data-filling-by-linear-regression

October 18, 2024

```
import pandas as pd
     import numpy as np
[]: df=pd.read_csv("/content/bike_buyers_2.csv")
[]:
           Unnamed: 0.1
                          Unnamed: 0
                                           ID Marital Status
                                                                Gender
                                                                           Income
                                       12496
                                                               Female
                                                                          40000.0
                       0
                                    0
                                                      Married
     1
                       1
                                    1
                                       24107
                                                      Married
                                                                  Male
                                                                          30000.0
     2
                       2
                                    2
                                       14177
                                                                          80000.0
                                                      Married
                                                                  Male
     3
                       3
                                    3
                                       24381
                                                       Single
                                                                  Male
                                                                          70000.0
                       4
     4
                                       25597
                                                                          30000.0
                                    4
                                                       Single
                                                                  Male
                                                                   •••
     995
                     995
                                  995
                                       23731
                                                      Married
                                                                  Male
                                                                          60000.0
     996
                     996
                                  996
                                       28672
                                                                          70000.0
                                                       Single
                                                                  Male
     997
                     997
                                  997
                                       11809
                                                      Married
                                                                  Male
                                                                          60000.0
     998
                     998
                                  998
                                       19664
                                                       Single
                                                                  Male
                                                                         100000.0
     999
                                  999
                                       12121
                                                       Single
                     999
                                                                  Male
                                                                          60000.0
           Children
                            Education
                                             Occupation Home Owner
     0
                            Bachelors
                                        Skilled Manual
                                                                 Yes
     1
                  3
                      Partial College
                                               Clerical
                                                                 Yes
                                                                          1
     2
                  5
                      Partial College
                                                                          2
                                           Professional
                                                                  No
     3
                  0
                            Bachelors
                                           Professional
                                                                 Yes
                                                                          1
     4
                  0
                                                                  No
                                                                          0
                            Bachelors
                                               Clerical
                  2
                          High School
                                                                          2
     995
                                           Professional
                                                                 Yes
                      Graduate Degree
                                           Professional
                                                                 Yes
                                                                          0
     996
     997
                  2
                            Bachelors
                                        Skilled Manual
                                                                 Yes
                                                                          0
     998
                  3
                            Bachelors
                                             Management
                                                                          3
                                                                  No
                  3
                                                                          2
     999
                          High School
                                           Professional
                                                                 Yes
         Commute Distance
                                               Age Purchased Bike
                                     Region
                 0-1 Miles
                                     Europe
                                              42.0
     0
                                                                 No
     1
                 0-1 Miles
                                     Europe
                                              43.0
                                                                 No
     2
                 2-5 Miles
                                     Europe
                                              60.0
                                                                 No
     3
                5-10 Miles
                                    Pacific
                                              41.0
                                                                Yes
```

4	0-1 Miles	Europe	36.0	Y	es
	•••			•••	
995	2-5 Miles	North America	54.0	Y	es
996	2-5 Miles	North America	35.0	Y	es
997	0-1 Miles	North America	38.0	Y	es
998	1-2 Miles	North America	38.0		No
999	10+ Miles	North America	53.0	Y	es

[1000 rows x 15 columns]

[]: df.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 15 columns):

#	Column	Non-Null Count	Dtype
0	Unnamed: 0.1	1000 non-null	int64
1	Unnamed: 0	1000 non-null	int64
2	ID	1000 non-null	int64
3	Marital Status	1000 non-null	object
4	Gender	1000 non-null	object
5	Income	1000 non-null	float64
6	Children	1000 non-null	int64
7	Education	1000 non-null	object
8	Occupation	1000 non-null	object
9	Home Owner	1000 non-null	object
10	Cars	1000 non-null	int64
11	Commute Distance	1000 non-null	object
12	Region	1000 non-null	object
13	Age	992 non-null	float64
14	Purchased Bike	1000 non-null	object
1.	67 + 64 (0) .		`

dtypes: float64(2), int64(5), object(8)

memory usage: 117.3+ KB

[]: df.describe()

[]:		Unnamed: 0.1	Unnamed: 0	ID	Income	Children	\
	count	1000.000000	1000.000000	1000.000000	1000.000000	1000.000000	
	mean	499.500000	499.500000	19965.992000	56267.605634	1.911000	
	std	288.819436	288.819436	5347.333948	30974.380206	1.620403	
	min	0.000000	0.000000	11000.000000	10000.000000	0.000000	
	25%	249.750000	249.750000	15290.750000	30000.000000	0.000000	
	50%	499.500000	499.500000	19744.000000	60000.000000	2.000000	
	75%	749.250000	749.250000	24470.750000	70000.000000	3.000000	
	max	999.000000	999.000000	29447.000000	170000.000000	5.000000	

```
Cars
                                   Age
             1000.000000
                           992.000000
     count
     mean
                1.460000
                            44.181452
     std
                1.117877
                            11.362007
     min
                0.000000
                            25.000000
     25%
                1.000000
                            35.000000
     50%
                1.000000
                            43.000000
     75%
                2.000000
                            52.000000
                4.000000
                            89.000000
     max
Г1:
     df.head()
[]:
        Unnamed: 0.1
                        Unnamed: 0
                                        ID Marital Status
                                                             Gender
                                                                       Income
                                                                               Children
     0
                    0
                                 0
                                     12496
                                                   Married
                                                             Female
                                                                      40000.0
                                                                                       1
     1
                    1
                                 1
                                     24107
                                                   Married
                                                               Male
                                                                      30000.0
                                                                                       3
     2
                    2
                                 2
                                     14177
                                                   Married
                                                               Male
                                                                     80000.0
                                                                                       5
     3
                    3
                                 3
                                                                                       0
                                     24381
                                                    Single
                                                               Male
                                                                      70000.0
     4
                    4
                                  4
                                     25597
                                                    Single
                                                               Male
                                                                      30000.0
                                                                                       0
                               Occupation Home Owner
                                                                                   Region
               Education
                                                         Cars Commute Distance
                           Skilled Manual
     0
               Bachelors
                                                   Yes
                                                            0
                                                                      0-1 Miles
                                                                                   Europe
        Partial College
                                 Clerical
                                                   Yes
                                                            1
                                                                      0-1 Miles
                                                                                   Europe
     1
     2
        Partial College
                             Professional
                                                    No
                                                            2
                                                                      2-5 Miles
                                                                                   Europe
     3
               Bachelors
                             Professional
                                                   Yes
                                                            1
                                                                     5-10 Miles
                                                                                  Pacific
     4
                                                            0
               Bachelors
                                 Clerical
                                                    No
                                                                      0-1 Miles
                                                                                   Europe
         Age Purchased Bike
     0
        42.0
        43.0
     1
                           No
        60.0
                           No
     2
     3
        41.0
                          Yes
        36.0
                          Yes
[]:
     df.tail()
          Unnamed: 0.1
[]:
                          Unnamed: 0
                                          ID Marital Status Gender
                                                                         Income
     995
                    995
                                                                Male
                                 995
                                       23731
                                                     Married
                                                                        60000.0
     996
                    996
                                 996
                                       28672
                                                      Single
                                                                Male
                                                                        70000.0
     997
                    997
                                 997
                                       11809
                                                                Male
                                                     Married
                                                                        60000.0
     998
                    998
                                 998
                                       19664
                                                      Single
                                                                Male
                                                                       100000.0
     999
                    999
                                 999
                                       12121
                                                      Single
                                                                Male
                                                                        60000.0
           Children
                            Education
                                            Occupation Home Owner
                                                                      Cars
                                                                           \
                          High School
                                          Professional
                                                                Yes
     995
                  2
     996
                  4
                     Graduate Degree
                                                                         0
                                          Professional
                                                                Yes
     997
                  2
                            Bachelors
                                        Skilled Manual
                                                                Yes
                                                                         0
     998
                  3
                            Bachelors
                                                                 No
                                                                         3
                                            Management
```

```
999
                 3
                        High School
                                       Professional
                                                            Yes
                                                                    2
         Commute Distance
                                  Region
                                           Age Purchased Bike
     995
                2-5 Miles North America 54.0
                                                           Yes
     996
                2-5 Miles North America 35.0
                                                           Yes
     997
                0-1 Miles North America 38.0
                                                           Yes
     998
                1-2 Miles North America 38.0
                                                            No
     999
                10+ Miles North America 53.0
                                                           Yes
[]: df.shape
[]: (1000, 15)
[]: df.isnull()
[]:
          Unnamed: 0.1 Unnamed: 0
                                           Marital Status Gender Income
                                       ID
                 False
                             False False
                                                     False
                                                             False
                                                                     False
     0
     1
                 False
                             False False
                                                     False
                                                             False
                                                                     False
     2
                 False
                             False False
                                                     False
                                                             False
                                                                     False
     3
                             False False
                 False
                                                     False
                                                             False
                                                                     False
     4
                 False
                             False False
                                                     False
                                                             False
                                                                     False
                   •••
                                                       •••
                                                             •••
     . .
                             •••
                                                             False
     995
                 False
                             False False
                                                     False
                                                                     False
     996
                 False
                             False False
                                                     False
                                                             False
                                                                     False
     997
                                                     False
                 False
                             False False
                                                             False
                                                                     False
     998
                 False
                             False False
                                                     False
                                                             False
                                                                     False
     999
                 False
                             False False
                                                     False
                                                             False
                                                                     False
          Children Education Occupation Home Owner
                                                         Cars Commute Distance \
     0
             False
                        False
                                    False
                                                 False False
                                                                          False
     1
             False
                        False
                                    False
                                                 False False
                                                                          False
     2
             False
                        False
                                    False
                                                 False False
                                                                          False
     3
             False
                        False
                                    False
                                                 False False
                                                                          False
     4
             False
                        False
                                    False
                                                 False False
                                                                          False
     . .
               •••
                                                 •••
     995
             False
                        False
                                    False
                                                 False False
                                                                          False
     996
             False
                        False
                                    False
                                                 False False
                                                                          False
     997
             False
                        False
                                    False
                                                 False False
                                                                          False
     998
             False
                        False
                                    False
                                                 False False
                                                                          False
     999
             False
                                                 False False
                        False
                                    False
                                                                          False
          Region
                    Age Purchased Bike
     0
           False False
                                  False
     1
          False False
                                  False
          False False
                                  False
     3
          False False
                                  False
     4
           False False
                                  False
```

```
995
     False False
                             False
     False False
                             False
996
997
     False False
                             False
998
     False False
                             False
999
     False False
                             False
[1000 rows x 15 columns]
```

[]: df.isnull().sum()

[]: Unnamed: 0.1 0 Unnamed: 0 0 ID 0 Marital Status 0 Gender 0 Income 0 Children 0 Education 0 Occupation 0 Home Owner 0 Cars Commute Distance 0 Region 0 8 Age 0 Purchased Bike dtype: int64

[]: df.isnull().mean()

[]: Unnamed: 0.1 0.000 Unnamed: 0 0.000 ID 0.000 Marital Status 0.000 Gender 0.000 Income 0.000 Children 0.000 Education 0.000 Occupation 0.000 Home Owner 0.000 Cars 0.000 Commute Distance 0.000 Region 0.000 Age 0.008 Purchased Bike 0.000 dtype: float64

[]:		Unnamed:	0.1 U	nnamed: 0) II) Marit	tal Status	Gende	r	In	come	\
	0		0	C	12496	5	Married	Femal	e 4	100	00.0	
	1		1	1	24107	7	Married	Mal	e :	300	00.0	
	2		2	2	2 14177	7	Married	Mal	е 8	300	00.0	
	3		3	3	3 24381	_	Single	Mal	e '	700	00.0	
	4		4	4	25597	7	Single	Mal	e :	300	00.0	
	• •		•••	•••	•••			•••				
	995		995	995			Married	Mal			00.0	
	996		996	996			Single	Mal			00.0	
	997		997	997)	Married	Mal	e (300	00.0	
	998		998	998		ļ	Single	Mal	e 10	000	00.0	
	999		999	999	12121	_	Single	Mal	е (300	00.0	
		Children		Educatio	n n	Occupa	ation Home	Owner	Car	2	\	
	0	1		Bachelor		led Ma		Yes)	`	
	1	3	Parti	al Colleg			rical	Yes		1		
	2	5		al Colleg	•	cofessi		No		2		
	3	0	I GI UI	Bachelor	•	cofessi		Yes		1		
	4	0		Bachelor			rical	No		0		
		•••		•••		•••	•••	•••				
	995	2	H:	igh Schoo	ol Pr	ofessi	ional	Yes		2		
	996	4		ate Degre		ofessi	ional	Yes	(О		
	997	2		Bachelor		led Ma	anual	Yes	(С		
	998	3		Bachelor	:s	Manage	ement	No	;	3		
	999	3	H:	igh Schoo	ol Pr	ofessi		Yes	:	2		
		Commute Di			Region	_	Purchased					
	0		Miles		Europe	42.0		No				
	1		Miles		Europe	43.0		No				
	2		Miles		Europe	60.0		No				
	3		Miles	P	acific	41.0		Yes				
	4	0-1	Miles		Europe	36.0		Yes				
	• •		•••				•••					
	995	2-5	Miles	North A	Merica	54.0		Yes				
	996	2-5	Miles	North A	merica	35.0		Yes				
	997	0-1	Miles	North A	Merica	38.0		Yes				
	998	1-2	Miles	North A	Merica	38.0		No				
	999	10+	Miles	North A	merica	53.0		Yes				

[1000 rows x 15 columns]

1 LINEAR REGRESSION

```
[]: from sklearn.linear_model import LinearRegression
     lr=LinearRegression()
[]: train = df1[df1["Age"].notnull()]
     test = df1[df1["Age"].isnull()]
[]: train.head()
[]:
        Unnamed: 0.1
                       Unnamed: 0
                                       ID Marital Status
                                                           Gender
                                                                     Income
                                                                              Children
                    0
                                    12496
                                                           Female
                                                                    40000.0
                                                  Married
     1
                    1
                                 1
                                    24107
                                                              Male
                                                                    30000.0
                                                                                     3
                                                  Married
                    2
                                                                                     5
     2
                                                                    80000.0
                                    14177
                                                  Married
                                                              Male
                    3
                                 3
     3
                                    24381
                                                   Single
                                                              Male
                                                                    70000.0
                                                                                     0
     4
                    4
                                 4
                                    25597
                                                                    30000.0
                                                                                     0
                                                   Single
                                                              Male
              Education
                               Occupation Home Owner
                                                       Cars Commute Distance
                                                                                 Region
                          Skilled Manual
                                                          0
     0
              Bachelors
                                                  Yes
                                                                                 Europe
                                                                    0-1 Miles
        Partial College
                                 Clerical
                                                  Yes
                                                          1
                                                                    0-1 Miles
                                                                                 Europe
                                                          2
        Partial College
                            Professional
                                                   No
                                                                    2-5 Miles
                                                                                 Europe
     3
              Bachelors
                            Professional
                                                  Yes
                                                          1
                                                                   5-10 Miles
                                                                                Pacific
     4
              Bachelors
                                 Clerical
                                                   No
                                                          0
                                                                    0-1 Miles
                                                                                 Europe
         Age Purchased Bike
     0 42.0
       43.0
     1
                          No
     2 60.0
                          No
     3 41.0
                         Yes
        36.0
                         Yes
[]: test.head()
          Unnamed: 0.1
[]:
                         Unnamed: 0
                                         ID Marital Status
                                                             Gender
                                                                            Income
                      9
                                   9
                                      19280
                                                                      56267.60563
     9
                                                    Married
                                                                Male
     98
                     98
                                  98
                                      19441
                                                    Married
                                                                Male
                                                                      40000.00000
     225
                    225
                                 225
                                      14135
                                                    Married
                                                                Male
                                                                      20000.00000
     371
                                      22918
                                                                      80000.00000
                    371
                                 371
                                                     Single
                                                                Male
     554
                    554
                                 554
                                      18580
                                                    Married
                                                            Female
                                                                      60000.00000
          Children
                           Education
                                         Occupation Home Owner
                                                                  Cars
     9
                     Partial College
                                             Manual
                                                             Yes
                                                                     1
     98
                     Graduate Degree
                                           Clerical
                                                             Yes
                                                                     0
                                                             Yes
                                                                     0
     225
                     Partial College
                                             Manual
                     Graduate Degree
                                         Management
                                                             Yes
                                                                     3
     371
     554
                     Graduate Degree
                                       Professional
                                                             Yes
```

```
Commute Distance
                                     Region
                                             Age Purchased Bike
     9
                 0-1 Miles
                                                              Yes
                                     Europe
                                             NaN
     98
                 0-1 Miles
                                     Europe
                                             NaN
                                                              Yes
     225
                 1-2 Miles
                                     Europe
                                             NaN
                                                               No
     371
                 0-1 Miles
                                   Pacific
                                             NaN
                                                               No
     554
                 2-5 Miles
                            North America
                                             NaN
                                                              Yes
[]:
     y=train["Age"]
[]: x=train.drop(["Age", "Marital Status", "Gender", "Education", "Occupation", "Home
       ⊖Owner", "Region", "Purchased Bike", "Commute Distance", "Unnamed: 0.1", "Unnamed:
       \hookrightarrow0"],axis=1)
[]: x.head()
[]:
            ID
                 Income
                          Children
                                    Cars
                40000.0
                                        0
        12496
                                 1
     1
        24107
                30000.0
                                 3
                                        1
                                 5
                                        2
       14177
                80000.0
        24381
                70000.0
                                 0
                                        1
     3
        25597
                30000.0
                                 0
                                        0
[]:
    lr.fit(x,y)
[]: LinearRegression()
[]:
     test
[]:
          Unnamed: 0.1
                          Unnamed: 0
                                          ID Marital Status
                                                               Gender
                                                                             Income
     9
                      9
                                   9
                                       19280
                                                     Married
                                                                 Male
                                                                       56267.60563
     98
                     98
                                       19441
                                  98
                                                     Married
                                                                 Male
                                                                        40000.00000
     225
                    225
                                 225
                                       14135
                                                     Married
                                                                 Male
                                                                        20000.00000
     371
                    371
                                 371
                                       22918
                                                      Single
                                                                 Male
                                                                        80000.00000
     554
                    554
                                 554
                                       18580
                                                                        60000.00000
                                                     Married
                                                              Female
     688
                    688
                                 688
                                       11699
                                                      Single
                                                                 Male
                                                                        60000.00000
     770
                    770
                                 770
                                       17699
                                                     Married
                                                                 Male
                                                                        60000.00000
     986
                    986
                                 986
                                       23704
                                                      Single
                                                                 Male
                                                                        40000.00000
          Children
                                            Occupation Home Owner
                            Education
                                                                     Cars
                                                                            \
     9
                     Partial College
                                                 Manual
                                                                Yes
                                                                         1
     98
                     Graduate Degree
                                              Clerical
                                                                Yes
                                                                         0
                  0
     225
                     Partial College
                                                                Yes
                                                                         0
                                                Manual
     371
                  5
                     Graduate Degree
                                            Management
                                                                Yes
                                                                         3
                  2
                     Graduate Degree
                                          Professional
                                                                         0
     554
                                                                Yes
     688
                  2
                            Bachelors
                                        Skilled Manual
                                                                 No
                                                                         2
     770
                  1
                     Graduate Degree
                                        Skilled Manual
                                                                 No
                                                                         0
     986
                  5
                          High School
                                          Professional
                                                                Yes
                                                                         4
```

```
Commute Distance
                                   Region
                                           Age Purchased Bike
     9
                0-1 Miles
                                   Europe
                                           NaN
                                                           Yes
                0-1 Miles
     98
                                   Europe
                                           NaN
                                                           Yes
     225
                1-2 Miles
                                   Europe
                                           NaN
                                                           No
     371
                0-1 Miles
                                  Pacific
                                          \tt NaN
                                                           Nο
     554
                2-5 Miles North America NaN
                                                           Yes
                0-1 Miles North America NaN
     688
                                                           Nο
     770
                0-1 Miles North America NaN
                                                           No
     986
                10+ Miles North America NaN
                                                           Yes
[]: x_new=test.drop(["Age","Marital Status","Gender","Education","Occupation","Home_
      ⇔Owner", "Region", "Purchased Bike", "Commute Distance", "Unnamed: 0.1", "Unnamed: ⊔
      \circlearrowleft0"],axis=1)
[]: x_new.head()
[]:
                              Children
                                         Cars
             ID
                      Income
     9
          19280
                 56267.60563
                                            1
                                      0
     98
          19441
                 40000.00000
                                            0
     225 14135
                 20000.00000
                                      1
                                            0
     371 22918
                 80000,00000
                                      5
                                            3
     554 18580 60000.00000
                                      2
                                            0
[]: pred=lr.predict(x_new)
[]: pred
[]: array([44.38300953, 36.68285017, 40.55618041, 55.82211518, 44.06780402,
            45.39772594, 40.54533003, 55.88701149])
[]: test["Age"]=pred
    <ipython-input-35-be88c5391501>:1: SettingWithCopyWarning:
    A value is trying to be set on a copy of a slice from a DataFrame.
    Try using .loc[row_indexer,col_indexer] = value instead
    See the caveats in the documentation: https://pandas.pydata.org/pandas-
    docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
      test["Age"]=pred
[]: test
[]:
          Unnamed: 0.1
                        Unnamed: 0
                                        ID Marital Status
                                                           Gender
                                                                         Income
                                    19280
                                                  Married
                                                             Male
                                                                    56267.60563
     9
                     9
                                  9
     98
                    98
                                 98 19441
                                                  Married
                                                             Male
                                                                    40000.00000
     225
                   225
                                225 14135
                                                  Married
                                                             Male
                                                                    20000.00000
```

	371		371	371	22918	S	ingle	Male	80000.00	0000	
	554		554	554			rried	Female			
	688		688	688	11699	S	ingle	Male	60000.00	0000	
	770		770	770	17699	Max	rried	Male	60000.00	0000	
	986		986	986	23704			Male	40000.00		
	900		900	900	23104	۵.	ingle	Male	40000.00	0000	
		Children	E	Education	n (Occupation	Home	Owner (Cars \		
	9	2	Dartial	College		Manual		Yes	1		
				_							
	98	0	Graduat	e Degre	е	Clerical		Yes	0		
	225	1	Partial	College	е	Manual		Yes	0		
	371	5	Graduat	e Degre	e 1	Management		Yes	3		
				_		_					
	554	2		e Degre		ofessional		Yes	0		
	688	2	В	Bachelor	s Skill	led Manual		No	2		
	770	1	Graduat	e Degre	e Skil	led Manual		No	0		
	986	5		gh School		ofessional		Yes	4		
	900	5	птв	gii Schoo.	T PI	Diessional		ies	4		
		Commute Di	stance]	Region	Age	Purch	nased Bil	кe		
	9	0-1	Miles		Europe	•			es		
					_						
	98		Miles		Europe			Υ e	es		
	225	1-2	Miles]	Europe	40.556180		1	Vо		
	371	0-1	Miles	P:	acific	55.822115		1	No.		
	554					44.067804			es		
	688	0-1	Miles	North A	nerica	45.397726		1	Vо		
	770	0-1	Miles	North A	merica	40.545330		1	Vο		
	770			North A					No		
	770 986			North A				I Ye			
[]:		10+									
[]:	986	10+									
	986	10+	Miles	North A	merica	55.887011	tatua	Ye	es	a \	
[]:	986	10+	Miles 0.1 Unn	North Annamed: 0	merica ID	55.887011 Marital St		Ye	Incom		
	986	10+	Miles	North A	merica	55.887011 Marital St	tatus rried	Ye	es		
	986	10+	Miles 0.1 Unn	North Annamed: 0	merica ID	55.887011 Marital St		Ye	Incom	0	
	986 trai	10+	Miles 0.1 Unn 0 1	North Annamed: 0	ID 12496 24107	55.887011 Marital St Max	rried rried	Gender Female Male	Income 40000.0 30000.0	0	
	986 trai	10+	Miles 0.1 Unn 0 1 2	North Annamed: 0 0 1 2	ID 12496 24107 14177	55.887011 Marital St Mar Mar Mar	rried rried rried	Gender Female Male	Income 4000.0 30000.0	0 0 0	
	986 trai 0 1 2 3	10+	Miles 0.1 Unn 0 1 2 3	North Annamed: 0	ID 12496 24107 14177 24381	Marital St Mar Mar Mar Mar St St Mar Mar Mar Mar St St Mar Mar St Mar St Mar	rried rried rried ingle	Gender Female Male Male	Income 40000.0 30000.0 80000.0 70000.0	0 0 0 0	
	986 trai	10+	Miles 0.1 Unn 0 1 2	North Annamed: 0 0 1 2	ID 12496 24107 14177 24381	Marital St Mar Mar Mar Mar St St Mar Mar Mar Mar St St Mar Mar St Mar St Mar	rried rried rried	Gender Female Male	Income 4000.0 30000.0	0 0 0 0	
	986 trai	n Unnamed:	Miles 0.1 Unn 0 1 2 3 4	named: 0 0 1 2 3	ID 12496 24107 14177 24381 25597	Marital St Mar Mar Mar Mar St St Mar Mar Mar Mar St St Mar Mar St Mar St Mar	rried rried rried ingle	Gender Female Male Male Male	Income 40000.0 30000.0 80000.0 70000.0	0 0 0 0	
	986 trai	10+ n Unnamed:	Miles 0.1 Unn 0 1 2 3 4	named: 0 0 1 2 3 4	ID 12496 24107 14177 24381 25597	Marital St Mar Mar Mar Mar S: S:	rried rried rried ingle ingle 	Gender Female Male Male Male Male	Income 4000.0 30000.0 80000.0 70000.0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
	986 trai	10+ In Unnamed:	Miles 0.1 Unn 0 1 2 3 4	named: 0 0 1 2 3 4 	ID 12496 24107 14177 24381 25597 	Marital St Marital St Mar Mar Mar St St 	rried rried rried ingle ingle rried	Gender Female Male Male Male Male 	Income 40000.0 30000.0 70000.0 30000.0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
	986 trai	10+ In Unnamed:	Miles 0.1 Unn 0 1 2 3 4	named: 0 0 1 2 3 4	ID 12496 24107 14177 24381 25597	Marital St Mar Mar Mar Mar S: S: 	rried rried rried ingle ingle rried ingle	Gender Female Male Male Male Male	Income 4000.0 30000.0 70000.0 60000.0 70000.0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
	986 trai	10+ In Unnamed:	Miles 0.1 Unn 0 1 2 3 4	named: 0 0 1 2 3 4 	ID 12496 24107 14177 24381 25597 23731 28672	Marital St Mar Mar Mar Mar S: S: 	rried rried rried ingle ingle rried	Gender Female Male Male Male Male 	Income 40000.0 30000.0 70000.0 30000.0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
	986 trai 0 1 2 3 4 995 996 997	10+ In Unnamed:	Miles 0.1 Unn 0 1 2 3 4 995 996	named: 0 0 1 2 3 4 995 996	ID 12496 24107 14177 24381 25597 23731 28672 11809	Marital St Mar Mar Mar St St St Mar	rried rried rried ingle ingle rried ingle rried	Gender Female Male Male Male Male Male Male	Income 4000.0 30000.0 80000.0 70000.0 60000.0		
	986 trai 0 1 2 3 4 995 996 997 998	10+ In Unnamed:	Miles 0.1 Unn 0 1 2 3 4 995 996 997	named: 0 0 1 2 3 4 995 996 997 998	ID 12496 24107 14177 24381 25597 23731 28672 11809 19664	Marital St St Marital St Ma	rried rried rried ingle ingle rried ingle rried ingle	Gender Female Male Male Male Male Male Male Male	Income 4000.0 3000.0 7000.0 30000.0 60000.0 100000.0		
	986 trai 0 1 2 3 4 995 996 997	10+ In Unnamed:	Miles 0.1 Unn 0 1 2 3 4 995 996	named: 0 0 1 2 3 4 995 996	ID 12496 24107 14177 24381 25597 23731 28672 11809	Marital St St Marital St Ma	rried rried rried ingle ingle rried ingle rried	Gender Female Male Male Male Male Male Male	Income 4000.0 30000.0 80000.0 70000.0 60000.0		
	986 trai 0 1 2 3 4 995 996 997 998	10+ In Unnamed:	Miles 0.1 Unn 0 1 2 3 4 995 996 997	named: 0 0 1 2 3 4 995 996 997 998	ID 12496 24107 14177 24381 25597 23731 28672 11809 19664	Marital St St Marital St Ma	rried rried rried ingle ingle rried ingle rried ingle	Gender Female Male Male Male Male Male Male Male	Income 4000.0 3000.0 7000.0 30000.0 60000.0 100000.0		
	986 trai 0 1 2 3 4 995 996 997 998	n Unnamed:	Miles 0.1 Unn 0 1 2 3 4 995 996 997 998 999	named: 0 0 1 2 3 4 995 996 997 998 999	ID 12496 24107 14177 24381 25597 23731 28672 11809 19664 12121	Marital St Mar Mar Mar Mar St St St Mar St	rried rried rried ingle ingle ingle rried ingle rried ingle ingle ingle	Gender Female Male Male Male Male Male Male Male	Income 4000.0 30000.0 80000.0 70000.0 60000.0 100000.0		
	986 trai	10+ In Unnamed: Children	Miles 0.1 Unn 0 1 2 3 4 995 996 997 998 999	named: 0 0 1 2 3 4 995 996 997 998 999	ID 12496 24107 14177 24381 25597 23731 28672 11809 19664 12121	Marital Si Marital Si Marital Si Marital Si Marital Si Si Si Marital Si Marital Si Si Occupation	rried rried rried ingle ingle ingle rried ingle rried ingle ingle ingle	Gender Female Male Male Male Male Male Male Male M	Income 4000.0 30000.0 80000.0 70000.0 60000.0 100000.0 60000.0		
	986 trai 0 1 2 3 4 995 996 997 998 999	10+ In Unnamed: Children	Miles 0.1 Unn 0 1 2 3 4 995 996 997 998 999	named: 0 0 1 2 3 4 995 996 997 998 999	ID 12496 24107 14177 24381 25597 23731 28672 11809 19664 12121 n (6	Marital St Marital St Marital St Marital St Marital St Marital St St Cocupation Led Manual	rried rried rried ingle ingle rried ingle ingle ingle Home	Gender Female Male Male Male Male Male Male Male M	Income 4000.0 30000.0 80000.0 70000.0 60000.0 100000.0 60000.0		
	986 trai	10+ In Unnamed: Children	Miles 0.1 Unn 0 1 2 3 4 995 996 997 998 999	named: 0 0 1 2 3 4 995 996 997 998 999	ID 12496 24107 14177 24381 25597 23731 28672 11809 19664 12121 0 S Skill	Marital Standard Marital Clerical	rried rried rried ingle ingle ingle rried ingle rried ingle Home	Gender Female Male Male Male Male Male Male Male M	Income 4000.0 30000.0 80000.0 70000.0 60000.0 100000.0 60000.0		
	986 trai 0 1 2 3 4 995 996 997 998 999	10+ In Unnamed: Children	Miles 0.1 Unn 0 1 2 3 4 995 996 997 998 999	named: 0 0 1 2 3 4 995 996 997 998 999	ID 12496 24107 14177 24381 25597 23731 28672 11809 19664 12121 0 S Skill	Marital St Marital St Marital St Marital St Marital St Marital St St Cocupation Led Manual	rried rried rried ingle ingle ingle rried ingle rried ingle Home	Gender Female Male Male Male Male Male Male Male M	Income 4000.0 30000.0 80000.0 70000.0 60000.0 100000.0 60000.0		
	986 trai 0 1 2 3 4 995 996 997 998 999	Unnamed: Children 1 3 5	Miles 0.1 Unn 0 1 2 3 4 995 996 997 998 999 E Partial Partial	named: 0 0 1 2 3 4 995 996 997 998 999 Education Sachelor: College	ID 12496 24107 14177 24381 25597 23731 28672 11809 19664 12121 n (s) Skille	Marital St Marital St Marital St Marital St Marital St Marital St St St Cocupation In Manual Clerical ofessional	rried rried rried ingle ingle rried ingle ingle tried ingle ingle Home	Gender Female Male Male Male Male Male Male Male M	Income 40000.0 30000.0 80000.0 70000.0 60000.0 100000.0 Cars \ 0 1 2		
	986 trai 0 1 2 3 4 995 996 997 998 999	Unnamed: Children 1 3 5 0	Miles 0.1 Unn 0 1 2 3 4 995 996 997 998 999 E Partial Partial	named: 0 0 1 2 3 4 995 996 997 998 999 Education Bachelor: College College	ID 12496 24107 14177 24381 25597 23731 28672 11809 19664 12121 Skiller Pros	Marital Standard Marita	rried rried rried ingle ingle rried ingle ingle tried ingle ingle Home	Gender Female Male Male Male Male Male Male Male M	Income 40000.0 30000.0 70000.0 30000.0 60000.0 100000.0 Cars \ 0 1 2 1		
	986 trai 0 1 2 3 4 995 996 997 998 999	Unnamed: Children 1 3 5	Miles 0.1 Unn 0 1 2 3 4 995 996 997 998 999 E Partial Partial	named: 0 0 1 2 3 4 995 996 997 998 999 Education Sachelor: College	ID 12496 24107 14177 24381 25597 23731 28672 11809 19664 12121 Skiller Pros	Marital St Marital St Marital St Marital St Marital St Marital St St St Cocupation In Manual Clerical ofessional	rried rried rried ingle ingle rried ingle ingle tried ingle ingle Home	Gender Female Male Male Male Male Male Male Male M	Income 40000.0 30000.0 80000.0 70000.0 60000.0 100000.0 Cars \ 0 1 2		

			•••		•••	•••	•••			
 995	 2	Hi	gh School	Pr	ofession	al	Yes	2		
996	4		te Degree		ofession		Yes	0		
997	2		Bachelors		led Manu		Yes	0		
998	3		Bachelors		Manageme		No	3		
999	3	Hi	gh School		ofession		Yes	2		
			_							
(Commute Di	stance	R	egion	Age Pu	rchased	Bike			
0	0-1	Miles	E	urope	42.0		No			
1	0-1	Miles	E	urope	43.0		No			
2	2-5	Miles	E	urope	60.0		No			
3	5-10	Miles	Pa	cific	41.0		Yes			
4	0-1	Miles	E	urope	36.0		Yes			
						•••				
995	2-5	Miles	North Am	erica	54.0		Yes			
996	2-5	Miles	North Am		35.0		Yes			
997		Miles	North Am		38.0		Yes			
998	1-2	Miles	North Am	erica	38.0		No			
99	10+	Miles	North Am	erica	53.0		Yes			
	l_data=pd.		[train,te	st],ax	is=0)					
	l_data=pd. l_data.tai		[train,te	est],ax	is=0)					
ina	l_data.tai Unnamed:	1() 0.1 Un	[train,te	ID	Marital	Status	Gender	Inco		\
ina	l_data.tai Unnamed:	1() 0.1 Un: 371		ID 22918	Marital	Status Single	Male	80000	0.0	\
fina 371 554	l_data.tai Unnamed:	1() 0.1 Un: 371 554	named: 0 371 554	ID 22918 18580	Marital	Single Married	Male Female	80000 60000	0.0	\
fina 371 554 388	l_data.tai Unnamed:	1() 0.1 Un: 371 554 688	named: 0 371 554 688	ID 22918 18580 11699	Marital	Single Married Single	Male Female Male	80000 60000 60000	0.0	\
371 554 588 770	l_data.tai Unnamed:	1() 0.1 Un: 371 554 688 770	named: 0 371 554 688 770	ID 22918 18580 11699 17699	Marital	Single Married Single Married	Male Female Male Male	80000 60000 60000	0.0	\
371 554 588 770	l_data.tai Unnamed:	1() 0.1 Un: 371 554 688	named: 0 371 554 688	ID 22918 18580 11699	Marital	Single Married Single	Male Female Male	80000 60000 60000	0.0	\
371 554 588 770	l_data.tai Unnamed:	1() 0.1 Un: 371 554 688 770 986	named: 0 371 554 688 770	ID 22918 18580 11699 17699 23704	Marital	Single Married Single Married Single	Male Female Male Male Male	80000 60000 60000	0.0	\
371 554 588 770 986	l_data.tai Unnamed:	1() 0.1 Un: 371 554 688 770 986	named: 0 371 554 688 770 986	ID 22918 18580 11699 17699 23704	Marital Occupati	Single Married Single Married Single on Home	Male Female Male Male Male	80000 60000 60000 40000	0.0	\
371 554 588 770 986	l_data.tai Unnamed: Children	1() 0.1 Un 371 554 688 770 986	named: 0 371 554 688 770 986	ID 22918 18580 11699 17699 23704	Marital	Single Married Single Married Single on Home nt	Male Female Male Male Male	80000 60000 60000 40000	0.0	\
	l_data.tai Unnamed: Children	1() 0.1 Un: 371 554 688 770 986 Gradua	named: 0 371 554 688 770 986 Education	ID 22918 18580 11699 17699 23704	Marital Occupati Manageme	Single Married Single Married Single on Home nt	Male Female Male Male Male Owner Yes	80000 60000 60000 40000 Cars	0.0	\
fina 371 554 588 770 986 371 554 588	l_data.tai Unnamed: Children 5 2	1() 0.1 Un 371 554 688 770 986 Gradua Gradua	named: 0 371 554 688 770 986 Education te Degree	ID 22918 18580 11699 17699 23704 Pr	Marital Occupati Manageme ofession	Single Married Single Married Single on Home nt al	Male Female Male Male Male Owner Yes Yes	80000 60000 60000 40000 Cars 3	0.0	\
fina 371 554 588 770 986 371 554 588 770	l_data.tai Unnamed: Children 5 2 2	1() 0.1 Un: 371 554 688 770 986 Gradua Gradua	named: 0 371 554 688 770 986 Education te Degree te Degree Bachelors	ID 22918 18580 11699 17699 23704 Pr Skil	Marital Occupati Manageme ofession led Manu	Single Married Single Married Single on Home nt al al	Male Female Male Male Male Owner Yes Yes No	80000 60000 60000 40000 Cars 3 0	0.0	\
371 554 588 770 986 371 554 588	l_data.tai Unnamed: Children 5 2 2 1	1() 0.1 Un: 371 554 688 770 986 Gradua Gradua	named: 0 371 554 688 770 986 Education te Degree te Degree Bachelors te Degree	ID 22918 18580 11699 17699 23704 Pr Skil	Marital Occupati Manageme ofession led Manu led Manu	Single Married Single Married Single on Home nt al al	Male Female Male Male Male Owner Yes Yes No	80000 60000 60000 40000 Cars 3 0 2	0.0	\
fina 371 554 688 770 986 371 554 688 770 986	l_data.tai Unnamed: Children 5 2 2 1	1() 0.1 Un: 371 554 688 770 986 Gradua Gradua Hi	named: 0 371 554 688 770 986 Education te Degree te Degree Bachelors te Degree gh School	ID 22918 18580 11699 17699 23704 Pr Skil	Occupati Manageme ofession led Manu led Manu ofession	Single Married Single Married Single on Home nt al al	Male Female Male Male Male Owner Yes Yes No No Yes	80000 60000 60000 40000 Cars 3 0 2 0 4	0.0	\
fina 371 554 588 770 986 371 554 588 770 986	l_data.tai Unnamed: Children 5 2 1 5 Commute Di	1() 0.1 Un: 371 554 688 770 986 Gradua Gradua Hi	named: 0 371 554 688 770 986 Education te Degree te Degree Bachelors te Degree gh School	ID 22918 18580 11699 17699 23704 Pr Skil Pr	Occupati Manageme ofession led Manu led Manu ofession	Single Married Single Married Single on Home nt al al al al ge Purch	Male Female Male Male Male Owner Yes Yes No No Yes	80000 60000 60000 40000 Cars 3 0 2 0 4	0.0	\
fina 371 554 588 770 986 371 554 588 770 986	l_data.tai Unnamed: Children 5 2 2 1 5 Commute Di 0-1	1() 0.1 Un: 371 554 688 770 986 Gradua Gradua Hi	named: 0 371 554 688 770 986 Education te Degree te Degree Bachelors te Degree gh School	ID 22918 18580 11699 17699 23704 Pr Skil Pr Skil Pr Legion	Occupati Manageme ofession led Manu led Manu ofession	Single Married Single Married Single on Home nt al al al al ge Purch	Male Female Male Male Male Owner Yes Yes No No Yes hased Bil	80000 60000 60000 40000 Cars 3 0 2 0 4	0.0	\
fina 371 554 588 770 986 371 554 588 770 986	l_data.tai Unnamed: Children 5 2 1 5 Commute Di 0-1 2-5	1() 0.1 Un: 371 554 688 770 986 Gradua Gradua Hi stance Miles	named: 0 371 554 688 770 986 Education te Degree Bachelors te Degree gh School	ID 22918 18580 11699 17699 23704 Pr Skill Pr Legion Leific	Occupati Manageme ofession led Manu ofession A 55.8221	Single Married Single Married Single on Home nt al al al ge Purch 15	Male Female Male Male Male Owner Yes Yes No No Yes Aased Bil	80000 60000 60000 40000 Cars 3 0 2 0 4	0.0	\
371 554 588 770 986 371 554 588 770 986	l_data.tai Unnamed: Children 5 2 1 5 Commute Di 0-1 2-5 0-1	1() 0.1 Un 371 554 688 770 986 Gradua Gradua Hi stance Miles Miles	named: 0 371 554 688 770 986 Education te Degree Bachelors te Degree gh School R Pa North Am	ID 22918 18580 11699 17699 23704 Pr Skil Pr Legion cific lerica lerica	Occupati Manageme ofession led Manu ofession A 55.8221 44.0678	Single Married Single Married Single on Home nt al al al ge Purch 15 04	Male Female Male Male Male Owner Yes Yes No No Yes Aased Bil	80000 60000 60000 40000 Cars 3 0 2 0 4	0.0	\

```
[]: final_data.reset_index(drop=True,inplace=True)
     final_data.head()
[]:
        Unnamed: 0.1
                                                           Gender
                                                                     Income
                                                                              Children
                       Unnamed: 0
                                       ID Marital Status
                                    12496
                                                                    40000.0
     0
                    0
                                 0
                                                  Married
                                                            Female
                                                                                     1
     1
                    1
                                 1
                                    24107
                                                                    30000.0
                                                                                     3
                                                  Married
                                                              Male
     2
                    2
                                 2
                                    14177
                                                  Married
                                                              Male
                                                                    80000.0
                                                                                     5
     3
                    3
                                 3
                                    24381
                                                   Single
                                                              Male
                                                                    70000.0
                                                                                     0
                                                                    30000.0
                                                                                     0
                                 4
                                    25597
                                                   Single
                                                              Male
              Education
                               Occupation Home Owner
                                                       Cars Commute Distance
                                                                                 Region
                          Skilled Manual
                                                  Yes
                                                          0
     0
              Bachelors
                                                                    0-1 Miles
                                                                                 Europe
                                                          1
     1
        Partial College
                                 Clerical
                                                  Yes
                                                                    0-1 Miles
                                                                                 Europe
        Partial College
                                                          2
                                                                    2-5 Miles
                            Professional
                                                   No
                                                                                 Europe
                                                                   5-10 Miles
     3
              Bachelors
                            Professional
                                                  Yes
                                                           1
                                                                                Pacific
     4
              Bachelors
                                 Clerical
                                                   Nο
                                                           0
                                                                    0-1 Miles
                                                                                 Europe
         Age Purchased Bike
        42.0
                          No
     0
     1 43.0
                          No
     2 60.0
                          No
        41.0
     3
                         Yes
        36.0
                         Yes
[]: final_data.tail()
[]:
          Unnamed: 0.1
                         Unnamed: 0
                                         ID Marital Status
                                                             Gender
                                                                       Income
     995
                    371
                                 371
                                      22918
                                                                Male
                                                                      80000.0
                                                     Single
     996
                                 554
                    554
                                      18580
                                                    Married
                                                             Female
                                                                      60000.0
     997
                    688
                                 688
                                      11699
                                                     Single
                                                                Male
                                                                      60000.0
     998
                    770
                                 770
                                      17699
                                                    Married
                                                                Male
                                                                      60000.0
     999
                    986
                                 986
                                      23704
                                                     Single
                                                                Male
                                                                      40000.0
                                                                    Cars
          Children
                           Education
                                           Occupation Home Owner
     995
                  5
                     Graduate Degree
                                           Management
                                                               Yes
                                                                       3
                     Graduate Degree
                                                                       0
     996
                                         Professional
                                                               Yes
                  2
                                                                       2
     997
                           Bachelors
                                       Skilled Manual
                                                                No
     998
                  1
                     Graduate Degree
                                       Skilled Manual
                                                                No
                                                                       0
     999
                  5
                         High School
                                         Professional
                                                               Yes
         Commute Distance
                                    Region
                                                   Age Purchased Bike
     995
                 0-1 Miles
                                   Pacific
                                            55.822115
                                                                    Nο
     996
                 2-5 Miles
                            North America
                                            44.067804
                                                                   Yes
     997
                 0-1 Miles
                            North America 45.397726
                                                                    No
     998
                 0-1 Miles
                            North America 40.545330
                                                                    No
     999
                 10+ Miles North America 55.887011
                                                                   Yes
```

```
[]: # Now Age has O null value.
final_data["Age"].isnull().mean()
```

[]: 0.0

2 THANK YOU