Telegram | 190030221/-Medical-Insur | Project 11. Medical Insurar | ONLINE VOTING SYSTEM - | medical insurance cost pre | Insurance Csv | Kaggle

colab.research.google.com/drive/1W9DrRq5RIj719bT6m2SNNcv-KVnSZsRB#scrollTo=dCei9HxoNdG5

MediumWhy an Int... | Sample Matrix, Pro... | AWS | Lifecycle Ma... | ad | Capital Cinemas Tre... | IRP | Free Internship Cert... | Introduction to Vari... | Catch me if you can... | Previous Tutorial: C...

Project 11. Medical Insurance Cost Prediction.ipynb

File Edit View Insert Runtime Tools Help Changes will not be saved

Share

+ Code + Text | Copy to Drive

Connect | Editing

Importing the Dependencies

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn import metrics
```

Data Collection & Analysis

```
[ ] # loading the data from csv file to a Pandas DataFrame
    insurance_dataset = pd.read_csv('/content/insurance.csv')
```

```
[ ] # first 5 rows of the dataframe
    insurance_dataset.head()
```

	age	sex	bmi	children	smoker	region	charges
0	19	female	27.900	0	yes	southwest	16884.92400
1	18	male	33.770	1	no	southeast	1725.55230
2	28	male	33.000	3	no	southeast	4449.46200
3	33	male	22.705	0	no	northwest	21984.47061
4	32	male	28.880	0	no	northwest	3866.85520

```
[ ] # number of rows and columns
    insurance_dataset.shape
```

Project_11_Medi....ipynb | archive.zip | sdp4_project (1)....ipynb | Mall_Customers (1).csv | Mall_Customers.csv | sdp4_project (1).ipynb | Show all

32°C Cloudy

ENG IN 12:17 13-10-2022

Telegram | 190030221/-Medical-Insur | Project 11. Medical Insurar | ONLINE VOTING SYSTEM - | medical insurance cost pre | Insurance Csv | Kaggle

colab.research.google.com/drive/1W9DrRq5RIj719bT6m2SNNcv-KVnSZsRB#scrollTo=dCei9HxoNdG5

MediumWhy an Int... | Sample Matrix, Pro... | AWS | Lifecycle Ma... | ad | Capital Cinemas Tre... | IRP | Free Internship Cert... | Introduction to Vari... | Catch me if you can... | Previous Tutorial: C...

Project 11. Medical Insurance Cost Prediction.ipynb

File Edit View Insert Runtime Tools Help Changes will not be saved

Share

+ Code + Text | Copy to Drive

Connect | Editing

```
[ ] # number of rows and columns
    insurance_dataset.shape
```

```
(1338, 7)
```

```
[ ] # getting some informations about the dataset
    insurance_dataset.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1338 entries, 0 to 1337
Data columns (total 7 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   age       1338 non-null   int64  
 1   sex       1338 non-null   object 
 2   bmi       1338 non-null   float64
 3   children  1338 non-null   int64  
 4   smoker    1338 non-null   object 
 5   region    1338 non-null   object 
 6   charges   1338 non-null   float64
dtypes: float64(2), int64(2), object(3)
memory usage: 73.3+ KB
```

Categorical Features:

- Sex
- Smoker
- Region

```
[ ] # checking for missing values
    insurance_dataset.isnull().sum()
```

```
age       0
sex       0
bmi       0
```

Project_11_Medi....ipynb | archive.zip | sdp4_project (1)....ipynb | Mall_Customers (1).csv | Mall_Customers.csv | sdp4_project (1).ipynb | Show all

32°C Cloudy

ENG IN 12:17 13-10-2022

Telegram | 190030221/-Medical-Insur | Project 11. Medical Insurar | ONLINE VOTING SYSTEM - | medical insurance cost pre | Insurance Csv | Kaggle

colab.research.google.com/drive/1W9DrRq5RIj719bT6m2SNNcv-KVnSZsRB#scrollTo=dCei9HxoNdG5

MediumWhy an Int... | Sample Matrix, Pro... | AWS | Lifecycle Ma... | ad | Capital Cinemas Tre... | IRP | Free Internship Cert... | Introduction to Vari... | Catch me if you can... | Previous Tutorial: C...

Project 11. Medical Insurance Cost Prediction.ipynb

File Edit View Insert Runtime Tools Help Changes will not be saved

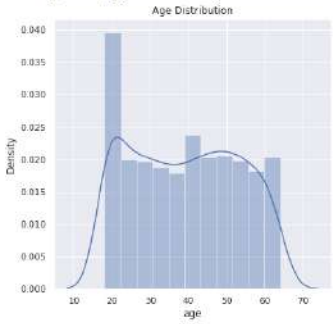
Share

+ Code + Text | Copy to Drive

Connect | Editing

```
[ ] # distribution of age value
    sns.set()
    plt.figure(figsize=(6,6))
    sns.distplot(insurance_dataset['age'])
    plt.title('Age Distribution')
    plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2557: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function
  warnings.warn(msg, FutureWarning)
```




```
[ ] # Gender column
    plt.figure(figsize=(6,6))
```

Project_11_Medi....ipynb | archive.zip | sdp4_project (1)....ipynb | Mall_Customers (1).csv | Mall_Customers.csv | sdp4_project (1).ipynb | Show all

32°C Cloudy

ENG IN 12:17 13-10-2022

Telegram | 190030221/-Medical-Insur | Project 11. Medical Insurar | ONLINE VOTING SYSTEM - | medical insurance cost pre | Insurance Csv | Kaggle

colab.research.google.com/drive/1W9DrRq5RIj719bT6m2SNNcv-KVnSZsRB#scrollTo=dCei9HxoNdG5

MediumWhy an Int... | Sample Matrix Pro... | AWS | Lifecycle Ma... | ad | Capital Cinemas Tre... | IRP | Free Internship Cert... | Introduction to Vari... | Catch me if you can... | Previous Tutorial: C...

Project 11. Medical Insurance Cost Prediction.ipynb

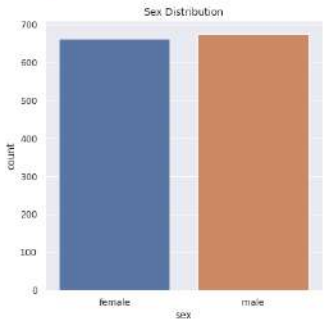
File Edit View Insert Runtime Tools Help Changes will not be saved

Share

+ Code + Text | Copy to Drive

Connect | Editing

```
[ ] # Gender column
    plt.figure(figsize=(6,6))
    sns.countplot(x='sex', data=insurance_dataset)
    plt.title('Sex Distribution')
    plt.show()
```




```
[ ] insurance_dataset['sex'].value_counts()
```

```
male      676
female    662
Name: sex, dtype: int64
```

```
[ ] # bmi distribution
```

Project_11_Medi....ipynb | archive.zip | sdp4_project (1)....ipynb | Mall_Customers (1).csv | Mall_Customers.csv | sdp4_project (1).ipynb | Show all

32°C Cloudy

ENG IN 12:17 13-10-2022

Telegram | 190030221/-Medical-Insur | Project 11. Medical Insurar | ONLINE VOTING SYSTEM - | medical insurance cost pre | Insurance Csv | Kaggle

colab.research.google.com/drive/1W9DrRq5RIj719bT6m2SNNcv-KVnSZsRB#scrollTo=dCei9HxoNdG5

MediumWhy an Int... | Sample Matrix, Pro... | AWS | Lifecycle Ma... | ad | Capital Cinemas Tre... | IRP | Free Internship Cert... | Introduction to Vari... | Catch me if you can... | Previous Tutorial: C...

Project 11. Medical Insurance Cost Prediction.ipynb

File Edit View Insert Runtime Tools Help Changes will not be saved

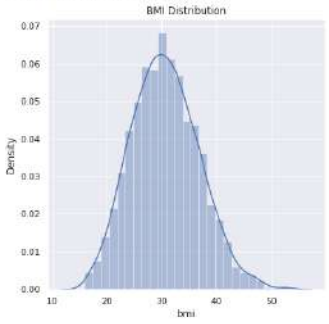
Share

+ Code + Text | Copy to Drive

Connect | Editing

```
# bmi distribution
plt.figure(figsize=(6,6))
sns.distplot(insurance_dataset['bmi'])
plt.title('BMI Distribution')
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2557: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function
  warnings.warn(msg, FutureWarning)
```



Normal BMI Range --> 18.5 to 24.9

```
[ ] # children column
    plt.figure(figsize=(6,6))
```

Project_11_Medi....ipynb | archive.zip | sdp4_project (1)....ipynb | Mall_Customers (1).csv | Mall_Customers.csv | sdp4_project (1).ipynb | Show all

32°C Cloudy

ENG IN 12:17 13-10-2022

Telegram | 190030221/-Medical-Insur | Project 11. Medical Insurar | ONLINE VOTING SYSTEM - | medical insurance cost pre | Insurance Csv | Kaggle

colab.research.google.com/drive/1W9DrRq5RIj719bT6m2SNNcv-KVnSZsR8#scrollTo=dCei9HxoNdG5

MediumWhy an Int... | Sample Matrix, Pro... | AWS | Lifecycle Ma... | ad | Capital Cinemas Tre... | IRP | Free Internship Cert... | Introduction to Vari... | Catch me if you can... | Previous Tutorial: C...

Project 11. Medical Insurance Cost Prediction.ipynb

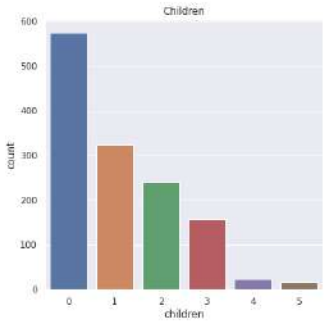
File Edit View Insert Runtime Tools Help Changes will not be saved

Share

+ Code + Text | Copy to Drive

Connect | Editing

```
# children column
plt.figure(figsize=(6,6))
sns.countplot(x='children', data=insurance_dataset)
plt.title('Children')
plt.show()
```




```
[ ] insurance_dataset['children'].value_counts()
```

```
0    574
1    324
2    240
3    157
4     25
```

Project_11_Medi....ipynb | archive.zip | sdp4_project (1)....ipynb | Mall_Customers (1).csv | Mall_Customers.csv | sdp4_project (1).ipynb | Show all

32°C Cloudy

ENG IN

12:17 13-10-2022

Telegram | 190030221/-Medical-Insur | Project 11. Medical Insurar | ONLINE VOTING SYSTEM - | medical insurance cost pre | Insurance Csv | Kaggle

colab.research.google.com/drive/1W9DrRq5RIj719bT6m2SNNcv-KVnSZsRB#scrollTo=dCei9HxoNdG5

MediumWhy an Int... | Sample Matrix, Pro... | AWS | Lifecycle Ma... | ad | Capital Cinemas Tre... | IRP | Free Internship Cert... | Introduction to Vari... | Catch me if you can... | Previous Tutorial: C...

Project 11. Medical Insurance Cost Prediction.ipynb

File Edit View Insert Runtime Tools Help Changes will not be saved

Share

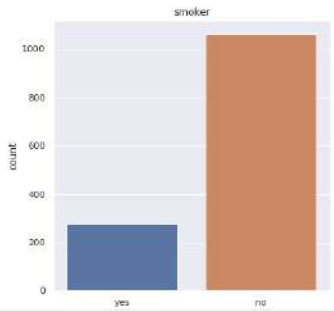
+ Code + Text | Copy to Drive

Connect | Editing

```
insurance_dataset['children'].value_counts()
```

```
0    574
1    324
2    240
3    157
4     25
5     18
Name: children, dtype: int64
```

```
# smoker column
plt.figure(figsize=(6,6))
sns.countplot(x='smoker', data=insurance_dataset)
plt.title('smoker')
plt.show()
```



Project_11_Medi....ipynb | archive.zip | sdp4_project (1)....ipynb | Mall_Customers (1).csv | Mall_Customers.csv | sdp4_project (1).ipynb | Show all

32°C Cloudy

ENG IN 12:17 13-10-2022

Telegram | 190030221/-Medical-Insur | Project 11. Medical Insurar | ONLINE VOTING SYSTEM - | medical insurance cost pre | Insurance Csv | Kaggle

colab.research.google.com/drive/1W9DrRq5RIj719bT6m2SNNcv-KVnSZsRB#scrollTo=dCei9HxoNdG5

MediumWhy an Int... | Sample Matrix, Pro... | AWS | Lifecycle Ma... | ad | Capital Cinemas Tre... | IRP | Free Internship Cert... | Introduction to Vari... | Catch me if you can... | Previous Tutorial: C...

Project 11. Medical Insurance Cost Prediction.ipynb

File Edit View Insert Runtime Tools Help Changes will not be saved

Share

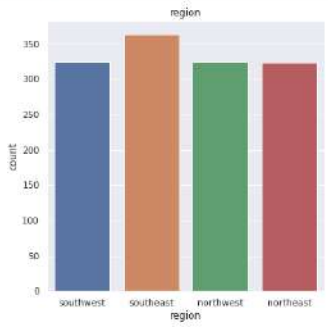
+ Code + Text Copy to Drive

Connect Editing

```
[ ] insurance_dataset['smoker'].value_counts()
```

```
no     1064
yes     274
Name: smoker, dtype: int64
```

```
# region column
plt.figure(figsize=(6,6))
sns.countplot(x='region', data=insurance_dataset)
plt.title('region')
plt.show()
```




```
[ ] insurance_dataset['region'].value_counts()
```

Project_11_Medi....ipynb | archive.zip | sdp4_project (1)....ipynb | Mall_Customers (1).csv | Mall_Customers.csv | sdp4_project (1).ipynb | Show all

32°C Cloudy

ENG IN 12:17 13-10-2022

Telegram | 190030221/-Medical-Insur | Project 11. Medical Insurar | ONLINE VOTING SYSTEM - | medical insurance cost pre | Insurance Csv | Kaggle

colab.research.google.com/drive/1W9DrRq5RIj719bT6m2SNNcv-KVnSZsRB#scrollTo=dCei9HxoNdG5

MediumWhy an Int... | Sample Matrix Pro... | AWS | Lifecycle Ma... | ad | Capital Cinemas Tre... | IRP | Free Internship Cert... | Introduction to Vari... | Catch me if you can... | Previous Tutorial: C...

Project 11. Medical Insurance Cost Prediction.ipynb

File Edit View Insert Runtime Tools Help Changes will not be saved

Share

+ Code + Text | Copy to Drive

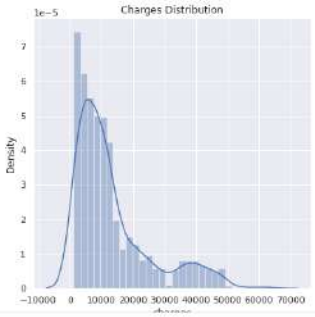
Connect | Editing

```
[ ] insurance_dataset['region'].value_counts()
```

```
southeast    364
northwest    325
southwest    325
northeast    324
Name: region, dtype: int64
```

```
[ ] # distribution of charges value
    plt.figure(figsize=(6,6))
    sns.distplot(insurance_dataset['charges'])
    plt.title('Charges Distribution')
    plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2557: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function
  warnings.warn(msg, FutureWarning)
```



Project_11_Medi....ipynb | archive.zip | sdp4_project (1)....ipynb | Mall_Customers (1).csv | Mall_Customers.csv | sdp4_project (1).ipynb | Show all

32°C Cloudy

ENG IN

12:17 13-10-2022

Telegram | 190030221/-Medical-Insur | Project 11. Medical Insurar | ONLINE VOTING SYSTEM - | medical insurance cost pre | Insurance Csv | Kaggle

colab.research.google.com/drive/1W9DrRq5RIj719bT6m2SNNcv-KVnSZsRB#scrollTo=dCei9HxoNdG5

MediumWhy an Int... | Sample Matrix Pro... | AWS | Lifecycle Ma... | ad | Capital Cinemas Tre... | IRP | Free Internship Cert... | Introduction to Vari... | Catch me if you can... | Previous Tutorial: C...

Project 11. Medical Insurance Cost Prediction.ipynb

File Edit View Insert Runtime Tools Help Changes will not be saved

Share | Connect | Editing

+ Code + Text | Copy to Drive

Data Pre-Processing

Encoding the categorical features

```
[ ] # encoding sex column
    insurance_dataset.replace({'sex':{'male':0,'female':1}}, inplace=True)

    3 # encoding 'smoker' column
    insurance_dataset.replace({'smoker':{'yes':0,'no':1}}, inplace=True)

    # encoding 'region' column
    insurance_dataset.replace({'region':{'southeast':0,'southwest':1,'northeast':2,'northwest':3}}, inplace=True)
```

Splitting the Features and Target

```
[ ] X = insurance_dataset.drop(columns='charges', axis=1)
    Y = insurance_dataset['charges']
```

```
[ ] print(X)
```

```
      age  sex     bmi  children  smoker  region
0      19    1  27.900         0       0       1
1      18    0  33.770         1       1       0
2      28    0  33.000         3       1       0
3      33    0  22.705         0       1       3
4      32    0  28.880         0       1       3
...   ...  ...     ...       ...     ...     ...
1333   50    0  30.970         3       1       3
1334   18    1  31.920         0       1       2
1335   18    1  36.850         0       1       0
1336   21    1  25.800         0       1       1
1337   61    1  29.070         0       0       3

[1338 rows x 6 columns]
```

Project_11_Medi....ipynb | archive.zip | sdp4_project (1)....ipynb | Mall_Customers (1).csv | Mall_Customers.csv | sdp4_project (1).ipynb | Show all

32°C Cloudy

ENG IN 12:17 13-10-2022

Telegram | 190030221/-Medical-Insur | Project 11. Medical Insurar | ONLINE VOTING SYSTEM - | medical insurance cost pre | Insurance Csv | Kaggle

colab.research.google.com/drive/1W9DrRq5RIj719bT6m2SNNcv-KVnSZsRB#scrollTo=dCei9HxoNdG5

MediumWhy an Int... | Sample Matrix, Pro... | AWS | Lifecycle Ma... | ad | Capital Cinemas Tre... | IRP | Free Internship Cert... | Introduction to Vari... | Catch me if you can... | Previous Tutorial: C...

Project 11. Medical Insurance Cost Prediction.ipynb

File Edit View Insert Runtime Tools Help Changes will not be saved

Share

+ Code + Text Copy to Drive

Connect Editing

```
[ ] print(Y)
```

```
0       16884.02400
1        1725.55230
2        4449.46200
3       21984.47061
4        3866.85520
            ...
1333    10600.54830
1334     2205.98080
1335     1629.83350
1336     2007.94500
1337    29141.36030
Name: charges, Length: 1338, dtype: float64
```

Splitting the data into Training data & Testing Data

```
[ ] X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.2, random_state=2)
```

```
[ ] print(X.shape, X_train.shape, X_test.shape)
```

```
(1338, 6) (1070, 6) (268, 6)
```

Model Training

Linear Regression

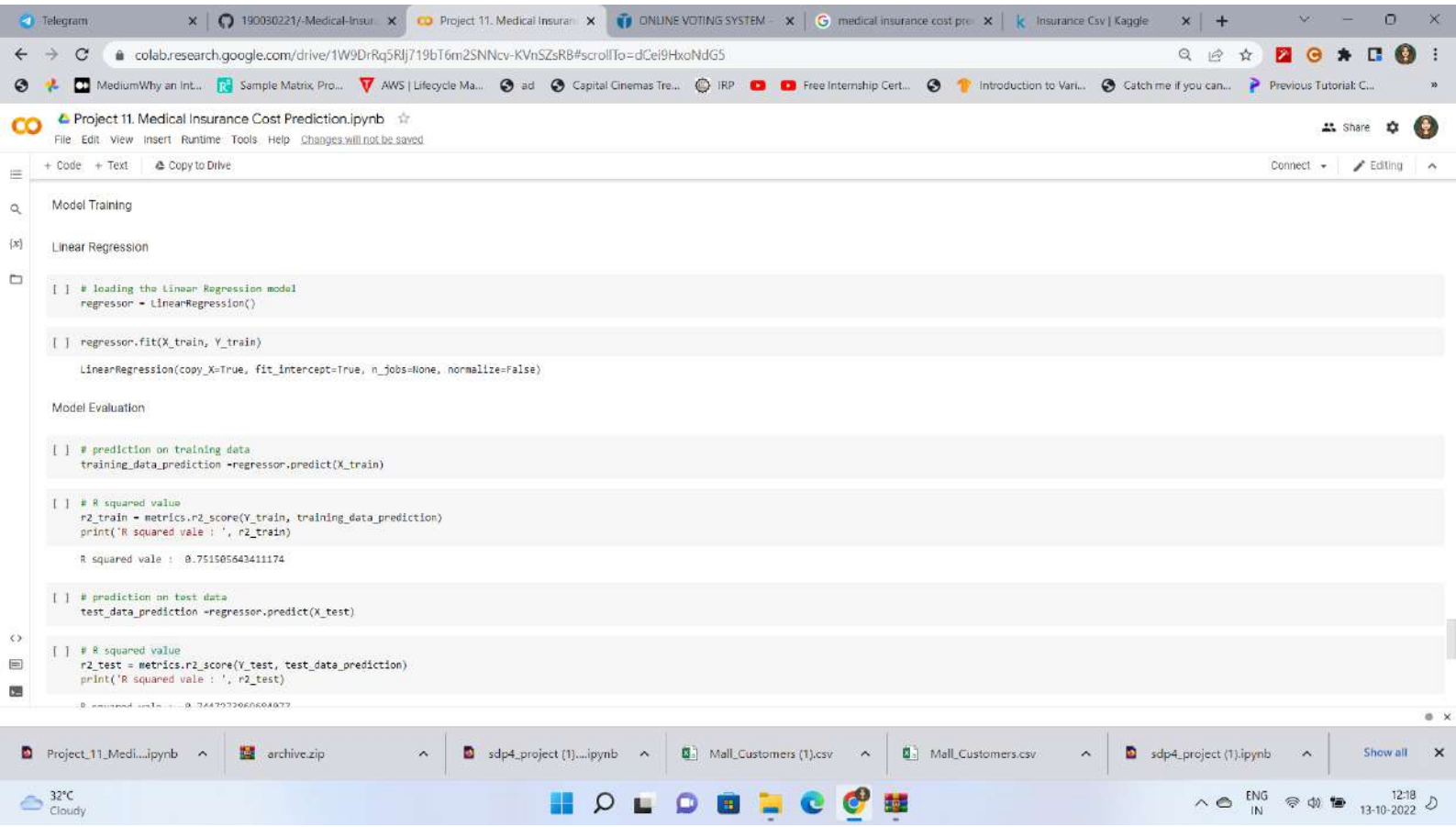
```
[ ] # loading the Linear Regression model
    regressor = LinearRegression()
```

```
[ ] regressor.fit(X_train, Y_train)
```

Project_11_Medi....ipynb | archive.zip | sdp4_project (1)....ipynb | Mall_Customers (1).csv | Mall_Customers.csv | sdp4_project (1).ipynb | Show all

32°C Cloudy

ENG IN 12:18 13-10-2022


Project 11. Medical Insurance Cost Prediction.ipynb
File Edit View Insert Runtime Tools Help Changes will not be saved
Share
+ Code + Text Copy to Drive
Connect Editing
Model Training
Linear Regression
[ ] # loading the Linear Regression model
regressor = LinearRegression()
[ ] regressor.fit(X_train, Y_train)
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None, normalize=False)
Model Evaluation
[ ] # prediction on training data
training_data_prediction =regressor.predict(X_train)
[ ] # R squared value
r2_train = metrics.r2_score(Y_train, training_data_prediction)
print('R squared vale : ', r2_train)
R squared vale : 0.751505643411174
[ ] # prediction on test data
test_data_prediction =regressor.predict(X_test)
[ ] # R squared value
r2_test = metrics.r2_score(Y_test, test_data_prediction)
print('R squared vale : ', r2_test)

Telegram | -Medical-Insurance-Cost-P | Project 11. Medical Insurar | ONLINE VOTING SYSTEM - | medical insurance cost pre | Insurance Csv | Kaggle

colab.research.google.com/drive/1W9DrRq5RIj719bT6m2SNNcv-KVnSZsRB#scrollTo=dCei9HxoNdG5

MediumWhy an Int... | Sample Matrix, Pro... | AWS | Lifecycle Ma... | ad | Capital Cinemas Tre... | IRP | Free Internship Cert... | Introduction to Vari... | Catch me if you can... | Previous Tutorial: C...

Project 11. Medical Insurance Cost Prediction.ipynb

File Edit View Insert Runtime Tools Help Changes will not be saved

Share

+ Code + Text Copy to Drive

Connect Editing

Importing the Dependencies

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn import metrics
```

Data Collection & Analysis

```
# loading the data from csv file to a Pandas DataFrame
insurance_dataset = pd.read_csv('/content/insurance.csv')
```

```
[ ] # first 5 rows of the dataframe
insurance_dataset.head()
```

	age	sex	bmi	children	smoker	region	charges
0	19	female	27.900	0	yes	southwest	16884.92400
1	18	male	33.770	1	no	southeast	1725.55230
2	28	male	33.000	3	no	southeast	4449.46200
3	33	male	22.705	0	no	northwest	21984.47061
4	32	male	28.880	0	no	northwest	3866.85520

```
[ ] # number of rows and columns
insurance_dataset.shape
```

Project_11_Medi....ipynb | archive.zip | sdp4_project (1)....ipynb | Mall_Customers (1).csv | Mall_Customers.csv | sdp4_project (1).ipynb | Show all

32°C Cloudy

ENG IN 12:20 13-10-2022

Telegram | 190030221/-Medical-Insur | Project 11. Medical Insurar | ONLINE VOTING SYSTEM - | medical insurance cost pre | Insurance Csv | Kaggle

colab.research.google.com/drive/1W9DrRq5RIj719bT6m2SNNcv-KVnSZsR8#scrollTo=dCei9HxoNdG5

MediumWhy an Int... | Sample Matrix Pro... | AWS | Lifecycle Ma... | ad | Capital Cinemas Tre... | IRP | Free Internship Cert... | Introduction to Vari... | Catch me if you can... | Previous Tutorial: C...

Project 11. Medical Insurance Cost Prediction.ipynb

File Edit View Insert Runtime Tools Help Changes will not be saved

Share

+ Code + Text Copy to Drive

Connect Editing

```
[ ] r2_test = metrics.r2_score(Y_test, test_data_prediction)
    print('R squared vale : ', r2_test)
```

```
R squared vale :  0.7447273869684077
```

Building a Predictive System

```
[ ] input_data = (31,1,25.74,0,1,0)

    # changing input_data to a numpy array
    input_data_as_numpy_array = np.asarray(input_data)

    # reshape the array
    input_data_reshaped = input_data_as_numpy_array.reshape(1,-1)

    prediction = regressor.predict(input_data_reshaped)
    print(prediction)

    print('The insurance cost is USD ', prediction[0])
```

```
[3760.0805765]
The insurance cost is USD  3760.080576490587
```

Project_11_Medi....ipynb | archive.zip | sdp4_project (1)....ipynb | Mall_Customers (1).csv | Mall_Customers.csv | sdp4_project (1).ipynb | Show all

32°C Cloudy

ENG IN 12:18 13-10-2022