PREDICTING HOUSE PRICE USING MACHINE LEARNING

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PHASE 3: DEVELOPMENT PART1

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Project Name	**HOUSE PRICE PREDICITON USING MACHINE LEARNING**

- In this phase we will begin building our projects by loading and preprocessing and visualization the dataset.

INTRODUCTION:

- Whether you're a homeowner looking to estimate the value of your property, a real estate investor seeking profitable opportunities, or a data scientist aiming to build a predictive model, the foundation of this endeavor lies in loading and preprocessing the dataset.

- Building a house price prediction model is a data-driven process that involves harnessing the power of machine learning to analyze historical housing data and make informed price predictions. This journey begins with the fundamental steps of data loading and preprocessing.

- This introduction will guide you through the initial steps of the process. We'll explore how to import essential libraries, load the housing dataset, and perform critical preprocessing steps. Data preprocessing is crucial as it helps clean, format, and prepare the data for further analysis. This includes handling missing values, encoding categorical variables, and ensuring that the data is appropriately scaled.

DATA SOURCE:

A good data source for house price prediction using machine learning should beAccurate, Complete, Covering the geographic area of interest, Accessible.

Dataset Link: (https://www.kaggle.com/datasets/vedavyasv/usa-housing)

GIVEN DATASET:

	Avg. Area Income	Avg. Area House Age	Avg. Area Number of Rooms	Avg. Area Number of Bedrooms	Area Population	Price	Address
0	79545.458574	5.682861	7.009188	4.09	23086.800503	1.059034e+06	208 Michael Ferry Apt. 674\nLaurabury, NE 3701...
1	79248.642455	6.002900	6.730821	3.09	40173.072174	1.505891e+06	188 Johnson Views Suite 079\nLake Kathleen, CA...
2	61287.067179	5.865890	8.512727	5.13	36882.159400	1.058988e+06	9127 Elizabeth Stravenue\nDanieltown, WI 06482...
3	63345.240046	7.188236	5.586729	3.26	34310.242831	1.260617e+06	USS Barnett\nFPO AP 44820
4	59982.197226	5.040555	7.839388	4.23	26354.109472	6.309435e+05	USNS Raymond\nFPO AE 09386
...	...	...	...	...	...	...	...
4995	60567.944140	7.830362	6.137356	3.46	22837.361035	1.060194e+06	USNS Williams\nFPO AP 30153-7653
4996	78491.275435	6.999135	6.576763	4.02	25616.115489	1.482618e+06	PSC 9258, Box 8489\nAPO AA 42991-3352
4997	63390.686886	7.250591	4.805081	2.13	33266.145490	1.030730e+06	4215 Tracy Garden Suite 076\nJoshualand, VA 01...
4998	68001.331235	5.534388	7.130144	5.44	42625.620156	1.198657e+06	USS Wallace\nFPO AE 73316
4999	65510.581804	5.992305	6.792336	4.07	46501.283803	1.298950e+06	37778 George Ridges Apt. 509\nEast Holly, NV 2...

5000 Rows x 7 Columns

STEPS TO FOLLOW:

1. IMPORT LIBRARIES:

Start by importing the necessary libraries:

PROGRAM:

```
import pandas as pd

import numpy as np

from sklearn.model_selection import train_test_split

from sklearn.preprocessing import StandardScaler
```

2. LOAD THE DATASET

Load your dataset into a Pandas Data Frame. You can typically findhouse price datasets in CSV format, but you can adapt this code to other formats as needed.

df = pd.read_csv(' E:\USA_Housing.csv ')

Pd.read()

3. EXPLORATORY DATA ANALYSIS (EDA):

Perform EDA to understand your data better. This includes checking for missing values, exploring the data's statistics, and visualizing it to identify patterns.

Check for missing values

print(df.isnull().sum())

Explore statistics

print(df.describe())

Visualize the data (e.g., histograms, scatter plots, etc.)

4. FEATURE ENGINEERING:

Depending on your dataset, you may need to create new features or transform existing ones. This can involve one-hot encoding categorical variables, handling date/time data, or scaling numerical features.

```
# Example: One-hot encoding for categorical variables

df = pd.get_dummies(df, columns=[' Avg. Area Income ', ' Avg. Area House Age '])
```

5. SPLIT THE DATA:

Split your dataset into training and testing sets. This helps you evaluate your model's performance later.

```
X = df.drop('price', axis=1) # Features

y = df['price']  # Target variable

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

6. FEATURE SCALING:

Apply feature scaling to normalize your data, ensuring that all features have similar scales. Standardization (scaling to mean=0 and std=1) is a common choice.

```
scaler = StandardScaler()

X_train = scaler.fit_transform(X_train)

X_test = scaler.transform(X_test)
```

LOADING AND PREPROCESSING THE DATA:

Loading and preprocessing the dataset is an important first step in building any machine learning model. However, it is especially important for house price prediction models, as house price datasets are often complex and noisy.

By loading and preprocessing the dataset, we can ensure that the machine learning algorithm is able to learn from the data effectively and accurately.

HANDLING MISSING VALUES:

House price datasets often contain missing values, which can be due to a variety of factors, such as human error or incomplete data collection. Common methods for handling missing values include dropping the rows with missing values, imputing the missing values with the mean or median of the feature, or using a more sophisticated method such as multiple imputation.

ENCODING CATEGORICAL VALUES:

House price datasets often contain categorical features, such as the type of house, the neighborhood, and the school district. These features need to be encoded before they can be used by machine learning models. One common way to encode categorical variables is to use one-hot encoding.

LOADING THE DATASET:

- ✓ Loading the dataset using machine learning is the process of bringing the data into the machine learning environment so that it can be used to train and evaluate a model.
- ✓ The specific steps involved in loading the dataset will vary depending on the machine learning library or framework that is being used. However, there are some general steps that are common to most machine learning frameworks:

IDENTIFY THE DATASET:

The first step is to identify the dataset that you want to load. This dataset may be stored in a local file, in a database, or in a cloud storage service.

LOAD THE DATASET:

Once you have identified the dataset, you need to load it into the machine learning environment. This may involve using a built-in function in the machine learning library, or it may involve writing your own code.

PREPROCESS THE DATASET:

Once the dataset is loaded into the machine learning environment, you may need to preprocess it before you can start training and evaluating your model. This may involve cleaning the data, transforming the data into a suitable format, and splitting the data into training and test sets.

PROGRAM:

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import r2_score,
mean_absolute_error,mean_squared_error
from sklearn.linear_model import LinearRegression
from sklearn.linear_model import Lasso
from sklearn.ensemble import RandomForestRegressor
from sklearn.svm import SVR
import xgboost as xg
%matplotlib inline
import warnings
warnings.filterwarnings("ignore")
```

LOADING THE DATASET:

dataset = pd.read_csv('E:/USA_Housing.csv')

DATA EXPLORATION:

	Avg. Area Income	Avg. Area House Age	Avg. Area Number of Rooms	Avg. Area Number of Bedrooms	Area Population	Price	Address
0	79545.458574	5.682861	7.009188	4.09	23086.800503	1.059034e+06	208 Michael Ferry Apt. 674\nLaurabury, NE 3701...
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...	...	...	...	...	...	...	...
4995	60567.944140	7.830362	6.137356	3.46	22837.361035	1.060194e+06	USNS Williams\nFPO AP 30153-7653
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4997	63390.686886	7.250591	4.805081	2.13	33266.145490	1.030730e+06	4215 Tracy Garden Suite 076\nJoshualand, VA 01...
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PREPROCESSING THE DATASET:

- Data preprocessing is the process of cleaning, transforming, and integrating data in order to make it ready for analysis.
- This may involve removing errors and inconsistencies, handling missing values, transforming the data into a consistent format, and scaling the data to a suitable range.

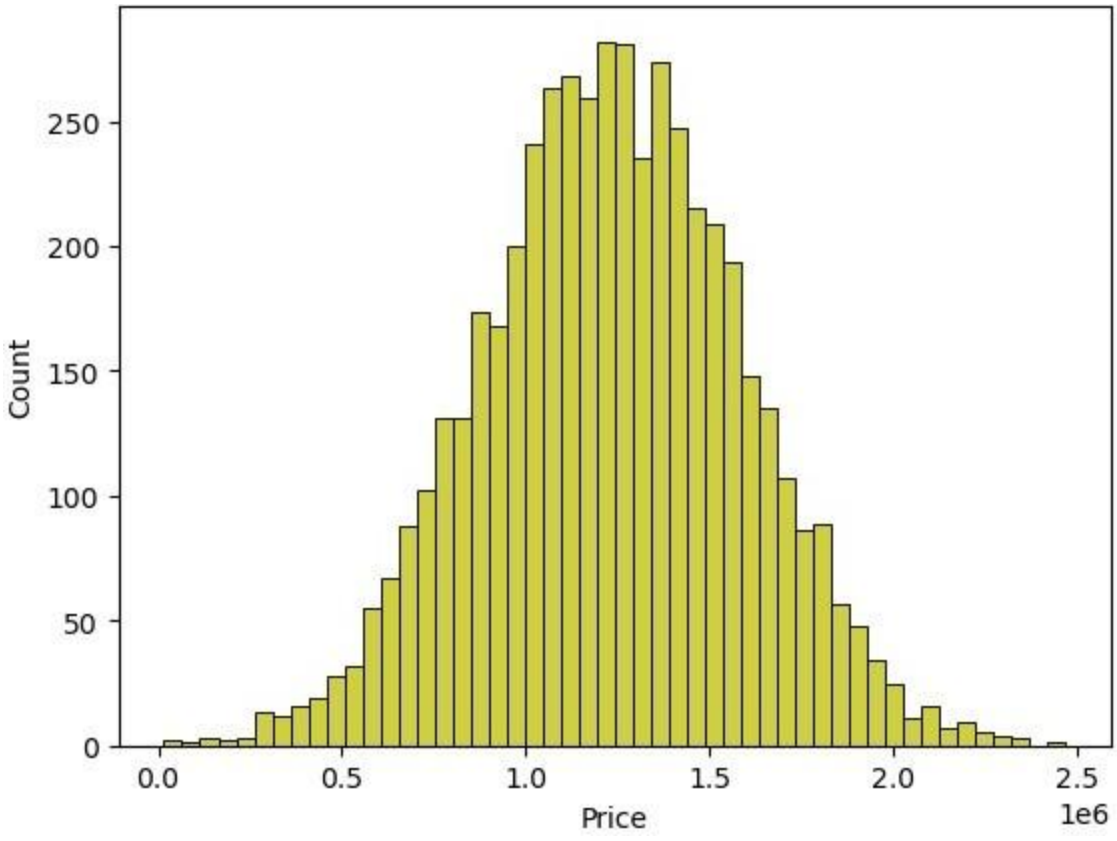
VISUALIZATION AND PREPROCESSING THE DATASET:

In [1]:

```
sns.histplot(dataset, x='Price', bins=50, color='y')
```

Out[1]:

<Axes: xlabel='Price', ylabel='Count'>

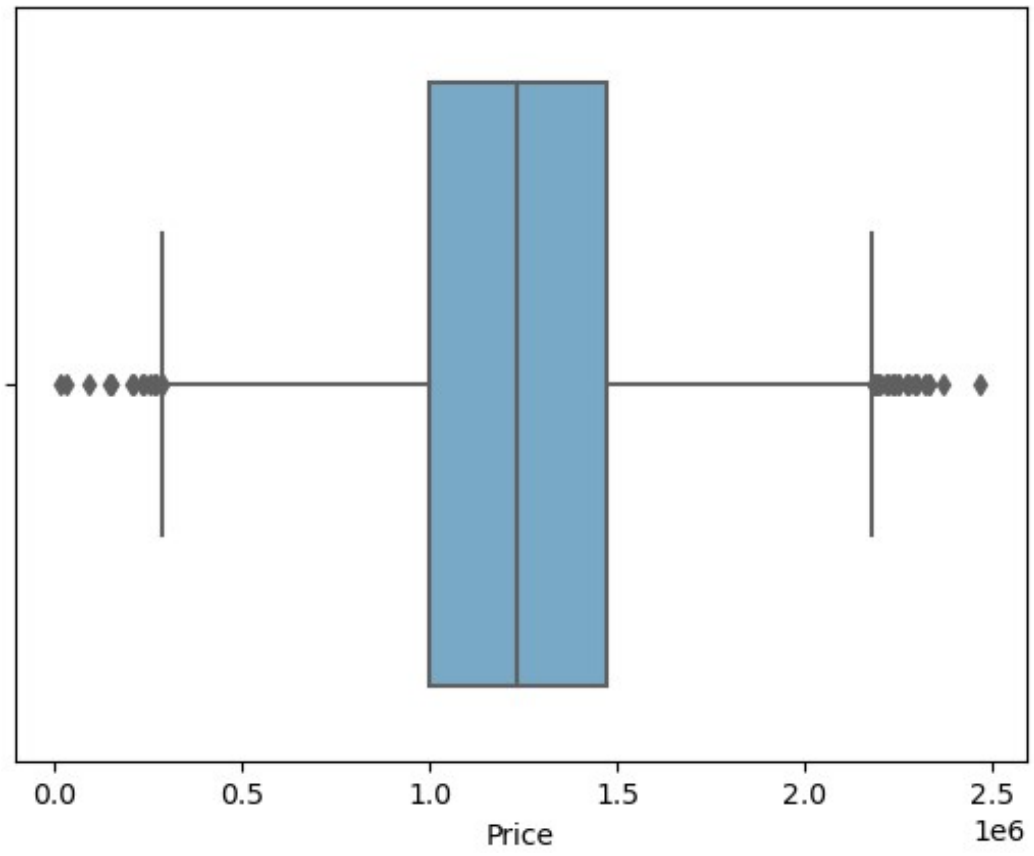


In [2]:

```
sns.boxplot(dataset, x='Price',  palette='Blues')
```

Out[2]:

<Axes: xlabel='Price'>

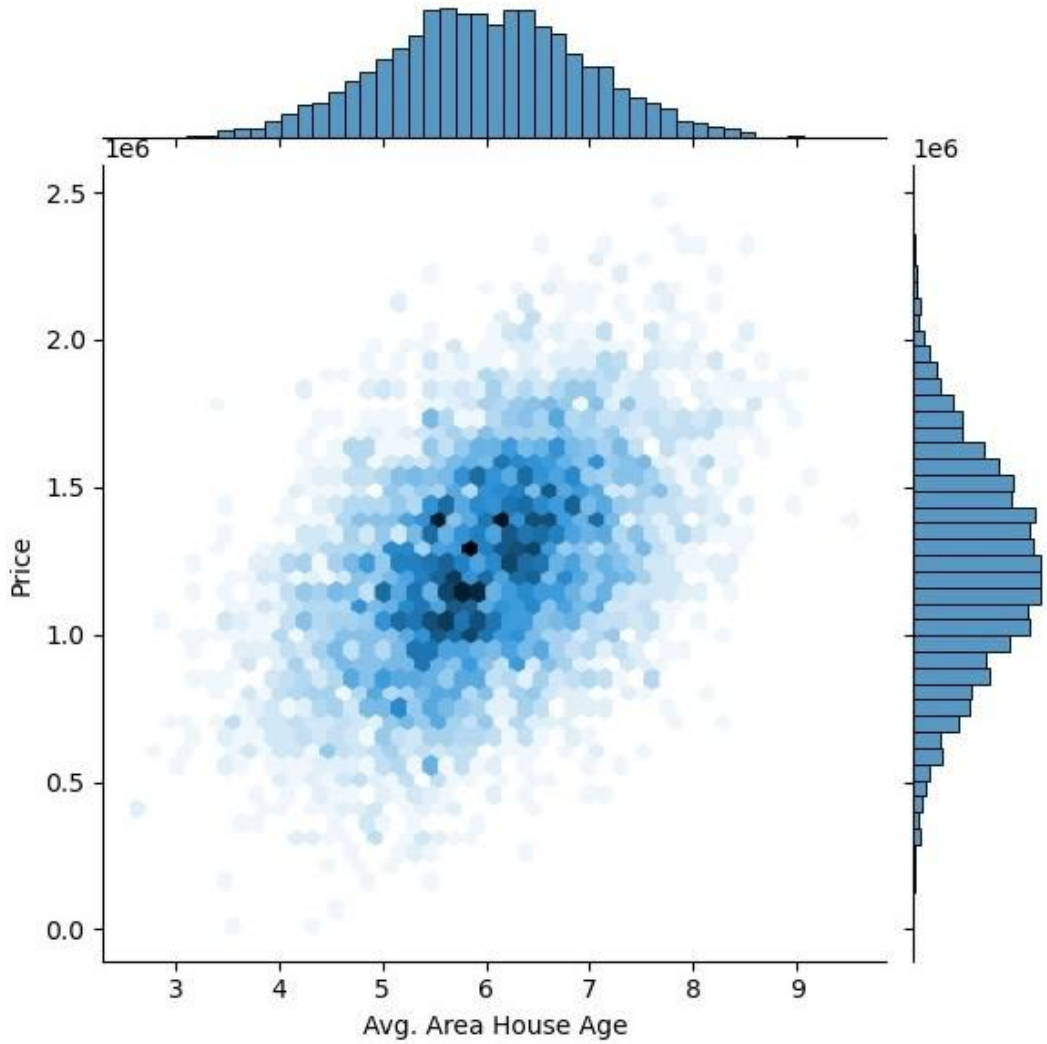


In [3]:

```
sns.jointplot(dataset, x='Avg. Area House Age', y='Price', kind='hex')
```

Out[3]:

<seaborn.axisgrid.JointGrid at 0x7caf1d571810>

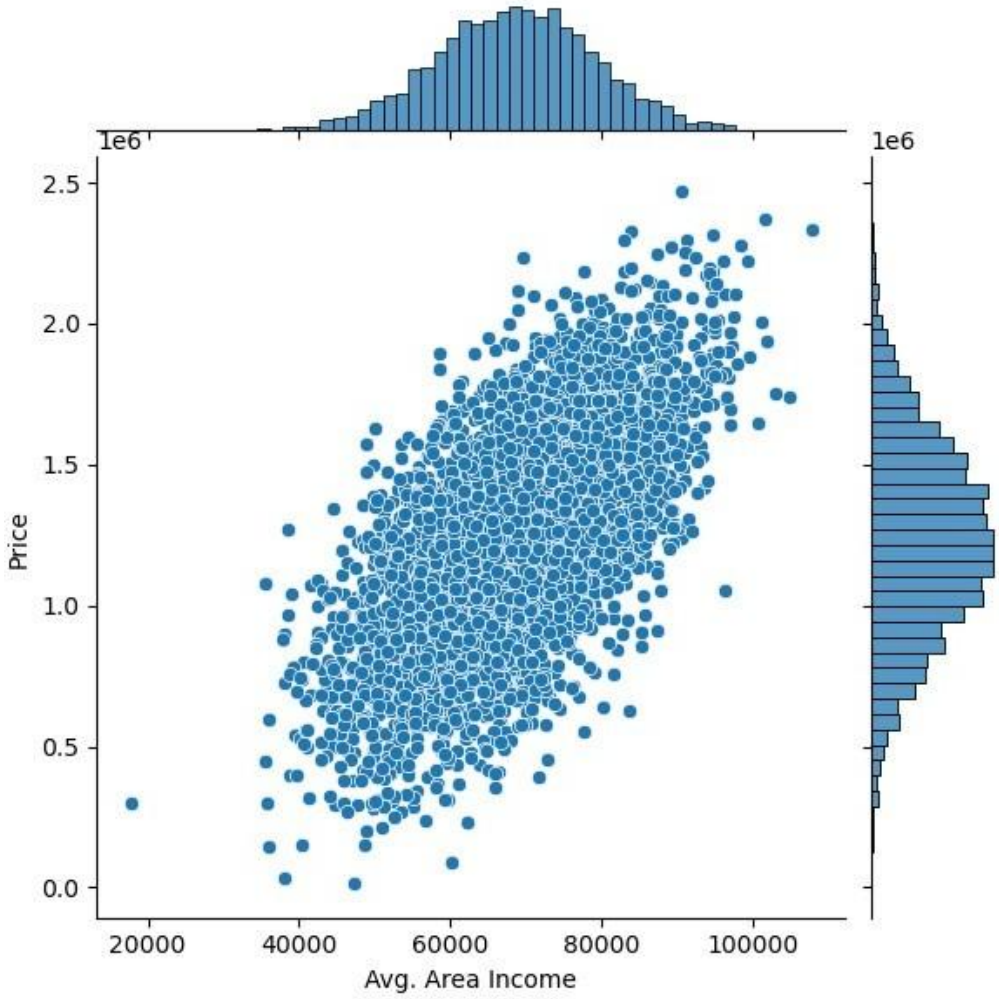


In [4]:

```
sns.jointplot(dataset, x='Avg. Area Income', y='Price')
```

Out[4]:

<seaborn.axisgrid.JointGrid at 0x7caf1d8bf7f0>



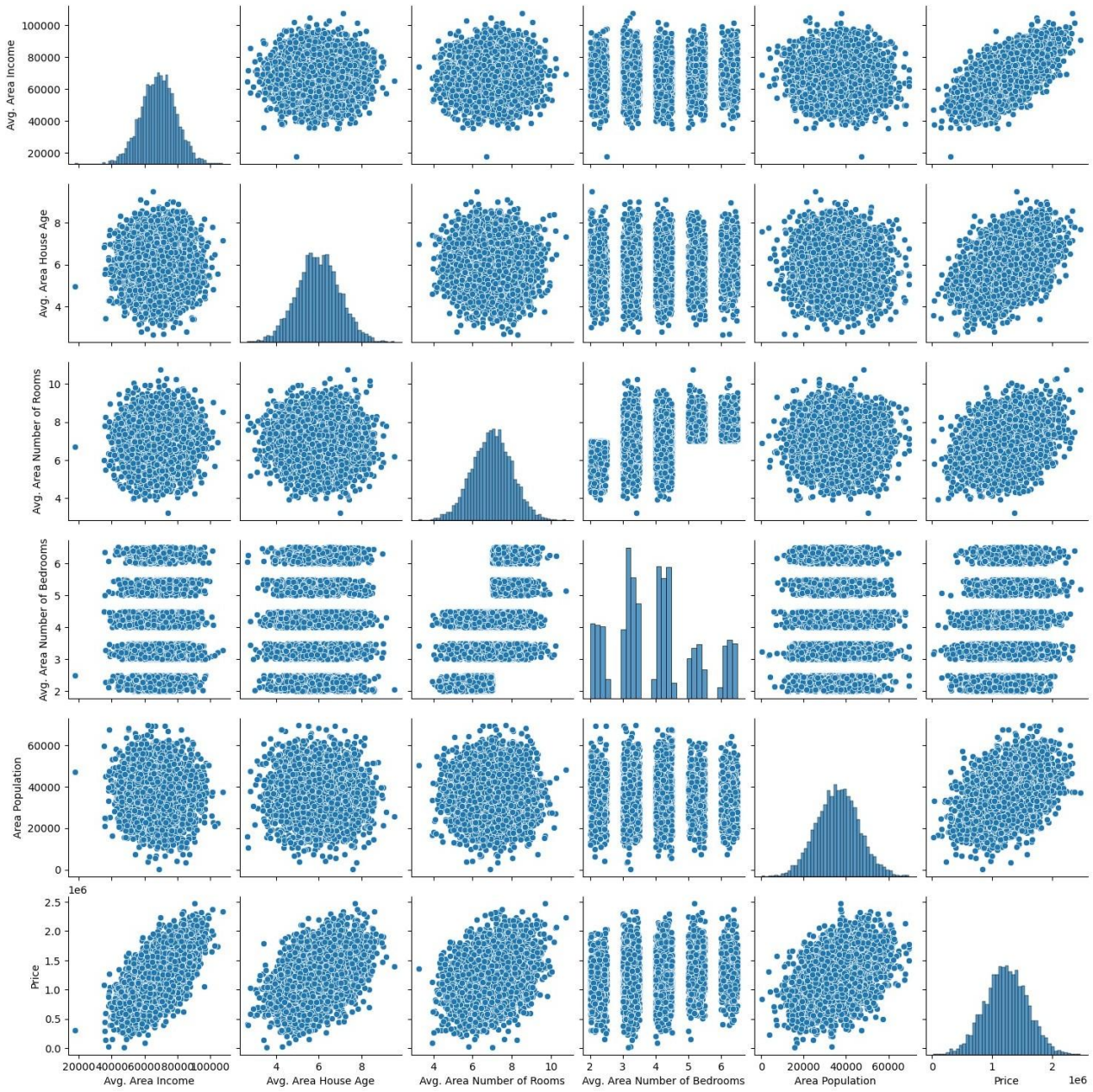
In [5]:

```
plt.figure(figsize=(12,8))sns.pairplot(dataset)
```

Out[5]:

<seaborn.axisgrid.PairGrid at 0x7caf0c2ac550>

<Figure size 1200x800 with 0 Axes>



In [6]:

```
dataset.hist(figsize=(10,8))
```

Out[6]:

array([[<Axes: title={'center': 'Avg. Area Income'}>,

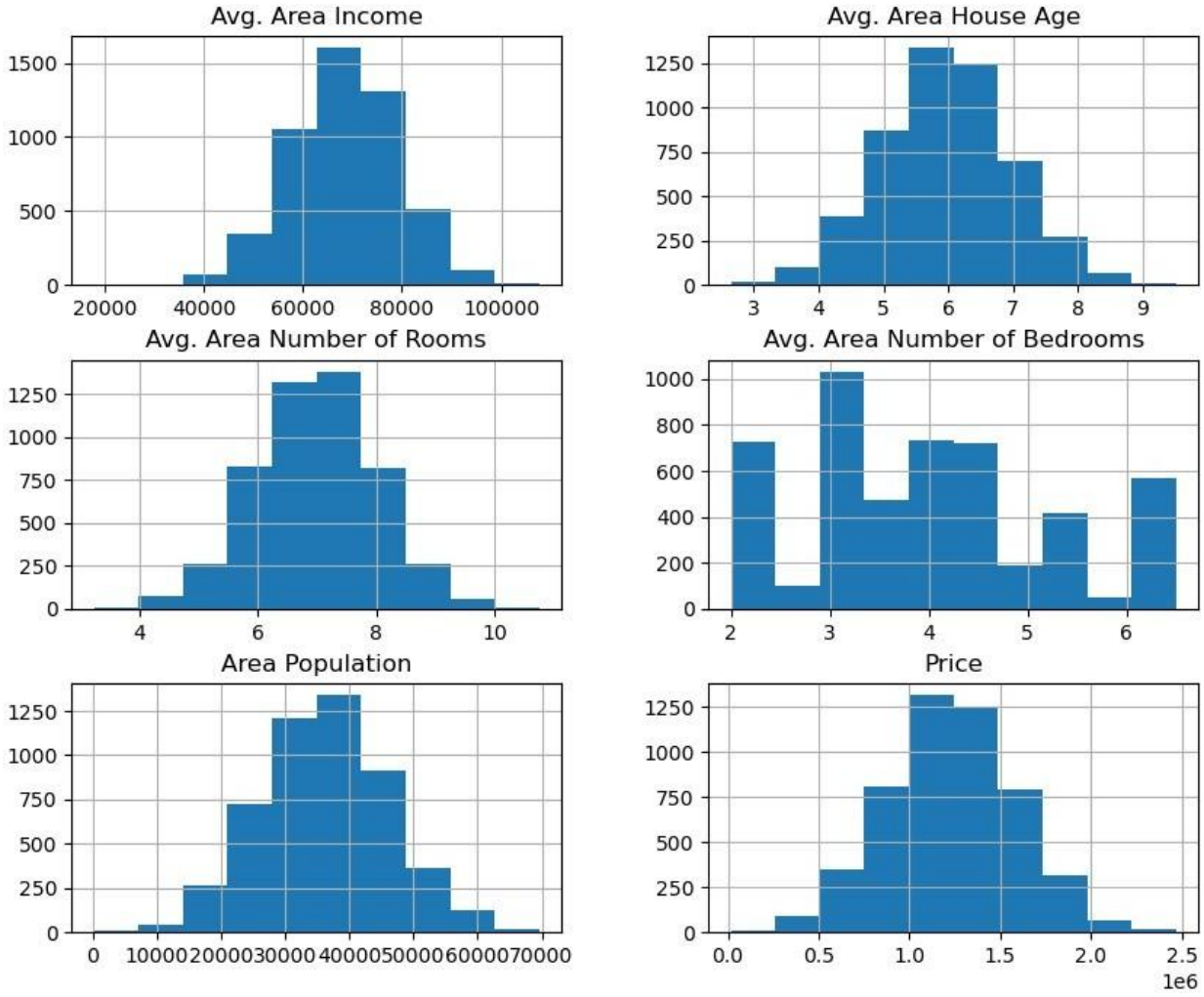
<Axes: title={'center': 'Avg. Area House Age'}>],

[<Axes: title={'center': 'Avg. Area Number of Rooms'}>,

<Axes: title={'center': 'Avg. Area Number of Bedrooms'}>],

[<Axes: title={'center': 'Area Population'}>,

<Axes: title={'center': 'Price'}>]], dtype=object)



VISUALIZING CORELATION:

In [7]:

```
dataset.corr(numeric_only=True)
```

Out[7]:

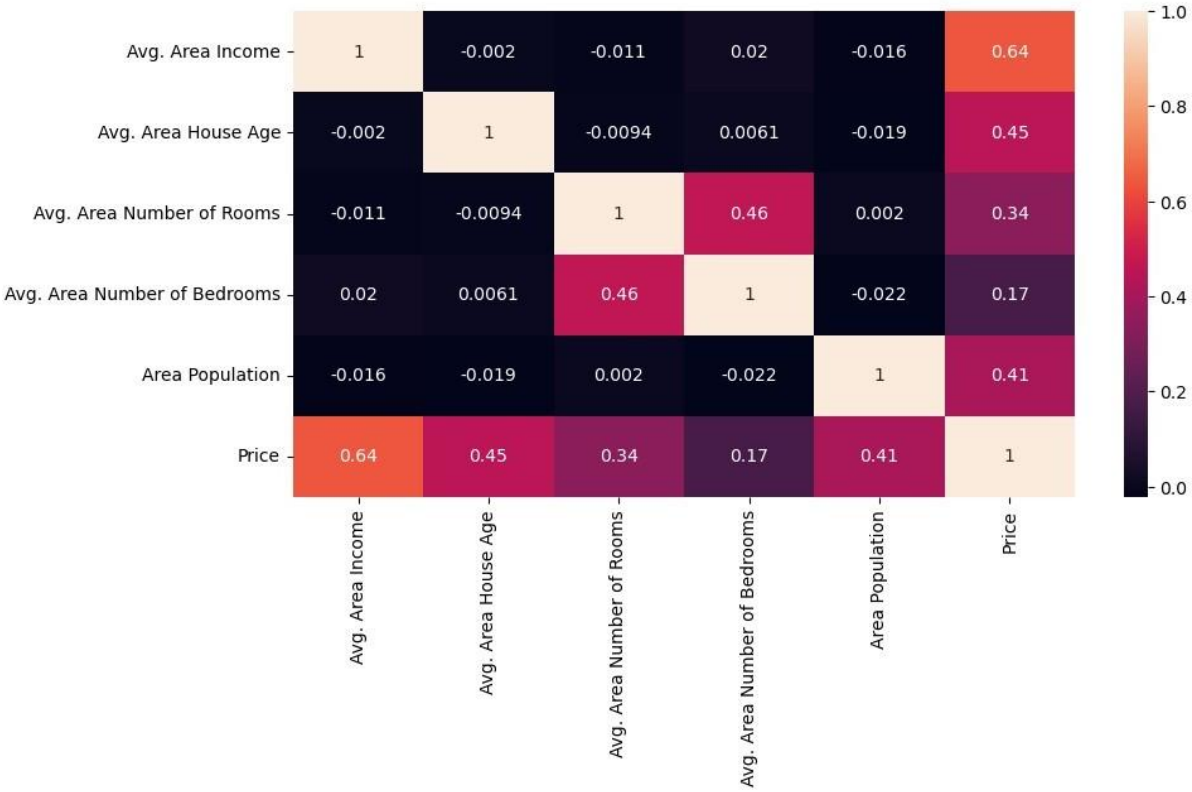
	Avg. Area Income	Avg. Area House Age	Avg. Area Number of Rooms	Avg. Area Number of Bedrooms	Area Population	Price
Avg. Area Income	1.000000	-0.002007	-0.011032	0.019788	-0.016234	0.639734
Avg. Area House Age	-0.002007	1.000000	-0.009428	0.006149	-0.018743	0.452543
Avg. Area Number of Rooms	-0.011032	-0.009428	1.000000	0.462695	0.002040	0.335664
Avg. Area Number of Bedrooms	0.019788	0.006149	0.462695	1.000000	-0.022168	0.171071
Area Population	-0.016234	-0.018743	0.002040	-0.022168	1.000000	0.408556
Price	0.639734	0.452543	0.335664	0.171071	0.408556	1.000000

In [8]:

```
plt.figure(figsize=(10,5))sns.heatmap(dataset.corr(numeric_only = True), annot= True)
```

Out[8]:

<Axes: >

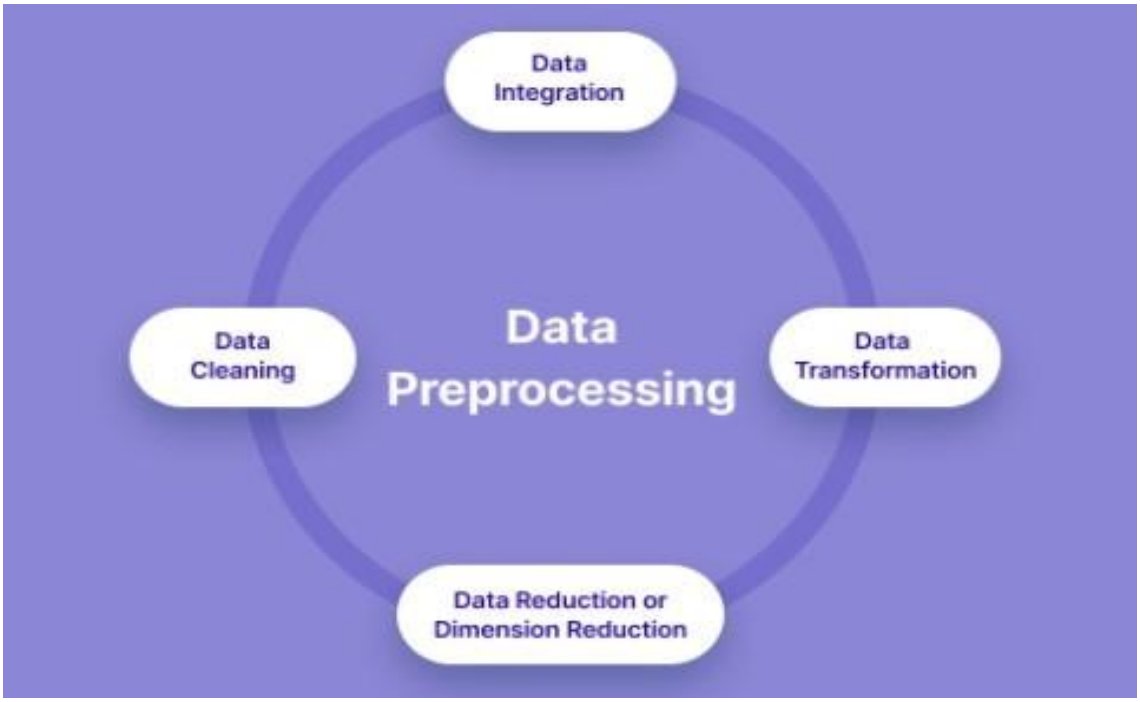


DATA PREPROCESSING STEPS INCLUDE:

- **DATA CLEANING:** This involves identifying and correcting errors andinconsistencies in the data. For example, this may involve removing duplicate records, correcting typos, and filling in missingvalues.

- **DATA TRANSFORMATION:** This involves converting the data into a format that is suitable for the analysis task. For example, this mayinvolve converting categorical data to numerical data, or scaling the data to a suitable range.
- **DATA INTEGRATION:** This involves combining data from multiplesources into a single dataset. This may involve resolving inconsistencies in the data, such as different data formats or different variable names.

Data preprocessing is an essential step in many data science projects. By carefully preprocessing the data, data scientists can improve the accuracy and reliability of their results.



PROGRAM:

```
# Importing necessary libraries
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler, OneHotEncoder
from sklearn.compose import ColumnTransformer
from sklearn.pipeline import Pipeline

# Step 1: Load the dataset
data = pd.read_csv('E:\USA_Housing.csv')

# Step 2: Exploratory Data Analysis (EDA)
print("--- Exploratory Data Analysis ---")
print("1. Checking for Missing Values:")
missing_values = data.isnull().sum()
print(missing_values)

print("\n2. Descriptive Statistics:")
description = data.describe()

print(description)
```

 # Step 3: Feature Engineering

```
print("\n--- Feature Engineering ---")


# Separate features and target variable
X = data.drop('price', axis=1)
y = data['price']


# Define which columns should be one-hot encoded (categorical)
categorical_cols = [' Avg. Area House Age']


# Define preprocessing steps using ColumnTransformer and Pipeline
preprocessor = ColumnTransformer(
    transformers=[
        ('num', StandardScaler(), [' Avg. Area Number of Rooms ', ' Avg. Area Number of Bedrooms ', ' Area Population ', ' Avg. Area Income ']),
        ('cat', OneHotEncoder(), categorical_cols)])
```

 # Step 4: Data Splitting

```
print("\n--- Data Splitting ---")

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

print(f"X_train shape: {X_train.shape}")

print(f"X_test shape: {X_test.shape}")

print(f"y_train shape: {y_train.shape}")

print(f"y_test shape: {y_test.shape}")
```

 # Step 5: Preprocessing and Feature Scaling using Pipeline

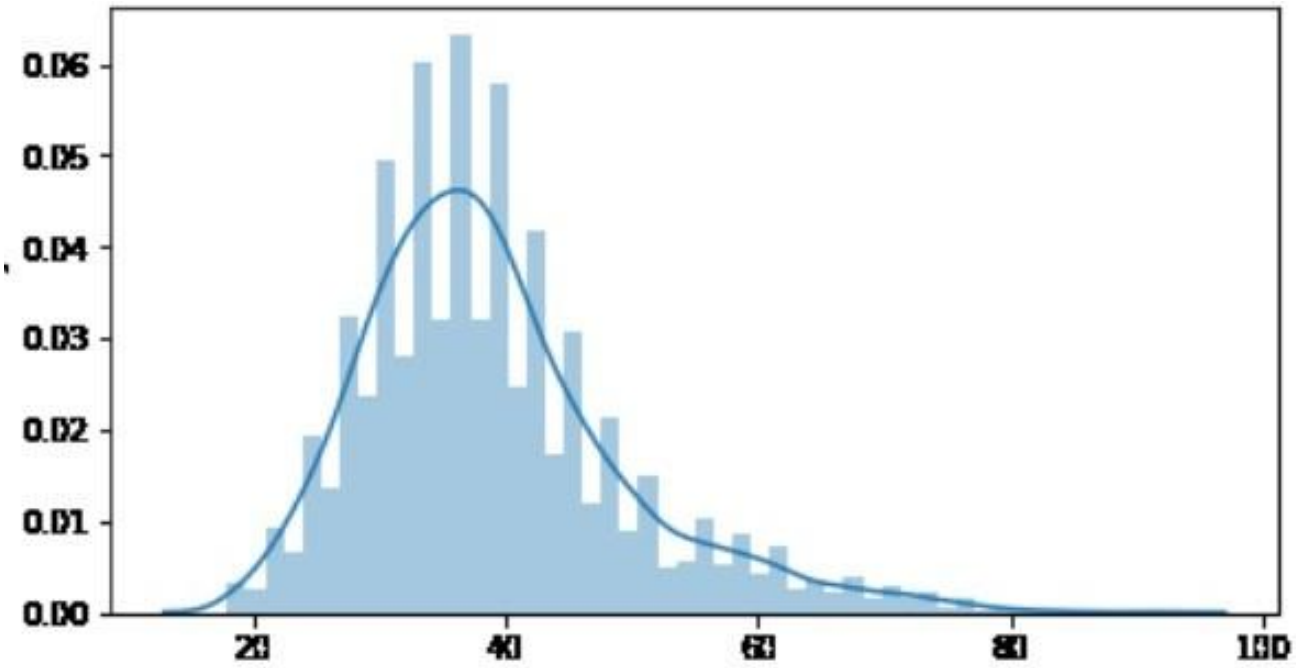
```
print("\n--- Feature Scaling ---")

model = Pipeline([

    ('preprocessor', preprocessor),

])

# Fit the preprocessing pipeline on the training data

X_train = model.fit_transform(X_train)

# Transform the testing data using the fitted pipeline

X_test = model.transform(X_test)


print("--- Preprocessing Complete! ---")
```

OUTPUT:

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5000 entries, 0 to 4999
Data columns (total 7 columns):

#	Column	Non-Null Count	Dtype
0	Avg. Area Income	5000 non-null	float64
1	Avg. Area House Age	5000 non-null	float64
2	Avg. Area Number of Rooms	5000 non-null	float64
3	Avg. Area Number of Bedrooms	5000 non-null	float64
4	Area Population	5000 non-null	float64
5	Price	5000 non-null	float64
6	Address	5000 non-null	object

dtypes: float64(6), object(1)
memory usage: 273.6+ KB



AVG.AREA HOUSE AGE

DATA SPLITTING:

X_train shape: (800, 7)

X_test shape: (200, 7)

y_train shape: (800,)

y_test shape: (200,)

CONCLUSION:

In the quest to build a house price prediction model, we have embarked on a critical journey that begins with loading and preprocessing the dataset.We have traversed through essential steps, starting with importing the necessary libraries to facilitate data manipulation and analysis.

- Understanding the data's structure, characteristics, and any potential issues through exploratory data analysis (EDA) is essential for informed decision-making.
- Data preprocessing emerged as a pivotal aspect of this process. It involves cleaning, transforming, and refining the dataset to ensure that it aligns with the requirements of machine learning algorithms.
- With these foundational steps completed, our dataset is now primed for the subsequent stages of building and training a house price prediction model.