PROBLEM STATEMENT

Need to develop a model to predict the total dollar amount that customers are willing to pay given the following attributes:

- Customer Name
- Customer e-mail
- Country
- Gender
- Age
- Annual Salary
- Credit Card Debt
- Net Worth

The model should predict:

- Car Purchase Amount

STEP #0: LIBRARIES IMPORT

In [21]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

STEP #1: IMPORT DATASET

In [22]:
```
car_df = pd.read_csv('Car_Purchasing_Data.csv', encoding='ISO-8859-1')
```

In [23]:
```
car_df
```

Out[23]:

	Customer Name	Customer e-mail	Country	Gender	Age	
0	Martina Avila	cubilia.Curae.Phasellus@quisaccumsanconvallis.edu	Bulgaria	0	41.851720	628
1	Harlan Barnes	eu.dolor@diam.co.uk	Belize	0	40.870623	666
2	Naomi Rodriquez	vulputate.mauris.sagittis@ametconsectetueradip...	Algeria	1	43.152897	537
3	Jade Cunningham	malesuada@dignissim.com	Cook Islands	1	58.271369	793
4	Cedric Leach	felis.ullamcorper.viverra@egetmollislectus.net	Brazil	1	57.313749	597
...	...	...	...	...	...	
495	Walter	ligula@Cumsociis.ca	Nepal	0	41.462515	719

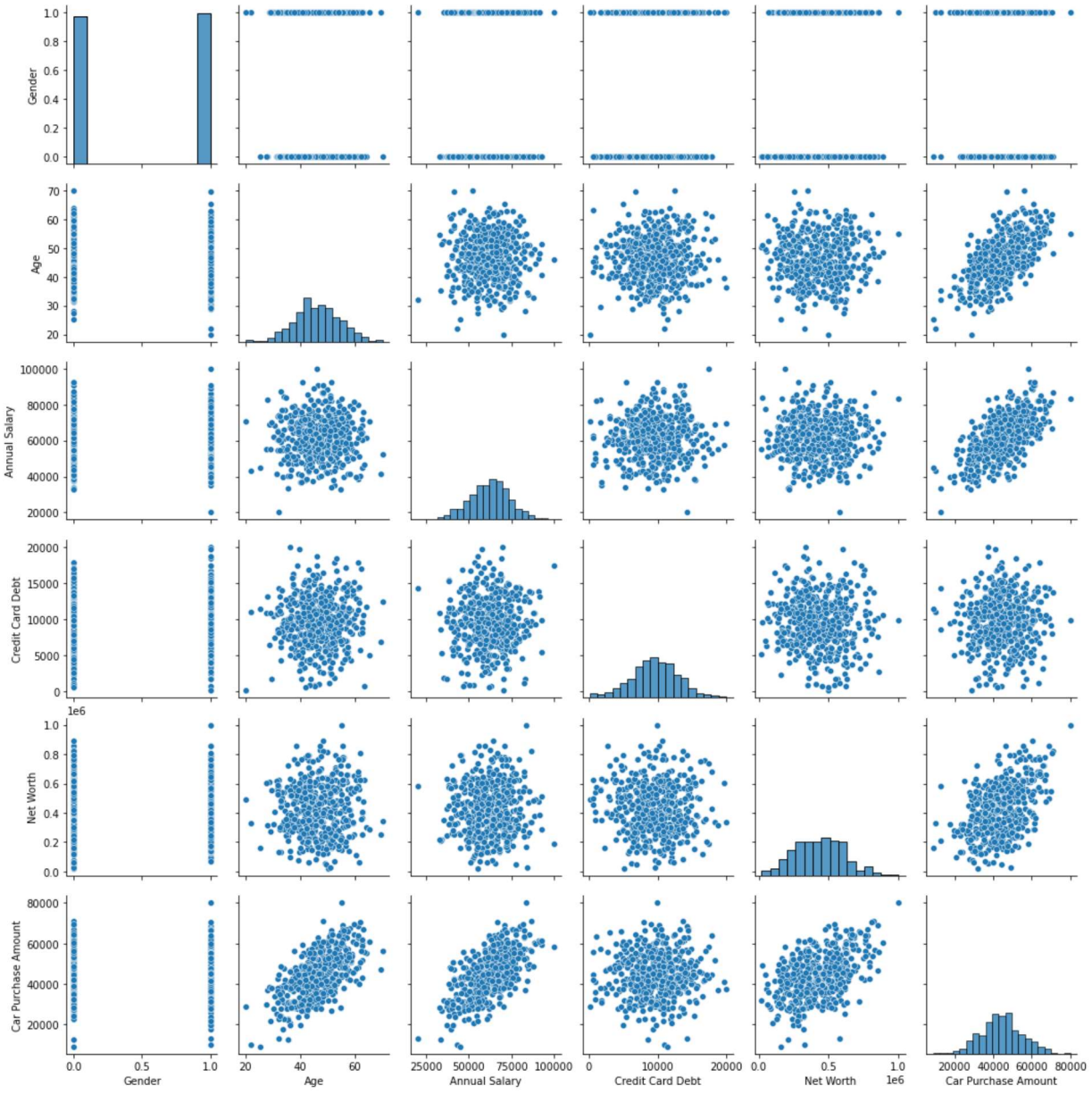
	Customer Name	Customer e-mail	Country	Gender	Age	
496	Vanna	Cum.sociis.natoque@Sedmolestie.edu	Zimbabwe	1	37.642000	56(
497	Pearl	penatibus.et@massanonante.com	Philippines	1	53.943497	68
498	Nell	Quisque.varius@arcuVivamussit.net	Botswana	1	59.160509	49
499	Marla	Camaron.marla@hotmail.com	marlal	1	46.731152	61

500 rows × 9 columns

STEP #2: VISUALIZE DATASET

In [24]:
```
sns.pairplot(car_df)
```

Out[24]: <seaborn.axisgrid.PairGrid at 0x270a67a0490>



STEP #3: CREATE TESTING AND TRAINING DATASET/DATA CLEANING

In [25]:
```
X = car_df.drop(['Customer Name', 'Customer e-mail', 'Country', 'Car Purchase Amount
```

In [ ]:
```

```

In [26]:
```
X
```

Out[26]:

	Gender	Age	Annual Salary	Credit Card Debt	Net Worth
0	0	41.851720	62812.09301	11609.380910	238961.2505
1	0	40.870623	66646.89292	9572.957136	530973.9078
2	1	43.152897	53798.55112	11160.355060	638467.1773
3	1	58.271369	79370.03798	14426.164850	548599.0524
4	1	57.313749	59729.15130	5358.712177	560304.0671
...	...	...	...	...	...
495	0	41.462515	71942.40291	6995.902524	541670.1016
496	1	37.642000	56039.49793	12301.456790	360419.0988
497	1	53.943497	68888.77805	10611.606860	764531.3203
498	1	59.160509	49811.99062	14013.034510	337826.6382
499	1	46.731152	61370.67766	9391.341628	462946.4924

500 rows × 5 columns

In [27]:
```
y = car_df['Car Purchase Amount']
y.shape
```

Out[27]:
```
(500,)
```

In [28]:
```
from sklearn.preprocessing import MinMaxScaler

scaler = MinMaxScaler()
X_scaled = scaler.fit_transform(X)
```

In [29]:
```
scaler.data_max_
```

Out[29]:
```
array([1.e+00, 7.e+01, 1.e+05, 2.e+04, 1.e+06])
```

In [30]:
```
scaler.data_min_
```

Out[30]:
```
array([    0.,    20., 20000.,   100., 20000.])
```

In [31]:
```
print(X_scaled[:,0])
```

```
[0. 0. 1. 1. 1. 1. 1. 1. 0. 1. 1. 1. 0. 0. 0. 1. 0. 1. 1. 0. 1. 0. 1. 1.
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 0. 1. 1. 0. 0. 1. 1. 0. 0. 0. 1. 1. 0. 0. 0. 0. 1. 1. 1. 1.]
```

In [32]:
```
y.shape
```

Out[32]:
```
(500,)
```

In [33]:
```
y = y.values.reshape(-1,1)
```

In [34]:
```
y.shape
```

Out[34]:
```
(500, 1)
```

In [35]:
```
y_scaled = scaler.fit_transform(y)
```

In [36]:
```
y_scaled
```

Out[36]:
```
array([[0.37072477],
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```

STEP#4: TRAINING THE MODEL

In [37]:

```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X_scaled, y_scaled, test_size =
```

In [38]:
```
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
from sklearn.preprocessing import MinMaxScaler

model = Sequential()
model.add(Dense(25, input_dim=5, activation='relu'))
model.add(Dense(25, activation='relu'))
model.add(Dense(1, activation='linear'))
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense (Dense)                (None, 25)                150
_________________________________________________________________
dense_1 (Dense)              (None, 25)                650
_________________________________________________________________
dense_2 (Dense)              (None, 1)                 26
=================================================================
Total params: 826
Trainable params: 826
Non-trainable params: 0
_________________________________________________________________
```

In [39]:
```
model.compile(optimizer='adam', loss='mean_squared_error')
```

In [40]:
```
epochs_hist = model.fit(X_train, y_train, epochs=20, batch_size=25,  verbose=1, vali
```

```
Epoch 1/20
12/12 [==============================] - 0s 16ms/step - loss: 0.0670 - val_loss: 0.0
464
Epoch 2/20
12/12 [==============================] - 0s 3ms/step - loss: 0.0301 - val_loss: 0.02
51
Epoch 3/20
12/12 [==============================] - 0s 4ms/step - loss: 0.0181 - val_loss: 0.01
82
Epoch 4/20
12/12 [==============================] - 0s 3ms/step - loss: 0.0137 - val_loss: 0.01
47
Epoch 5/20
12/12 [==============================] - 0s 4ms/step - loss: 0.0107 - val_loss: 0.01
19
Epoch 6/20
12/12 [==============================] - 0s 4ms/step - loss: 0.0084 - val_loss: 0.00
99
Epoch 7/20
12/12 [==============================] - 0s 3ms/step - loss: 0.0067 - val_loss: 0.00
84
Epoch 8/20
12/12 [==============================] - 0s 3ms/step - loss: 0.0053 - val_loss: 0.00
67
Epoch 9/20
12/12 [==============================] - 0s 3ms/step - loss: 0.0041 - val_loss: 0.00
52
Epoch 10/20
12/12 [==============================] - 0s 3ms/step - loss: 0.0031 - val_loss: 0.00
44
Epoch 11/20
12/12 [==============================] - 0s 4ms/step - loss: 0.0026 - val_loss: 0.00
37
```

```
Epoch 12/20
12/12 [==============================] - 0s 3ms/step - loss: 0.0020 - val_loss: 0.00
30
Epoch 13/20
12/12 [==============================] - 0s 3ms/step - loss: 0.0017 - val_loss: 0.00
26
Epoch 14/20
12/12 [==============================] - ETA: 0s - loss: 0.001 - 0s 3ms/step - loss:
0.0015 - val_loss: 0.0023
Epoch 15/20
12/12 [==============================] - 0s 4ms/step - loss: 0.0013 - val_loss: 0.00
20
Epoch 16/20
12/12 [==============================] - 0s 4ms/step - loss: 0.0011 - val_loss: 0.00
18
Epoch 17/20
12/12 [==============================] - 0s 3ms/step - loss: 9.9379e-04 - val_loss:
0.0016
Epoch 18/20
12/12 [==============================] - 0s 3ms/step - loss: 9.0831e-04 - val_loss:
0.0016
Epoch 19/20
12/12 [==============================] - 0s 4ms/step - loss: 8.3466e-04 - val_loss:
0.0014
Epoch 20/20
12/12 [==============================] - 0s 3ms/step - loss: 7.6295e-04 - val_loss:
0.0013
```

STEP#5: EVALUATING THE MODEL

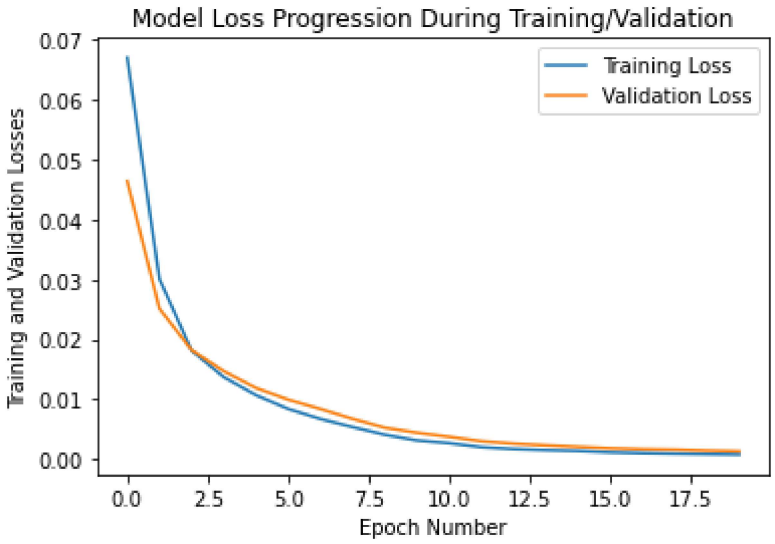
In [41]:
```
print(epochs_hist.history.keys())
```

```
dict_keys(['loss', 'val_loss'])
```

In [42]:
```
plt.plot(epochs_hist.history['loss'])
plt.plot(epochs_hist.history['val_loss'])

plt.title('Model Loss Progression During Training/Validation')
plt.ylabel('Training and Validation Losses')
plt.xlabel('Epoch Number')
plt.legend(['Training Loss', 'Validation Loss'])
```

Out[42]:
```
<matplotlib.legend.Legend at 0x270b4f92c10>
```



In [43]:
```
# Gender, Age, Annual Salary, Credit Card Debt, Net Worth
```

```
X_Testing = np.array([[1, 50, 50000, 10985, 629312]])
```

In [44]:
```
y_predict = model.predict(X_Testing)
y_predict.shape
```

Out[44]: (1, 1)

In [45]:
```
print('Expected Purchase Amount=', y_predict[:,0])
```

```
Expected Purchase Amount= [160163.5]
```