253
Epoch 117/250
700/700 [==============================] - 0s 64us/sample - loss: 1271.5510
Epoch 118/250
700/700 [==============================] - 0s 60us/sample - loss: 1251.4214
Epoch 119/250
700/700 [==============================] - 0s 61us/sample - loss: 1229.1171
Epoch 120/250
700/700 [==============================] - 0s 60us/sample - loss: 1208.7758
Epoch 121/250
700/700 [==============================] - 0s 60us/sample - loss: 1187.9427
Epoch 122/250
700/700 [==============================] - 0s 63us/sample - loss: 1165.2395
Epoch 123/250
700/700 [==============================] - 0s 63us/sample - loss: 1145.2062
Epoch 124/250
700/700 [==============================] - 0s 61us/sample - loss: 1126.4923
Epoch 125/250
700/700 [==============================] - 0s 60us/sample - loss: 1106.6625
Epoch 126/250
700/700 [==============================] - 0s 64us/sample - loss: 1086.2521
Epoch 127/250
700/700 [==============================] - 0s 61us/sample - loss: 1066.8931
Epoch 128/250
700/700 [==============================] - 0s 70us/sample - loss: 1046.8664
Epoch 129/250
700/700 [==============================] - 0s 61us/sample - loss: 1027.4995
Epoch 130/250
700/700 [==============================] - 0s 63us/sample - loss: 1006.7457
Epoch 131/250
700/700 [==============================] - 0s 58us/sample - loss: 986.1231
Epoch 132/250
700/700 [==============================] - 0s 63us/sample - loss: 966.0200
Epoch 133/250
700/700 [==============================] - 0s 61us/sample - loss: 946.2505
Epoch 134/250
700/700 [==============================] - 0s 63us/sample - loss: 926.6428
Epoch 135/250
700/700 [==============================] - 0s 63us/sample - loss: 906.2352
Epoch 136/250
700/700 [==============================] - 0s 60us/sample - loss: 886.0105
Epoch 137/250
700/700 [==============================] - 0s 63us/sample - loss: 869.6947
Epoch 138/250
700/700 [==============================] - 0s 64us/sample - loss: 851.0990
```

```
Epoch 139/250
700/700 [==============================] - 0s 63us/sample - loss: 834.8774
Epoch 140/250
700/700 [==============================] - 0s 63us/sample - loss: 817.4577
Epoch 141/250
700/700 [==============================] - 0s 69us/sample - loss: 798.3013
Epoch 142/250
700/700 [==============================] - 0s 64us/sample - loss: 781.5522
Epoch 143/250
700/700 [==============================] - 0s 66us/sample - loss: 762.3143
Epoch 144/250
700/700 [==============================] - 0s 64us/sample - loss: 743.4881
Epoch 145/250
700/700 [==============================] - 0s 66us/sample - loss: 724.0567
Epoch 146/250
700/700 [==============================] - 0s 63us/sample - loss: 705.3350
Epoch 147/250
700/700 [==============================] - 0s 64us/sample - loss: 688.3854
Epoch 148/250
700/700 [==============================] - 0s 66us/sample - loss: 667.0976
Epoch 149/250
700/700 [==============================] - 0s 60us/sample - loss: 655.9895
Epoch 150/250
700/700 [==============================] - 0s 69us/sample - loss: 635.5615
Epoch 151/250
700/700 [==============================] - 0s 74us/sample - loss: 620.9428
Epoch 152/250
700/700 [==============================] - 0s 71us/sample - loss: 606.0777
Epoch 153/250
700/700 [==============================] - 0s 64us/sample - loss: 589.3234
Epoch 154/250
700/700 [==============================] - 0s 64us/sample - loss: 573.9811
Epoch 155/250
700/700 [==============================] - 0s 64us/sample - loss: 555.9401
Epoch 156/250
700/700 [==============================] - 0s 63us/sample - loss: 541.7101
Epoch 157/250
700/700 [==============================] - 0s 70us/sample - loss: 524.0872
Epoch 158/250
700/700 [==============================] - 0s 63us/sample - loss: 508.9383
Epoch 159/250
700/700 [==============================] - 0s 64us/sample - loss: 493.7547
Epoch 160/250
700/700 [==============================] - 0s 63us/sample - loss: 478.8888
Epoch 161/250
700/700 [==============================] - 0s 76us/sample - loss: 463.3976
Epoch 162/250
700/700 [==============================] - 0s 64us/sample - loss: 449.5318
Epoch 163/250
700/700 [==============================] - 0s 64us/sample - loss: 435.2809
Epoch 164/250
700/700 [==============================] - 0s 64us/sample - loss: 419.9857
Epoch 165/250
700/700 [==============================] - 0s 61us/sample - loss: 408.0466
Epoch 166/250
700/700 [==============================] - 0s 64us/sample - loss: 396.0792
Epoch 167/250
700/700 [==============================] - 0s 64us/sample - loss: 383.2396
Epoch 168/250
700/700 [==============================] - 0s 63us/sample - loss: 367.9875
Epoch 169/250
700/700 [==============================] - 0s 63us/sample - loss: 354.1670
Epoch 170/250
700/700 [==============================] - 0s 63us/sample - loss: 340.1690
Epoch 171/250
```

```
700/700 [==============================] - 0s 64us/sample - loss: 328.7966
Epoch 172/250
700/700 [==============================] - 0s 66us/sample - loss: 317.7703
Epoch 173/250
700/700 [==============================] - 0s 69us/sample - loss: 306.8613
Epoch 174/250
700/700 [==============================] - 0s 67us/sample - loss: 296.0338
Epoch 175/250
700/700 [==============================] - 0s 67us/sample - loss: 284.8212
Epoch 176/250
700/700 [==============================] - 0s 60us/sample - loss: 273.0503
Epoch 177/250
700/700 [==============================] - 0s 66us/sample - loss: 262.2324
Epoch 178/250
700/700 [==============================] - 0s 61us/sample - loss: 251.7230
Epoch 179/250
700/700 [==============================] - 0s 61us/sample - loss: 240.7198
Epoch 180/250
700/700 [==============================] - 0s 61us/sample - loss: 230.6565
Epoch 181/250
700/700 [==============================] - 0s 64us/sample - loss: 219.9403
Epoch 182/250
700/700 [==============================] - 0s 63us/sample - loss: 211.2201
Epoch 183/250
700/700 [==============================] - 0s 63us/sample - loss: 201.5473
Epoch 184/250
700/700 [==============================] - 0s 60us/sample - loss: 192.8432
Epoch 185/250
700/700 [==============================] - 0s 61us/sample - loss: 184.2710
Epoch 186/250
700/700 [==============================] - 0s 57us/sample - loss: 175.3587
Epoch 187/250
700/700 [==============================] - 0s 55us/sample - loss: 166.2722
Epoch 188/250
700/700 [==============================] - 0s 61us/sample - loss: 157.3738
Epoch 189/250
700/700 [==============================] - 0s 59us/sample - loss: 149.2969
Epoch 190/250
700/700 [==============================] - 0s 61us/sample - loss: 141.6626
Epoch 191/250
700/700 [==============================] - 0s 59us/sample - loss: 134.6339
Epoch 192/250
700/700 [==============================] - 0s 57us/sample - loss: 128.4960
Epoch 193/250
700/700 [==============================] - 0s 69us/sample - loss: 121.8767
Epoch 194/250
700/700 [==============================] - 0s 60us/sample - loss: 116.2836
Epoch 195/250
700/700 [==============================] - 0s 61us/sample - loss: 109.2472
Epoch 196/250
700/700 [==============================] - 0s 63us/sample - loss: 103.7902
Epoch 197/250
700/700 [==============================] - 0s 60us/sample - loss: 98.8897
Epoch 198/250
700/700 [==============================] - 0s 60us/sample - loss: 93.7661
Epoch 199/250
700/700 [==============================] - 0s 61us/sample - loss: 88.4047
Epoch 200/250
700/700 [==============================] - 0s 60us/sample - loss: 84.2646
Epoch 201/250
700/700 [==============================] - 0s 61us/sample - loss: 79.5805
Epoch 202/250
700/700 [==============================] - 0s 61us/sample - loss: 74.9456
Epoch 203/250
700/700 [==============================] - 0s 61us/sample - loss: 70.9472
```

```
Epoch 204/250
700/700 [==============================] - 0s 61us/sample - loss: 67.1021
Epoch 205/250
700/700 [==============================] - 0s 61us/sample - loss: 63.1922
Epoch 206/250
700/700 [==============================] - 0s 59us/sample - loss: 59.8186
Epoch 207/250
700/700 [==============================] - 0s 63us/sample - loss: 56.8748
Epoch 208/250
700/700 [==============================] - 0s 64us/sample - loss: 53.9034
Epoch 209/250
700/700 [==============================] - 0s 63us/sample - loss: 50.6025
Epoch 210/250
700/700 [==============================] - 0s 61us/sample - loss: 47.8103
Epoch 211/250
700/700 [==============================] - 0s 63us/sample - loss: 45.3179
Epoch 212/250
700/700 [==============================] - 0s 60us/sample - loss: 42.6483
Epoch 213/250
700/700 [==============================] - 0s 61us/sample - loss: 40.1013
Epoch 214/250
700/700 [==============================] - 0s 61us/sample - loss: 38.2661
Epoch 215/250
700/700 [==============================] - 0s 67us/sample - loss: 36.5119
Epoch 216/250
700/700 [==============================] - 0s 64us/sample - loss: 34.6081
Epoch 217/250
700/700 [==============================] - 0s 66us/sample - loss: 33.7661
Epoch 218/250
700/700 [==============================] - 0s 60us/sample - loss: 32.7889
Epoch 219/250
700/700 [==============================] - 0s 66us/sample - loss: 31.6185
Epoch 220/250
700/700 [==============================] - 0s 66us/sample - loss: 30.3277
Epoch 221/250
700/700 [==============================] - 0s 66us/sample - loss: 29.4205
Epoch 222/250
700/700 [==============================] - 0s 66us/sample - loss: 28.9027
Epoch 223/250
700/700 [==============================] - 0s 60us/sample - loss: 28.1476
Epoch 224/250
700/700 [==============================] - 0s 66us/sample - loss: 27.8418
Epoch 225/250
700/700 [==============================] - 0s 66us/sample - loss: 27.0312
Epoch 226/250
700/700 [==============================] - 0s 60us/sample - loss: 26.8154
Epoch 227/250
700/700 [==============================] - 0s 60us/sample - loss: 26.2801
Epoch 228/250
700/700 [==============================] - 0s 61us/sample - loss: 26.0723
Epoch 229/250
700/700 [==============================] - 0s 61us/sample - loss: 25.6823
Epoch 230/250
700/700 [==============================] - 0s 61us/sample - loss: 25.4368
Epoch 231/250
700/700 [==============================] - 0s 63us/sample - loss: 25.2948
Epoch 232/250
700/700 [==============================] - 0s 63us/sample - loss: 24.8572
Epoch 233/250
700/700 [==============================] - 0s 61us/sample - loss: 25.3475
Epoch 234/250
700/700 [==============================] - 0s 66us/sample - loss: 24.7605
Epoch 235/250
700/700 [==============================] - 0s 63us/sample - loss: 25.0212
Epoch 236/250
```

```
700/700 [==============================] - 0s 64us/sample - loss: 24.3752
Epoch 237/250
700/700 [==============================] - 0s 64us/sample - loss: 24.8712
Epoch 238/250
700/700 [==============================] - 0s 63us/sample - loss: 24.5973
Epoch 239/250
700/700 [==============================] - 0s 60us/sample - loss: 24.1756
Epoch 240/250
700/700 [==============================] - 0s 64us/sample - loss: 24.3818
Epoch 241/250
700/700 [==============================] - 0s 63us/sample - loss: 24.3913
Epoch 242/250
700/700 [==============================] - 0s 60us/sample - loss: 24.4098
Epoch 243/250
700/700 [==============================] - 0s 63us/sample - loss: 24.5523
Epoch 244/250
700/700 [==============================] - 0s 61us/sample - loss: 24.4174
Epoch 245/250
700/700 [==============================] - 0s 61us/sample - loss: 24.4073
Epoch 246/250
700/700 [==============================] - 0s 69us/sample - loss: 24.2050
Epoch 247/250
700/700 [==============================] - 0s 67us/sample - loss: 24.2827
Epoch 248/250
700/700 [==============================] - 0s 64us/sample - loss: 24.2046
Epoch 249/250
700/700 [==============================] - 0s 71us/sample - loss: 24.3464
Epoch 250/250
700/700 [==============================] - 0s 90us/sample - loss: 23.8913
```

Out[31]:
```
<tensorflow.python.keras.callbacks.History at 0x2c266e5bc08>
```

Plot Loss Data

In [32]:
```
model.history.history
```

Out[32]:
```
{'loss': [256557.7725,
  256421.75017857144,
  256282.34267857144,
  256125.5980357143,
  255951.82553571428,
  255759.18839285715,
  255546.20375,
  255311.1219642857,
  255054.31607142856,
  254774.213125,
  254466.64785714285,
  254133.02366071427,
  253771.3094642857,
  253377.80910714285,
  252953.4549107143,
  252494.20446428572,
  252001.2207142857,
  251471.00767857142,
  250901.05223214286,
  250289.26330357144,
  249637.77366071427,
  248938.78767857142,
  248195.86482142858,
  247400.5394642857,
  246564.59589285715,
  245672.17892857143,
  244721.10348214285,
  243720.3392857143,
```

```
242654.9055357143,
241534.65758928572,
240356.41848214285,
239109.3,
237798.56910714286,
236417.47366071428,
234973.83,
233453.27071428573,
231854.12839285715,
230185.65839285715,
228448.71660714285,
226619.80660714285,
224716.3675892857,
222728.655,
220667.40544642857,
218506.23589285713,
216264.42857142858,
213943.05169642856,
211529.23660714287,
209030.34580357143,
206432.57169642858,
203744.42767857143,
200967.3624107143,
198093.86875,
195124.68455357142,
192051.940625,
188897.80366071427,
185654.25794642858,
182302.86455357142,
178850.49919642857,
175318.48830357142,
171689.09491071428,
167976.30544642857,
164178.95910714284,
160290.1205357143,
156307.9005357143,
152232.3717857143,
148090.12267857144,
143860.1475892857,
139575.2025,
135178.39691964287,
130748.25598214286,
126237.59174107143,
121687.32223214286,
117068.38973214285,
112396.47133928571,
107700.20433035714,
102950.746875,
98158.358125,
93366.174375,
88570.53861607143,
83764.82169642857,
78970.74892857143,
74172.52080357143,
69406.92662946429,
64680.11705357143,
60025.98415178571,
55399.72638392857,
50861.14145089286,
46419.78145089286,
42084.85046875,
37876.02944196429,
33806.48832589286,
29875.988761160716,
26126.733850446428,
```

```
22607.533091517857,
19267.88082589286,
16131.875323660714,
13243.177578125,
10669.750920758928,
8372.636026785714,
6382.384698660714,
4751.859522879464,
3445.907359095982,
2497.4809416852677,
1887.7771965680804,
1597.861484375,
1516.3802427455357,
1493.9349755859375,
1475.7048367745535,
1453.5902790178573,
1427.2151088169642,
1405.2012039620536,
1382.1222377232143,
1360.5543247767857,
1337.5141524832588,
1314.7563071986608,
1293.2252915736608,
1271.551040736607,
1251.421351841518,
1229.117101702009,
1208.7758238002232,
1187.9427361188616,
1165.2394562639508,
1145.206247907366,
1126.492263532366,
1106.6625310407367,
1086.2520793805804,
1066.8931134905133,
1046.8664477539062,
1027.4994594029017,
1006.7457414899553,
986.1230548967634,
966.0199846540179,
946.2505255998884,
926.6428128487723,
906.2352333286831,
886.0104799107143,
869.6946927315848,
851.0989927455357,
834.8773517717634,
817.4577479771206,
798.3013152204242,
781.5521613420759,
762.3142578125,
743.4881298828125,
724.0566720145089,
705.3349689592634,
688.3854471261161,
667.0976283482142,
655.9894817243304,
635.5614515904018,
620.9427814592634,
606.0777423967634,
589.323436453683,
573.9810573032925,
555.9400812639509,
541.710099748884,
524.087193952288,
508.9383157784598,
```

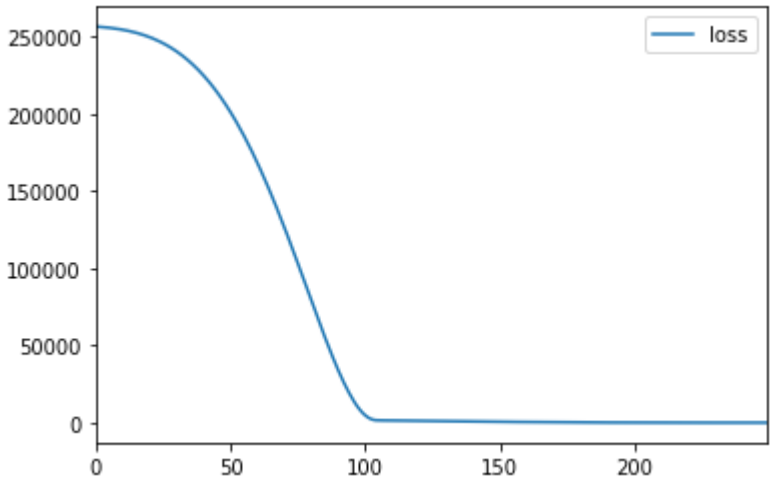
```
493.75470145089287,
478.88875244140627,
463.397588936942,
449.5318204171317,
435.2808700125558,
419.98565272739955,
408.04658081054686,
396.0791765485491,
383.2396292550223,
367.98752423967636,
354.16699776785714,
340.1690159388951,
328.79656808035713,
317.77028398786274,
306.86130658830916,
296.03383466448105,
284.8212234061105,
273.05031903948105,
262.23244437081473,
251.7230437360491,
240.71976361955916,
230.65648088727679,
219.94033543178014,
211.2200758579799,
201.5473121861049,
192.84316911969867,
184.27098467145646,
175.3587002999442,
166.27216779436384,
157.3737530517578,
149.296892351423,
141.66261326381138,
134.63389469691685,
128.49601305280413,
121.87669581821987,
116.28355076381139,
109.24720029558455,
103.7901711164202,
98.88965641566685,
93.76607495989118,
88.40469408307757,
84.26464671543667,
79.58048065185547,
74.94561109270369,
70.94724247523716,
67.10213017054967,
63.19216142926897,
59.81856166294643,
56.87477081298828,
53.903420933314734,
50.60245986938477,
47.81030386788505,
45.317883889334546,
42.648280072893414,
40.101321520124166,
38.2660525730678,
36.511915588378905,
34.608141544887,
33.766106818062916,
32.78885361807687,
31.61848476954869,
30.327706974574497,
29.420523332868303,
28.90267096383231,
28.147580097743443,
```

```
27.841753932407926,
27.03118222917829,
26.815431834629603,
26.280051127842494,
26.07231816973005,
25.68232584272112,
25.436826596941266,
25.294825820922853,
24.8572218976702,
25.347549623761857,
24.760472608293806,
25.021214926583426,
24.37519650050572,
24.87122024536133,
24.59730902535575,
24.17561556134905,
24.38176722935268,
24.391268016270228,
24.409804970877513,
24.552341210501535,
24.4173630632673,
24.407328807285854,
24.20496502467564,
24.282730440412248,
24.20457919529506,
24.34638724190848,
23.891298337663923]}
```

In [33]:
```
loss_df = pd.DataFrame(model.history.history)
```

In [34]:
```
loss_df.plot()
```

Out[34]: <matplotlib.axes._subplots.AxesSubplot at 0x2c266e78b48>



Evaluate Model & do Predictions

In [35]:
```
model.evaluate(X_train, y_train, verbose = 0)
```

Out[35]: 24.829104952130997

In [36]:
```
model.evaluate(X_test, y_test, verbose=0)
```

Out[36]: 25.34867889404297

In [37]:
```
test_predictions = model.predict(X_test)
```

In [38]:
```
test_predictions
```

Out[38]:
```
array([[404.88785],
       [622.5229 ],
       [591.1463 ],
       [571.4848 ],
       [366.57382],
       [578.3249 ],
       [514.5848 ],
       [458.45612],
       [548.5641 ],
       [446.8811 ],
       [610.79614],
       [547.8915 ],
       [418.6782 ],
       [408.51636],
       [649.8867 ],
       [436.73703],
       [507.55304],
       [659.0263 ],
       [661.5487 ],
       [564.58484],
       [334.1546 ],
       [444.3362 ],
       [382.28363],
       [378.41693],
       [565.75665],
       [609.7432 ],
       [531.6683 ],
       [427.37155],
       [654.48596],
       [413.55716],
       [442.03308],
       [484.50058],
       [437.90076],
       [680.7811 ],
       [424.1382 ],
       [417.35544],
       [500.98648],
       [549.6443 ],
       [509.23044],
       [395.22116],
       [617.5339 ],
       [416.12198],
       [603.4411 ],
       [445.26685],
       [501.31992],
       [580.54535],
       [667.6559 ],
       [489.66425],
       [318.30832],
       [484.82394],
       [516.50757],
       [381.33917],
       [540.9367 ],
       [408.1756 ],
       [640.38824],
       [490.47934],
       [627.1114 ],
       [625.76404],
       [446.53687],
       [484.2005 ],
```

```
       [490.5866 ],
       [473.87802],
       [681.5634 ],
       [402.9773 ],
       [699.8867 ],
       [585.55743],
       [582.1945 ],
       [536.9797 ],
       [483.9646 ],
       [515.96643],
       [360.9193 ],
       [539.97577],
       [569.8254 ],
       [527.4628 ],
       [453.14133],
       [530.31885],
       [506.3749 ],
       [442.96527],
       [542.62665],
       [639.5263 ],
       [465.6759 ],
       [566.34314],
       [689.3948 ],
       [458.2661 ],
       [707.8    ],
       [472.13095],
       [402.70453],
       [584.21924],
       [436.07468],
       [488.23657],
       [615.9946 ],
       [438.8638 ],
       [454.92465],
       [434.8215 ],
       [506.3774 ],
       [607.5406 ],
       [321.48456],
       [435.72427],
       [535.51587],
       [518.02997],
       [604.2519 ],
       [524.75757],
       [333.80026],
       [575.1093 ],
       [431.57587],
       [561.4533 ],
       [512.67596],
       [390.80606],
       [565.6402 ],
       [454.03204],
       [448.04373],
       [639.8795 ],
       [523.5095 ],
       [549.7611 ],
       [417.27292],
       [478.18353],
       [585.6136 ],
       [666.34973],
       [699.3344 ],
       [658.5289 ],
       [559.7343 ],
       [502.38696],
       [390.1647 ],
       [281.3654 ],
       [478.9503 ],
```

```
       [615.2153 ],
       [372.83447],
       [511.55316],
       [510.52573],
       [492.93784],
       [479.84045],
       [423.51273],
       [492.8659 ],
       [470.86633],
       [599.32025],
       [572.4692 ],
       [414.76047],
       [629.57733],
       [465.7172 ],
       [563.3906 ],
       [405.3062 ],
       [531.44586],
       [571.79144],
       [356.9054 ],
       [549.1028 ],
       [602.4167 ],
       [384.02032],
       [541.73175],
       [561.7451 ],
       [452.23004],
       [631.1533 ],
       [372.13763],
       [473.78156],
       [528.28644],
       [371.92212],
       [460.8126 ],
       [435.95874],
       [497.86093],
       [345.73315],
       [394.82346],
       [603.5606 ],
       [505.9172 ],
       [468.07715],
       [489.63168],
       [534.33435],
       [344.32355],
       [511.32452],
       [250.77007],
       [503.40872],
       [540.5388 ],
       [488.77713],
       [470.25363],
       [392.1658 ],
       [415.60684],
       [548.84   ],
       [475.34518],
       [579.1921 ],
       [489.30072],
       [600.2574 ],
       [546.0952 ],
       [541.105  ],
       [499.90134],
       [644.8225 ],
       [559.6301 ],
       [576.8182 ],
       [443.42966],
       [414.94724],
       [419.7555 ],
       [568.1454 ],
       [608.1213 ],
```

```
       [437.16034],
       [487.2855 ],
       [587.00543],
       [524.76746],
       [357.15448],
       [644.43427],
       [527.4001 ],
       [337.00684],
       [492.07095],
       [409.59235],
       [605.602  ],
       [346.14755],
       [521.5466 ],
       [404.2186 ],
       [258.68997],
       [519.0839 ],
       [340.4311 ],
       [361.95227],
       [575.3747 ],
       [416.0877 ],
       [550.27094],
       [520.44305],
       [510.4168 ],
       [324.52698],
       [403.96436],
       [601.5867 ],
       [616.9798 ],
       [602.59625],
       [565.26086],
       [472.97974],
       [459.79807],
       [507.7814 ],
       [445.28168],
       [510.43967],
       [501.93182],
       [399.6759 ],
       [604.5884 ],
       [258.19308],
       [627.1667 ],
       [587.9385 ],
       [326.8478 ],
       [479.0848 ],
       [594.371  ],
       [378.03763],
       [459.62646],
       [324.69653],
       [517.83844],
       [409.01752],
       [555.3647 ],
       [640.7657 ],
       [536.0951 ],
       [502.41925],
       [633.8628 ],
       [514.4553 ],
       [530.962  ],
       [518.2386 ],
       [456.85382],
       [505.00797],
       [460.49268],
       [590.5626 ],
       [465.404  ],
       [426.8436 ],
       [540.95557],
       [493.19678],
       [678.83856],
```

```
       [372.48093],
       [550.79535],
       [577.07214],
       [433.616  ],
       [542.3204 ],
       [584.91797],
       [578.2087 ],
       [719.68915],
       [432.48123],
       [398.13397],
       [313.78522],
       [447.84906],
       [387.5231 ],
       [542.5277 ],
       [522.05585],
       [563.41595],
       [447.487  ],
       [533.5866 ],
       [381.41724],
       [500.81494],
       [636.1747 ],
       [495.69446],
       [567.6303 ],
       [469.62805],
       [273.02127],
       [516.7581 ],
       [620.4499 ],
       [350.2752 ],
       [450.10886],
       [498.72824],
       [542.20575],
       [610.7491 ],
       [388.03546],
       [449.09103],
       [481.7414 ],
       [597.445  ],
       [498.90958],
       [321.28958],
       [554.3425 ],
       [444.1086 ],
       [528.40607],
       [514.9183 ],
       [608.6457 ],
       [416.4028 ],
       [410.55405]], dtype=float32)
```

In [39]:
```
test_predictions = pd.Series(test_predictions.reshape(300,))
```

Create a DataFrame having Actual & Predicted value

In [40]:
```
prediction_df = pd.DataFrame(y_test, columns=['Test True Y'])
```

In [41]:
```
prediction_df = pd.concat([prediction_df, test_predictions], axis=1)
```

In [42]:
```
prediction_df.columns = ['Test True Y', 'Model Predictions']
```

In [43]:
```
prediction_df
```

Out[43]:

	Test True Y	Model Predictions
0	402.296319	404.887848

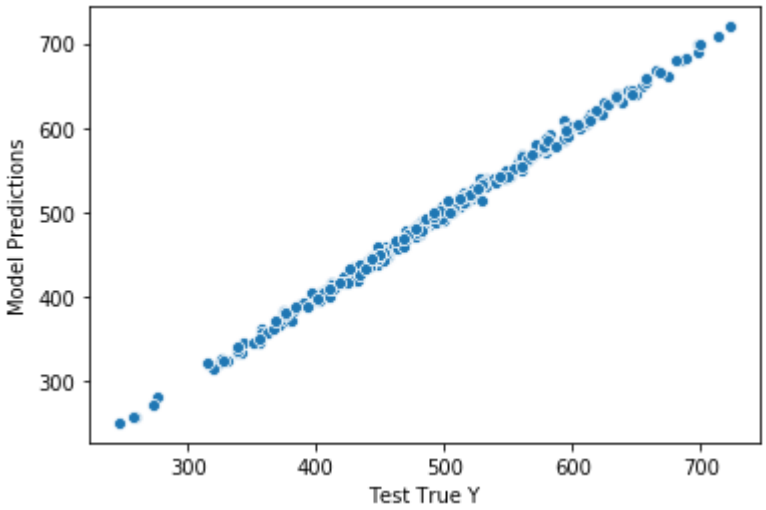
	Test True Y	Model Predictions
1	624.156198	622.522888
2	582.455066	591.146301
3	578.588606	571.484802
4	371.224104	366.573822
...	...	...
295	525.704657	528.406067
296	502.909473	514.918274
297	612.727910	608.645691
298	417.569725	416.402802
299	410.538250	410.554047

300 rows × 2 columns

Plot Actual vs Predicted results

In [44]:
```
sns.scatterplot(x='Test True Y', y='Model Predictions', data=prediction_df)
```

Out[44]: <matplotlib.axes._subplots.AxesSubplot at 0x2c268900fc8>



Determine Model Evaluation parameters

In [45]:
```
from sklearn import metrics
```

In [46]:
```
metrics.mean_absolute_error(prediction_df['Test True Y'],prediction_df['Model Predictio
```

Out[46]: 4.035157520814229

In [47]:
```
metrics.mean_squared_error(prediction_df['Test True Y'],prediction_df['Model Prediction
```

Out[47]: 25.348683058822864

In [48]:
```
df.describe()
```

Out[48]:

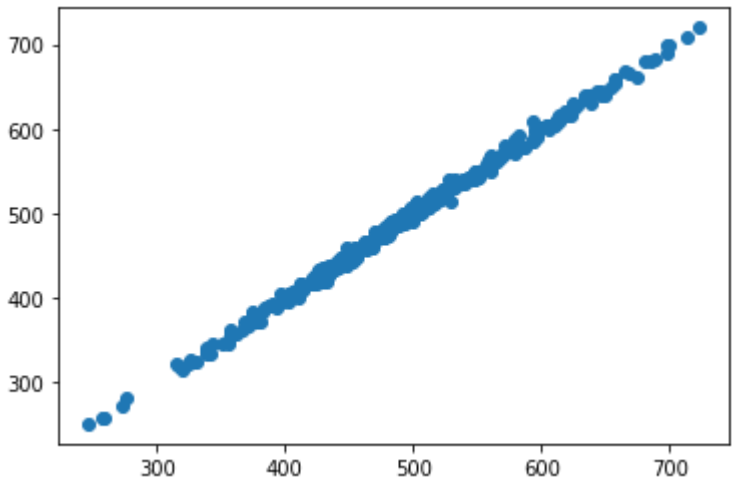
	price	feature1	feature2
count	1000.000000	1000.000000	1000.000000
mean	498.673029	1000.014171	999.979847
std	93.785431	0.974018	0.948330
min	223.346793	997.058347	996.995651
25%	433.025732	999.332068	999.316106
50%	502.382117	1000.009915	1000.002243
75%	564.921588	1000.637580	1000.645380
max	774.407854	1003.207934	1002.666308

In [49]:
```
np.sqrt(metrics.mean_squared_error(prediction_df['Test True Y'],prediction_df['Model Pr
```

Out[49]:
```
5.034747566544212
```

In [53]:
```
plt.scatter(prediction_df['Test True Y'],prediction_df['Model Predictions'])
```

Out[53]:
```
<matplotlib.collections.PathCollection at 0x2c269fa6e08>
```



Predicting against a random data and saving Model for future use

In [60]:
```
new_data = [[998, 1000]]
```

In [61]:
```
new_data = scaler.transform(new_data)
```

In [62]:
```
model.predict(new_data)
```

Out[62]:
```
array([[419.4767]], dtype=float32)
```

In [63]:
```
from tensorflow.keras.models import load_model
```

In [64]:
```
model.save('ann-predictor.h5')
```

In [72]:
```
#future_model = load_model('ann-predictor.h5')
```

In [ ]:
```

```