predicting_diamond_prices

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1 Predicting Diamond Prices

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## Introduction

A jewelry company wants to put in a bid to purchase a large set of diamonds, but is unsure how much it should bid. The results from a predictive model were used to make a recommendation on how much the jewelry company should bid for a set of 3,000 diamonds in USD (United States Dollar).

1. Carat represents the weight of the diamond, and is a numerical variable.

- Cut represents the quality of the cut of the diamond, and falls into 5 categories: fair, good, very good, ideal, and premium. Each of these categories are represented by a number, 1-5, in the Cut_Ord variable.
- Clarity represents the internal purity of the diamond, and falls into 8 categories: I1, SI2, SI1, VS1, VS2, VVS2, VVS1, and IF. Each of these categories are represented by a number, 1-8, in the Clarity_Ord variable.

- Note: Transforming category variables to ordinal variables like this is not always appropriate, but we've done it here for simplicity.

### Termonolgy

1. *Carat* represents the weight of the diamond, and is a numerical variable.

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- *Clarity* represents the internal purity of the diamond, and falls into 8 categories: I1, SI2, SI1, VS1, VS2, VVS2, VVS1, and IF. Each of these categories are represented by a number, 1-8, in the *Clarity_Ord* variable.
- Note: Transforming category variables to ordinal variables like this is not always appropriate, but we've done it here for simplicity.

## Gather Data

```
In [1]: import pandas as pd
        import numpy as np
        import matplotlib.pyplot as plt
        from matplotlib.patches import FancyBboxPatch
        import seaborn as sns
        import scipy.stats as stats
```

```
In [2]: df_given_original = pd.read_csv('./diamond-data/diamonds.csv')
```

```
In [3]: df_predicted_original = pd.read_csv('./diamond-data/new-diamonds.csv')
```

```
In [4]: df_given = df_given_original.copy()
```

```
In [5]: df_predicted = df_predicted_original.copy()
```

## Assess Data

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

```
Out[6]:    Unnamed: 0  carat        cut  cut_ord color clarity  clarity_ord
        0           1   1.22    Premium        4     G     SI1            3
        1           2   1.01       Good        2     G     VS2            5
        2           3   0.71  Very Good        3     I     VS2            5
        3           4   1.01      Ideal        5     D     SI2            2
        4           5   0.27      Ideal        5     H    VVS2            6
```

## Clean Data

```
In [7]: # df.rename(columns={ df.columns[0]: "index" }, inplace = True)
        df_predicted.drop(columns={ df_predicted.columns[0]}, inplace = True)
```

```
In [8]: df_predicted.head()
```

```
Out[8]:    carat        cut  cut_ord color clarity  clarity_ord
        0   1.22    Premium        4     G     SI1            3
        1   1.01       Good        2     G     VS2            5
        2   0.71  Very Good        3     I     VS2            5
        3   1.01      Ideal        5     D     SI2            2
        4   0.27      Ideal        5     H    VVS2            6
```

```
In [9]: # linear regression model
        # - 5,269 + 8,413 x Carat + 158.1 x Cut + 454 x Clarity

        given1 = -5269
        given2 = 8413
        given3 = 158.1
        given4 = 454

        df_predicted['price'] = given1 + (given2 * df_predicted['carat']) + (given3 * df_predi
        # df.sort_values(['price'], inplace = True)
        df_predicted.head(3)
```

```
Out[9]:    carat        cut  cut_ord color clarity  clarity_ord    price
        0   1.22    Premium        4     G     SI1            3  6989.26
        1   1.01       Good        2     G     VS2            5  5814.33
        2   0.71  Very Good        3     I     VS2            5  3448.53
```

```
In [10]: # bid price, 70% of pridicted final price

         df_predicted['bid'] = df_predicted['price'] * 0.7
         df_predicted.head(3)
```

```
Out[10]:    carat        cut  cut_ord color clarity  clarity_ord    price       bid
         0   1.22    Premium        4     G     SI1            3  6989.26  4892.482
         1   1.01       Good        2     G     VS2            5  5814.33  4070.031
         2   0.71  Very Good        3     I     VS2            5  3448.53  2413.971
```

```
In [11]: df_predictedNegativePrices = df_predicted[df_predicted.price < 0]
         df_predictedNegativePrices.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 291 entries, 13 to 2963
Data columns (total 8 columns):
carat          291 non-null float64
cut            291 non-null object
cut_ord        291 non-null int64
color          291 non-null object
clarity        291 non-null object
clarity_ord    291 non-null int64
price          291 non-null float64
bid            291 non-null float64
dtypes: float64(3), int64(2), object(3)
```

```
memory usage: 20.5+ KB
```

### Calculate Price Difference

```
In [12]: # df_given.at[df_given['carat'].eq(1).idxmax(),'bid']
```

```
In [13]: # df_given.loc[df_given['carat'] == 1, 'bid'].iloc[0]
```

```
In [14]: def returnDiamonPrice(carat, cut, clarity):
             return df_predicted.loc[(df_predicted['carat'] == carat) &
                                     (df_predicted['cut'] == cut) &
                                     (df_predicted['clarity'] == clarity)].iloc[0]['price']
```

```
In [15]: # carat = 1
         # cut = "Premium"
         # clarity = "SI1"
         predictedPriceLightDiamond = returnDiamonPrice(1, 'Premium', 'SI1')
         predictedPriceLightDiamond
```

```
Out[15]: 5138.4
```

```
In [16]: # carat = 2
         # cut = "Premium"
         # clarity = "SI1"
         predictedPriceHeavyDiamond = returnDiamonPrice(2, 'Premium', 'SI1')
         predictedPriceHeavyDiamond
```

```
Out[16]: 13551.4
```

```
In [17]: # predictedPriceLightDiamond = 5138.4
         # predictedPriceHeavyDiamond = 13551.4
         predictedPriceHeavyDiamond - predictedPriceLightDiamond
```

```
Out[17]: 8413.0
```

### Calculate Specific Predicted Price

```
In [18]: # carat = 1.5
         # cut = "Very Good"
         # clarity = "VS2"
         returnDiamonPrice(1.5, 'Very Good', 'VS2')
```

```
Out[18]: 10094.8
```

### Recommended Bid Price

```
In [19]: bidPrice = sum(df_predicted['price']*.7)
         print("70% of the sum total price is ${:,.2f}".format(bidPrice))
```

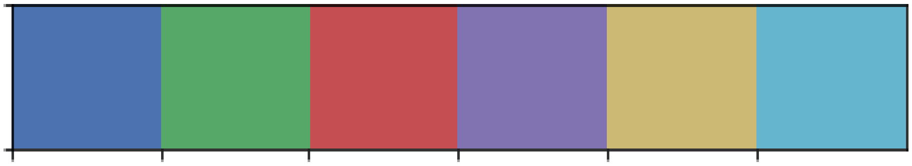
```
70% of the sum total price is $8,213,465.93
```

### Colors and Functions

```
In [20]: listColors = ['bright',
                       'colorblind',
                       'dark',
                       'deep',
                       'muted',
                       'pastel'
                      ]

         cmap = sns.color_palette(listColors[3])
         sns.palplot(cmap)

         # for i in range(0, len(listColors)):
         #     color = sns.color_palette(listColors[i])
         #     sns.palplot(color)
```



```
In [21]: def getCorr(dataframeParam, xParam, yParam):

             calcPears_A = dataframeParam.corr(method = 'pearson')
             print("Corr Method A:")
             print(calcPears_A)
             print()

             print("Corr Method B:")
             calcCorr = stats.pearsonr(dataframeParam[xParam], dataframeParam[yParam])
             calcPears_B = round(calcCorr[0],2)
             calcP_B = round(calcCorr[1],2)
             print("  Pearson: {}".format(calcPears_B))
             print("  P: {}".format(calcP_B))
             print()

         #     calcPears_C = dataframeParam[[xParam, yParam]].corr(method='pearson')[yParam][x
         #     print("Corr Method C:")
         #     print("  {}".format(calcPears_C))
         #     print()
         #     calcPears_D = np.corrcoef(x = dataframeParam[xParam], y = dataframeParam[yParam
         #     print("Corr Method D:")
         #     print("  {}".format(calcPears_D))
         #     print()
```

```
In [22]: # REG PLOT
         def plotFunctionUnPolished(dataframeParam, xParam, yParam, colorInList):

             sns.jointplot(x=dataframeParam[xParam],
                                   y=dataframeParam[yParam],
                                   ylim = [0,25000],
                                   kind='reg', size=8, space=.1, color=cmap[colorInList],
                                   scatter_kws={'edgecolor': 'skyblue',
                                                "alpha":.9
                                               })
             plt.show()
```

```
In [23]: # SCATTER PLOT
         def plotFunctionPolished(dataset, dataframeParam, xParam, yParam, colorInList):

             left, width = 0, 10
             bottom, height = 0, 6
             right = left + width
             top = bottom + height

             xText = xParam.capitalize()
             yText = yParam.capitalize()

             fig = plt.figure(figsize=(width,height))
             axes = plt.subplot(111)

             sns.regplot(data = dataframeParam, x = xParam, y = yParam,
                         ci = 95, color = cmap[colorInList], scatter_kws={'edgecolor': cmap[5]
                                                                          'linewidth': 1.25,
                                                                          's':75})
             plt.title('Relationship Between\n{} and {} {}'.format(xText,dataset,yText), fonts
             plt.xlabel('Carat', fontsize = 15)
             plt.ylabel('\nPrice', fontsize = 15)
             plt.ylim(-5000,25000)
             plt.xticks(fontsize = 10)
             plt.yticks(fontsize = 10)
             plt.tight_layout()

             calcCorr = stats.pearsonr(dataframeParam[xParam], dataframeParam[yParam])
             calcPears = round(calcCorr[0],2)
             calcP = round(calcCorr[1],2)
```

```
    # Add a title and a box around it
    ax = plt.gca()
    ax.add_patch(FancyBboxPatch((0.01, 0.807),
                                width=.175, height=.15, clip_on=False,
                                boxstyle="square,pad=0", zorder=3,
                                facecolor='white', alpha=1.0,
                                transform=plt.gca().transAxes))

    plt.text(-0.01, 1.01, "\n\n    Pearson  {} \n    p = {} ".format(calcPears,calcP)
             horizontalalignment='left',
             verticalalignment='top',
             size='large',
             transform=axes.transAxes)

    plt.savefig('./assets/images/relationshipCaratAndPrice_{}'.format(dataset), dpi =
    plt.show()
```

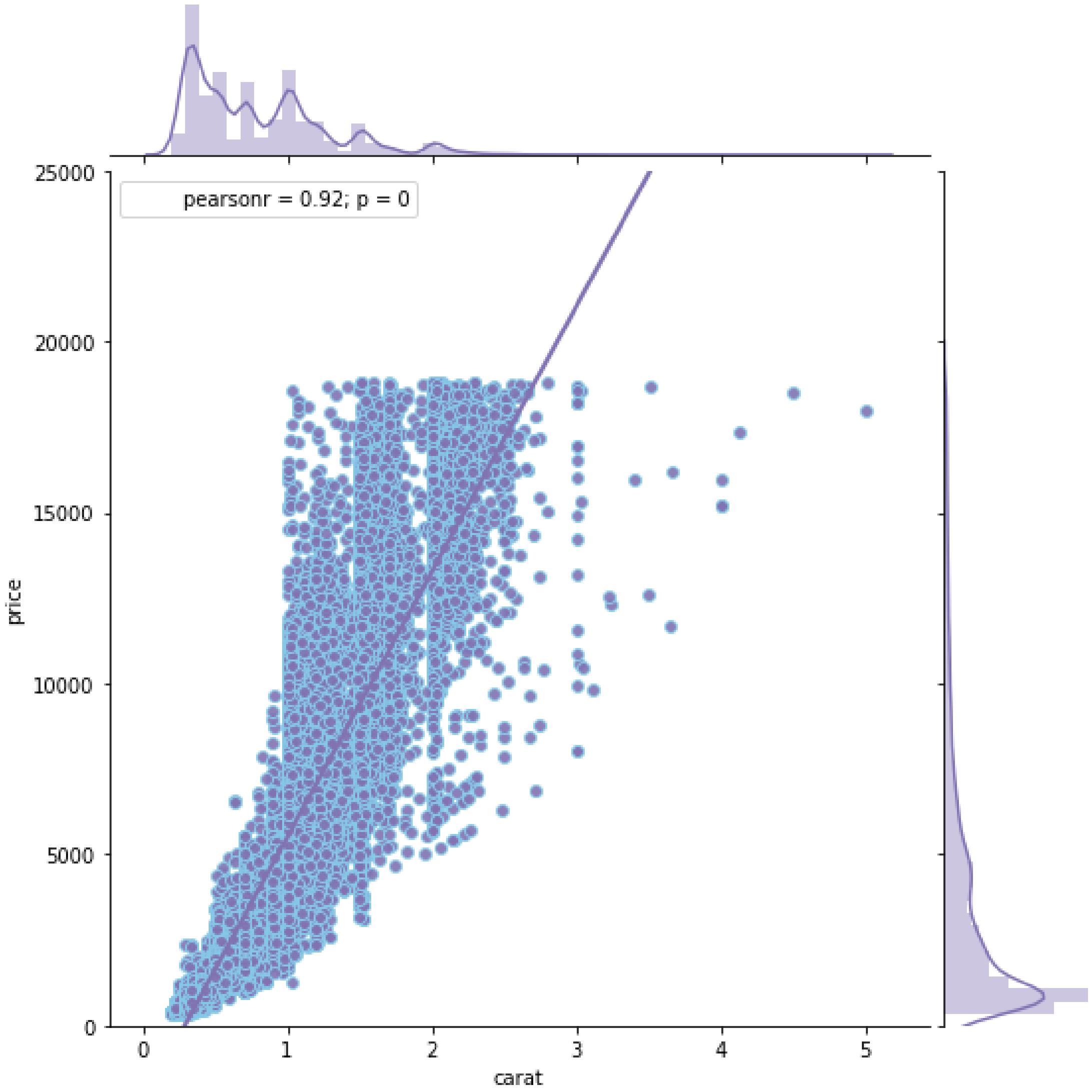
### Visualization 1: Given Price

```
In [24]: getCorr(df_given, "carat", "price")
```

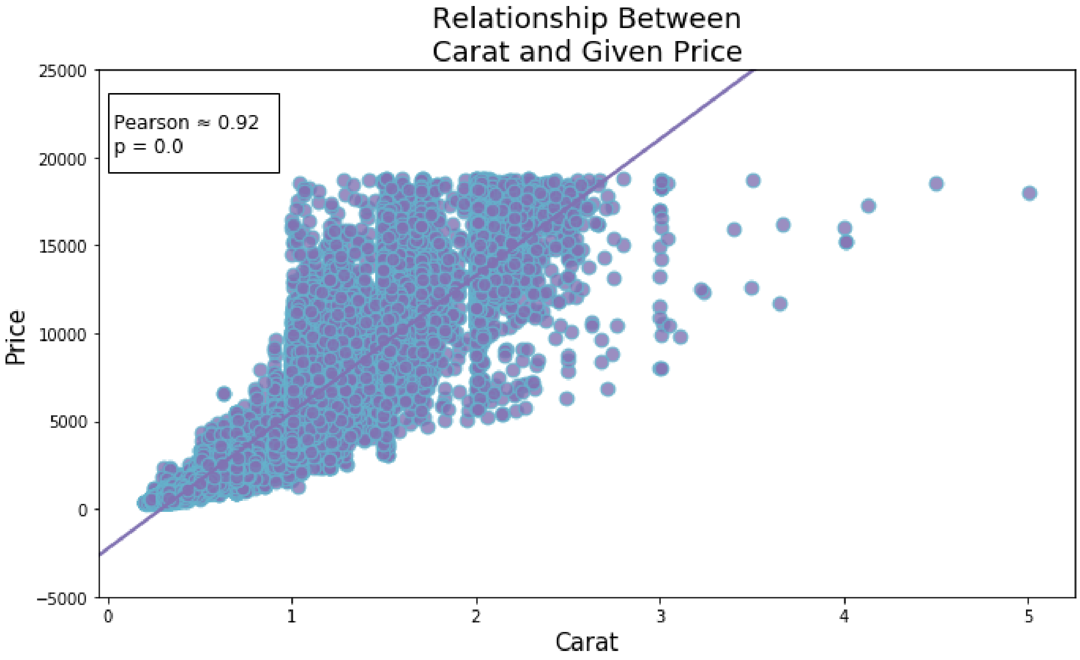
```
Corr Method A:
             Unnamed: 0     carat   cut_ord  clarity_ord     price
Unnamed: 0     1.000000 -0.002164  0.001330     0.000927 -0.001947
carat         -0.002164  1.000000 -0.135679    -0.343725  0.921777
cut_ord        0.001330 -0.135679  1.000000     0.189461 -0.053804
clarity_ord    0.000927 -0.343725  0.189461     1.000000 -0.142159
price         -0.001947  0.921777 -0.053804    -0.142159  1.000000

Corr Method B:
  Pearson: 0.92
  P: 0.0
```

```
In [25]: plotFunctionUnPolished(df_given, "carat", "price", 3)
```



```
In [26]: plotFunctionPolished("Given", df_given, "carat", "price", 3)
```



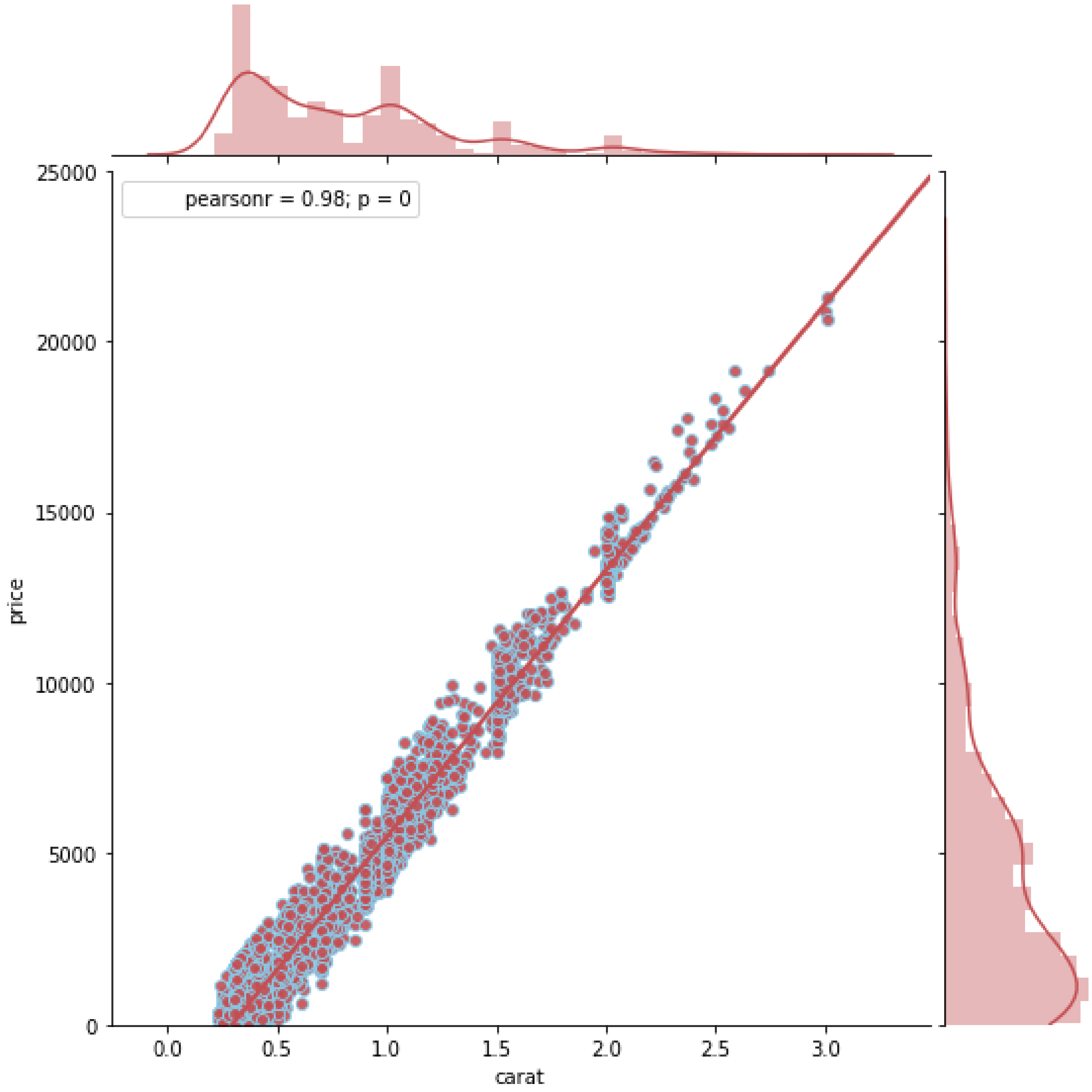
### Visualization 2: Predicted Price

```
In [27]: getCorr(df_predicted, "carat", "price")
```

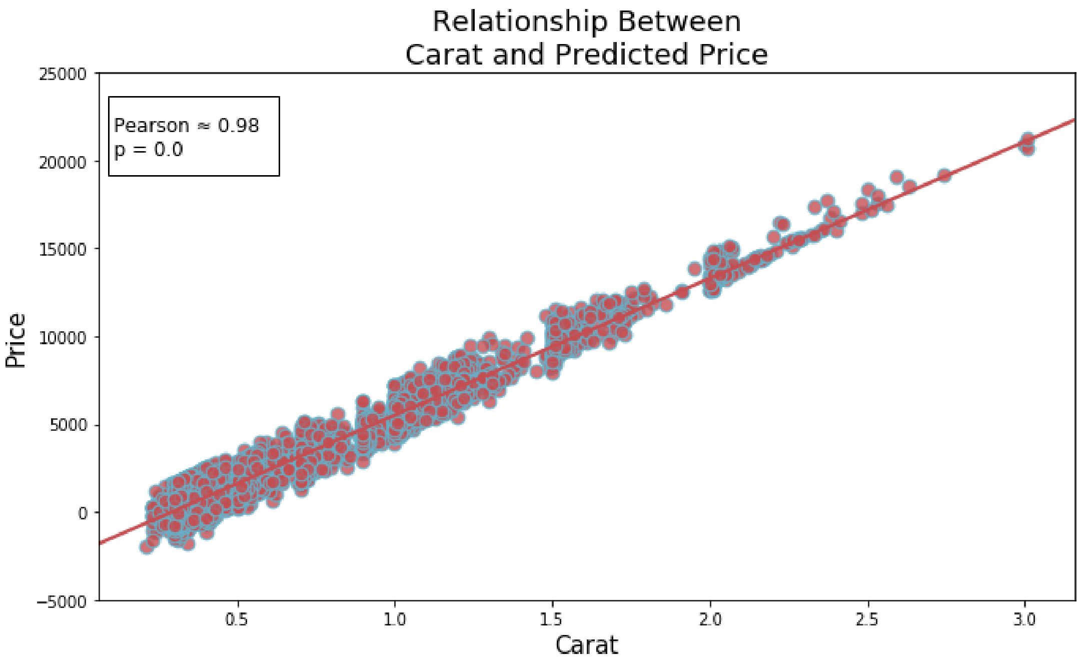
```
Corr Method A:
                 carat   cut_ord  clarity_ord     price       bid
carat         1.000000 -0.113335    -0.368920  0.980307  0.980307
cut_ord      -0.113335  1.000000     0.170511 -0.039627 -0.039627
clarity_ord  -0.368920  0.170511     1.000000 -0.183065 -0.183065
price         0.980307 -0.039627    -0.183065  1.000000  1.000000
bid           0.980307 -0.039627    -0.183065  1.000000  1.000000

Corr Method B:
  Pearson: 0.98
  P: 0.0
```

```
In [28]: plotFunctionUnPolished(df_predicted, "carat", "price", 2)
```

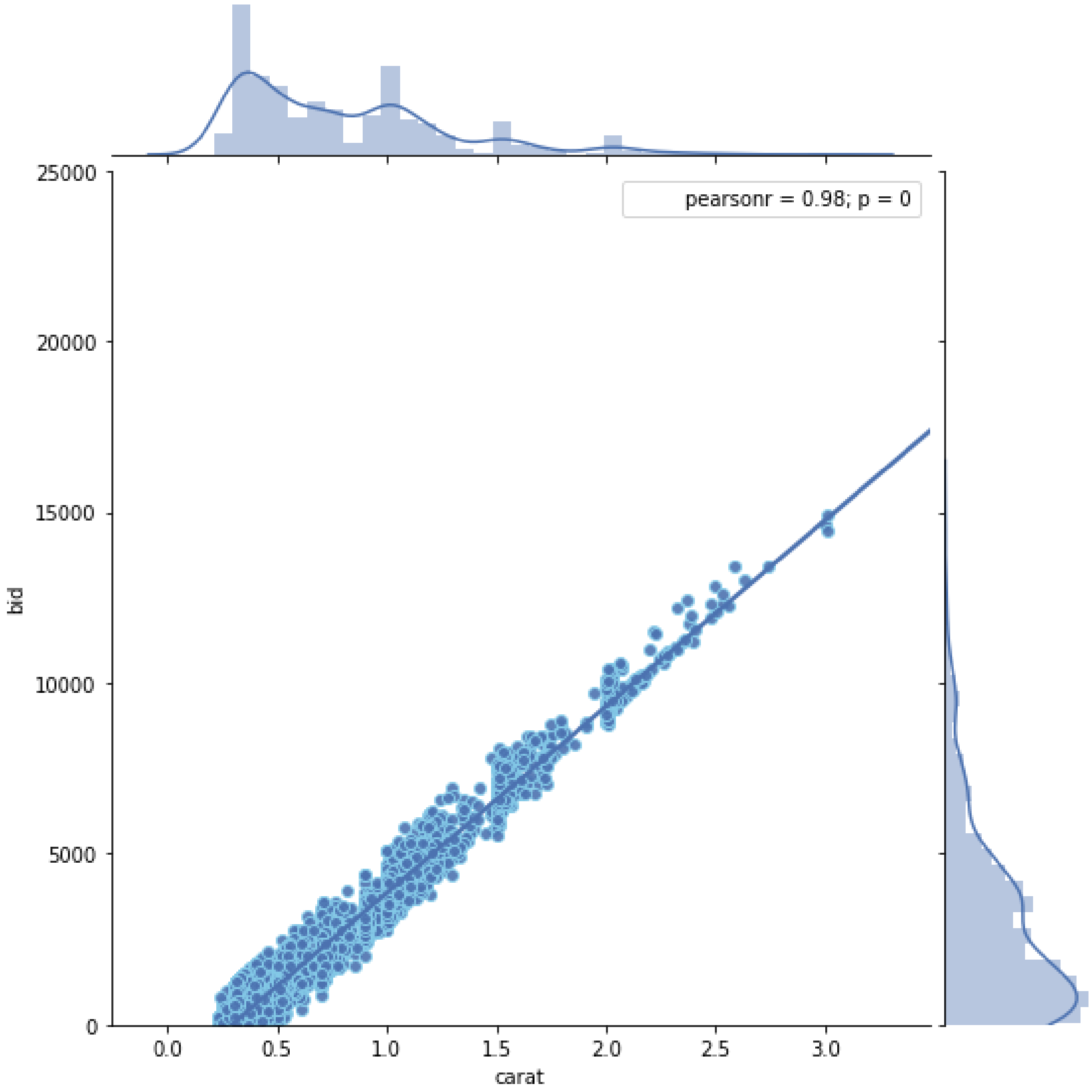


```
In [29]: plotFunctionPolished("Predicted", df_predicted, "carat", "price", 2)
```

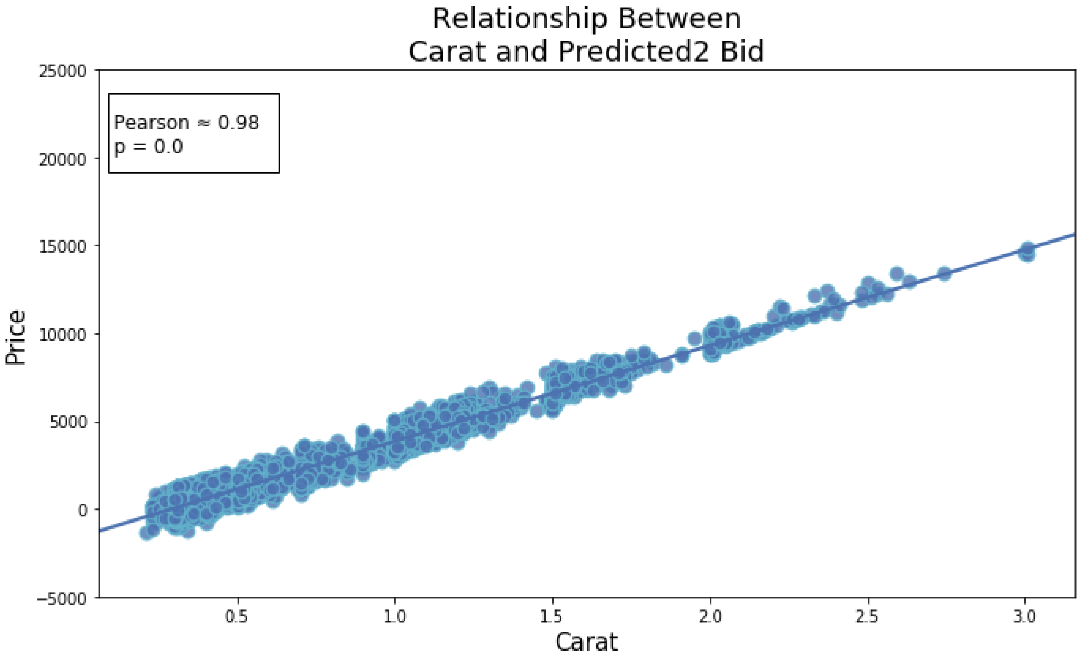


### Visualization 3: Predicted Bid

```
In [30]: plotFunctionUnPolished(df_predicted, "carat", "bid", 0)
```



```
In [31]: plotFunctionPolished("Predicted2", df_predicted, "carat", "bid", 0)
```



## Analysis
Analysis and recommendation is located in the `predicting_diamond_prices_Report.ipynb` file.
## Store Data

```
In [32]: df_predicted.to_csv('./report/new-diamondsReport.csv', index = False)
```