Advanced Machine Learning

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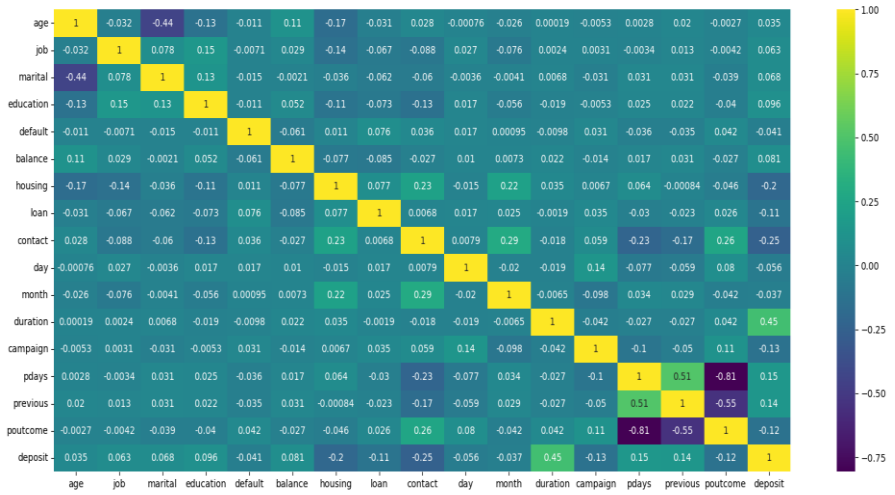
classification dataset

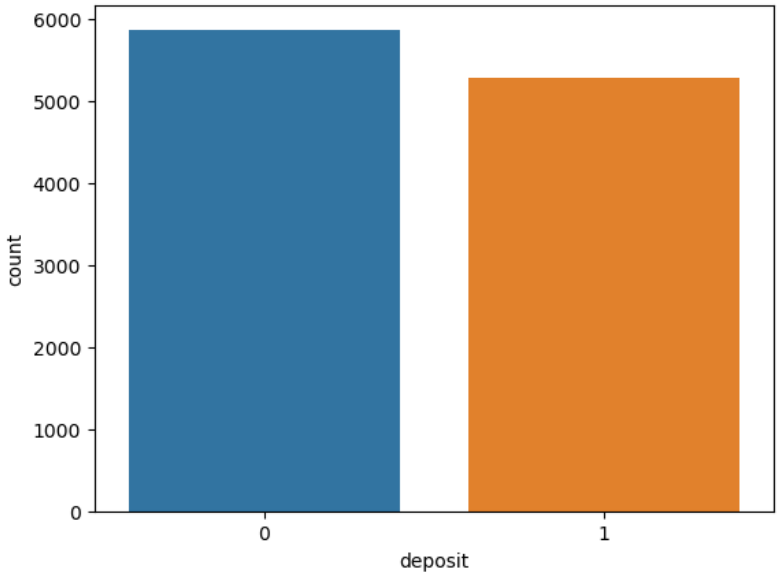
Name :	• **Banking marketing**
Number of Classes :	• 2 [Yes ,No]
Total Size of Dataset :	• 11,162
Training Data Size :	• 7813
Test Data Size :	• 3349
Features :	• 17

Data visualization:

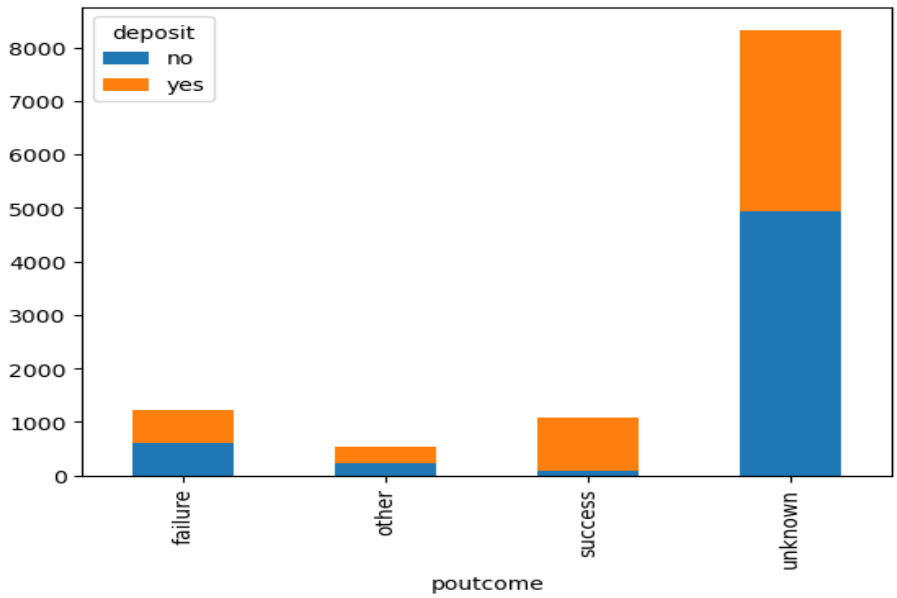
1) Heatmap :



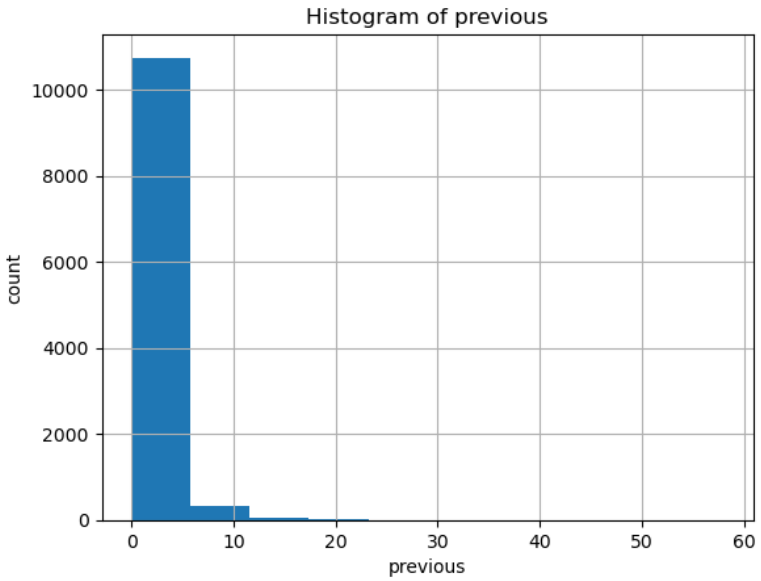
2) Count plot :



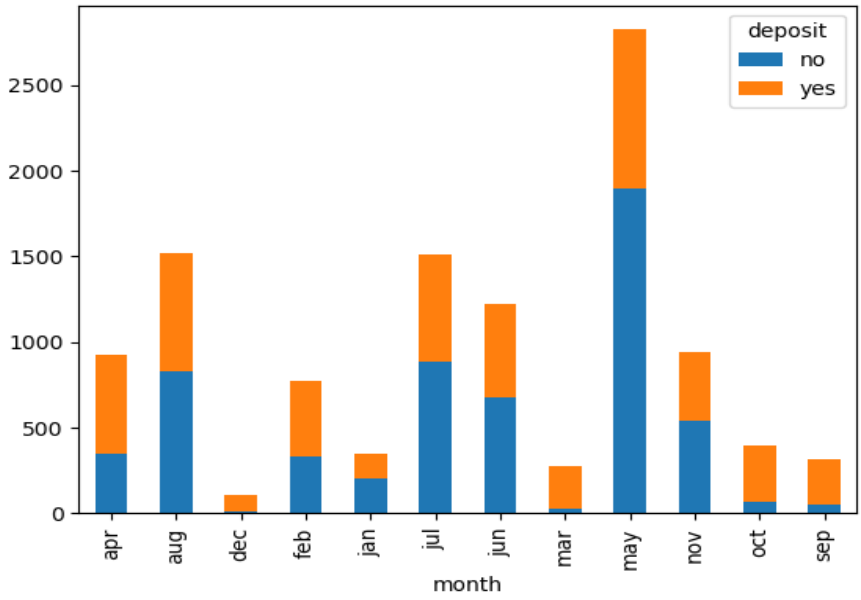
3) Poutcome :



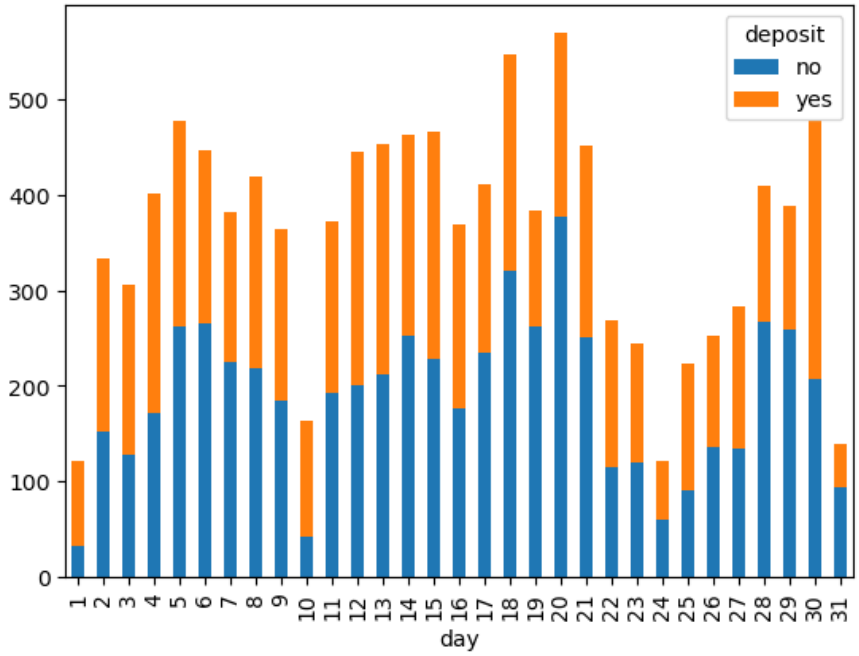
4) Histogram of "previous" :



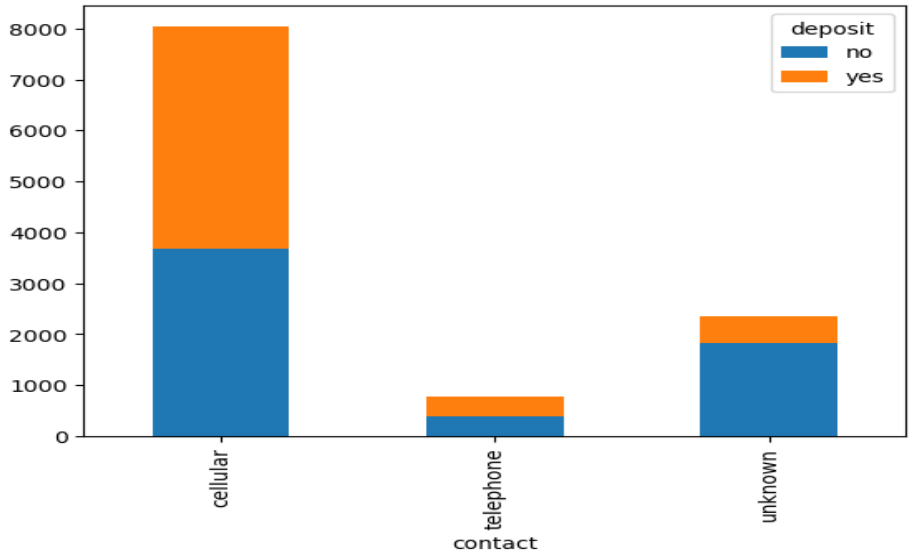
5) Bar chart of categorical variable "month" :



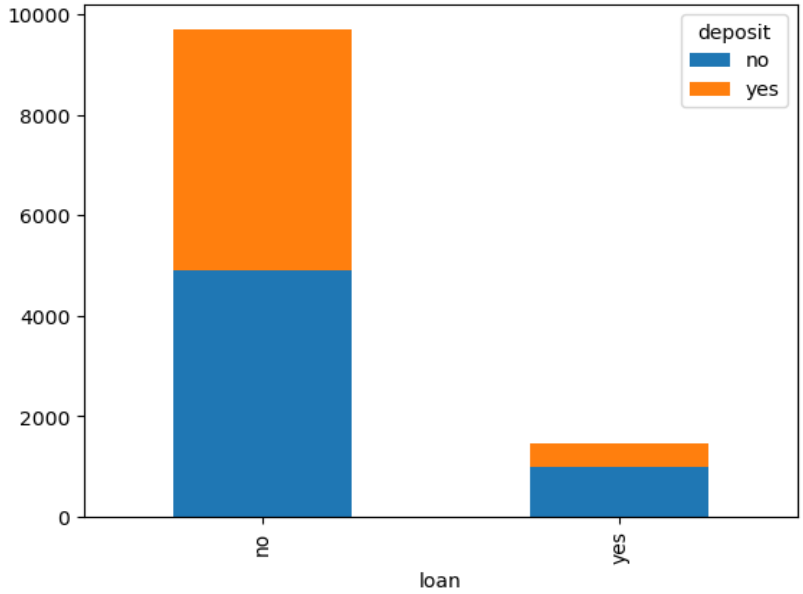
6) Bar chart of categorical variable ("day") :



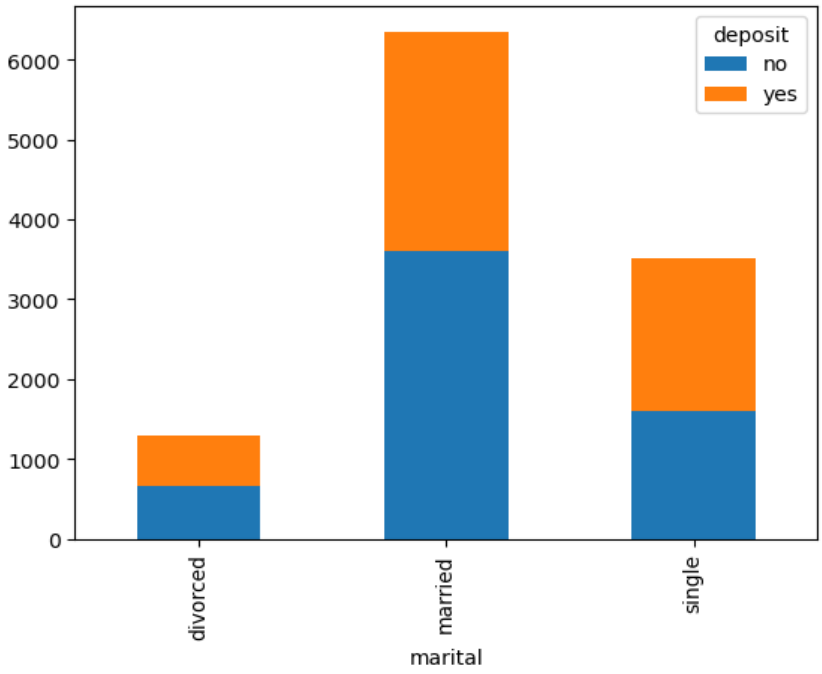
7) Bar chart of categorical variable ("contact") :



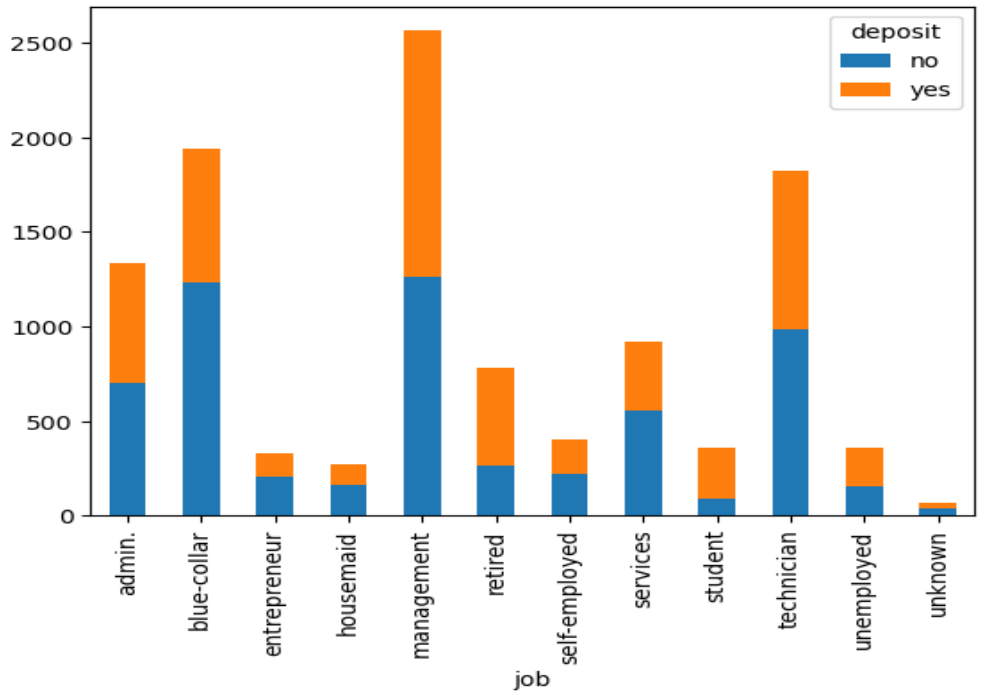
8) Bar chart of categorical variable ("loan") :



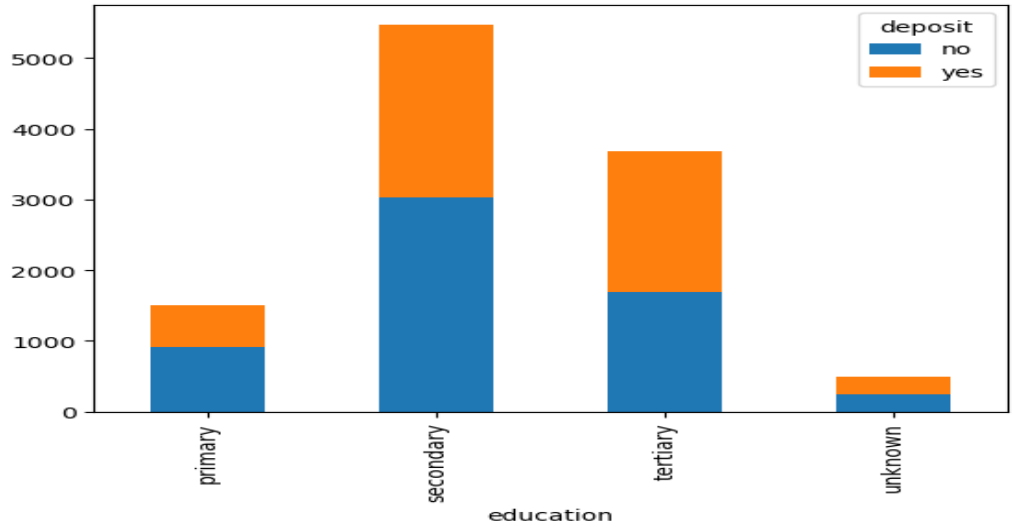
9) Bar chart of categorical variable ("marital") :



10) Bar chart of categorical variable ("job") :



11) Bar chart of categorical variable ("education") :



Decision Tree Model:

1) Implementation Details :

1) Model Hyperparameters:

Criterion	'gini'
max_depth	10
max_features	None
min_samples_split	30

2) Feature Extraction:

```
X = df.drop(columns=['deposit'])  # Features ['age','job','marital','education','default','balance',housing','loan','contact',
                                  #           'day','month','duration','campaign','pdays','previous','poutcome']

y = df['deposit']  #Target
```

The dimension of the resulted features is mentioned in the output: 16 features were extracted.

3) Regularization:

minimum samples per leaf and minimum samples per split, which are used to prevent overfitting.

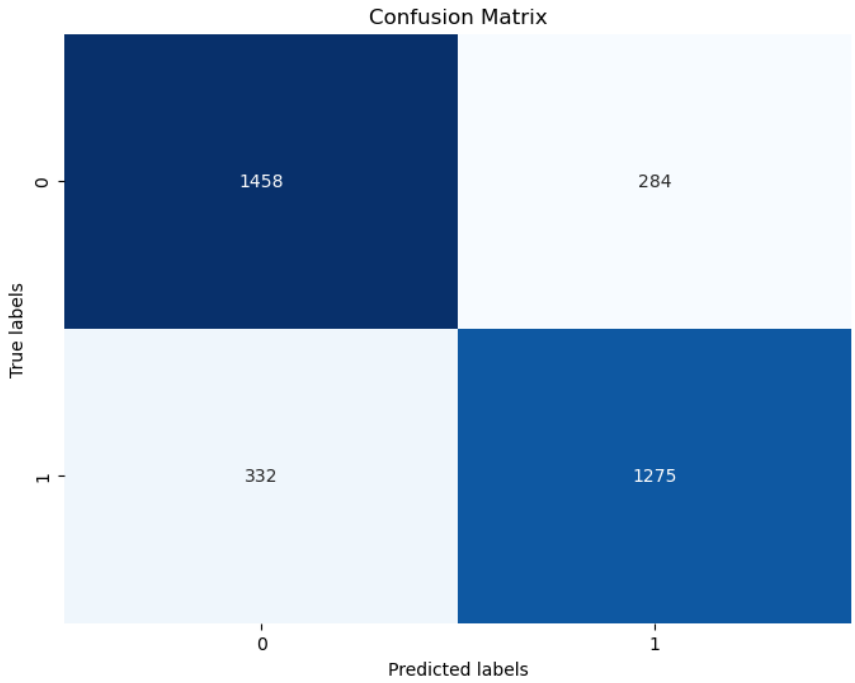
- Min Samples Leaf: Minimum number of samples required to be at a leaf node is set to 5.
- Min Samples Split: Minimum number of samples required to split an internal node is set to 30

2) Result Details:

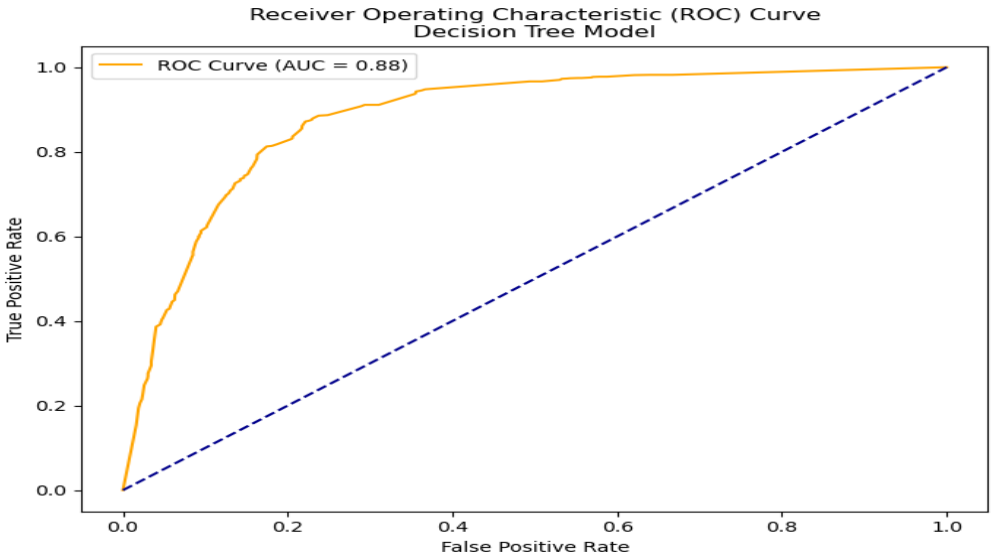
1) Model Accuracy :

- **Model accuracy**: 0.8160644968647357

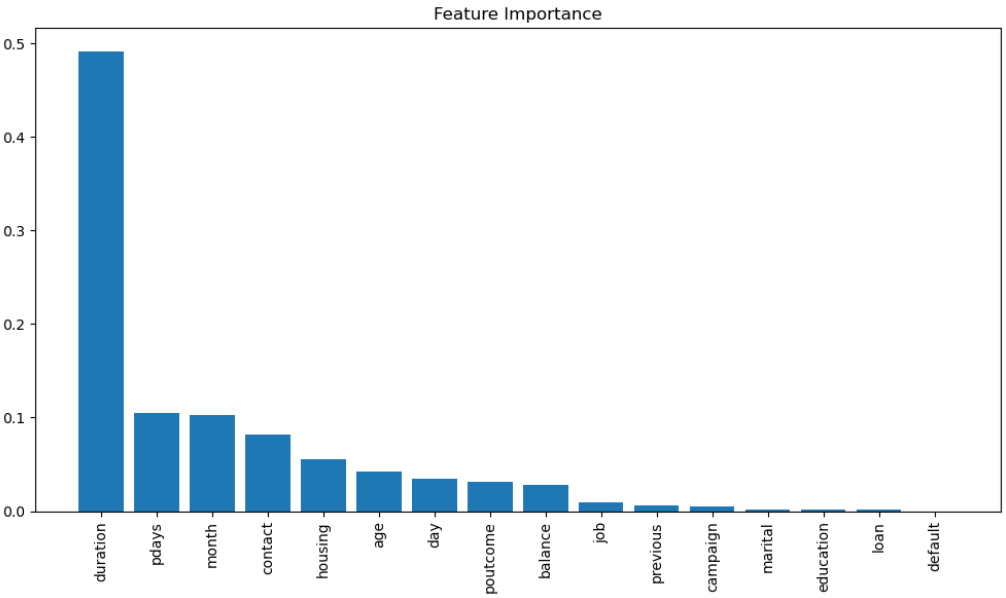
2) Confusion Matrix :



3) Receiver Operating Characteristic (ROC) Curve :



4) Feature Importance :



Neural Network Model:

1) Implementation Details :

1) Model Hyperparameters :

hidden layers	**3 hidden layers**
optmizer	**'adam'**
laearning_rate	**0.001**
epochs	**10**
batch_size	**25**
validation_split	**25%**

2) Feature Extraction:

```
X = df.drop(columns=['deposit'])  # Features ['age','job','marital','education','default','balance',housing','loan','contact',
                                  #           'day','month','duration','campaign','pdays','previous','poutcome']

y = df['deposit']  #Target
```

The dimension of the resulted features is mentioned in the output: 16 features were extracted.

3) Regularization :

Dropout regularization is used after the first hidden layer with a dropout rate of 0.3.

- Dropout is a technique used to prevent overfitting by randomly dropping a fraction of the input units (neurons) during training, which helps in generalization.

4) Batch Size:

The batch size is set to 25. This means that during each iteration of training, 25 samples are processed together before updating the weights of the neural network. Using mini-batch training helps in achieving a balance between computational efficiency and model convergence.

5) Number of Epochs:

The number of epochs is set to 10. An epoch refers to one complete pass through the entire training dataset.

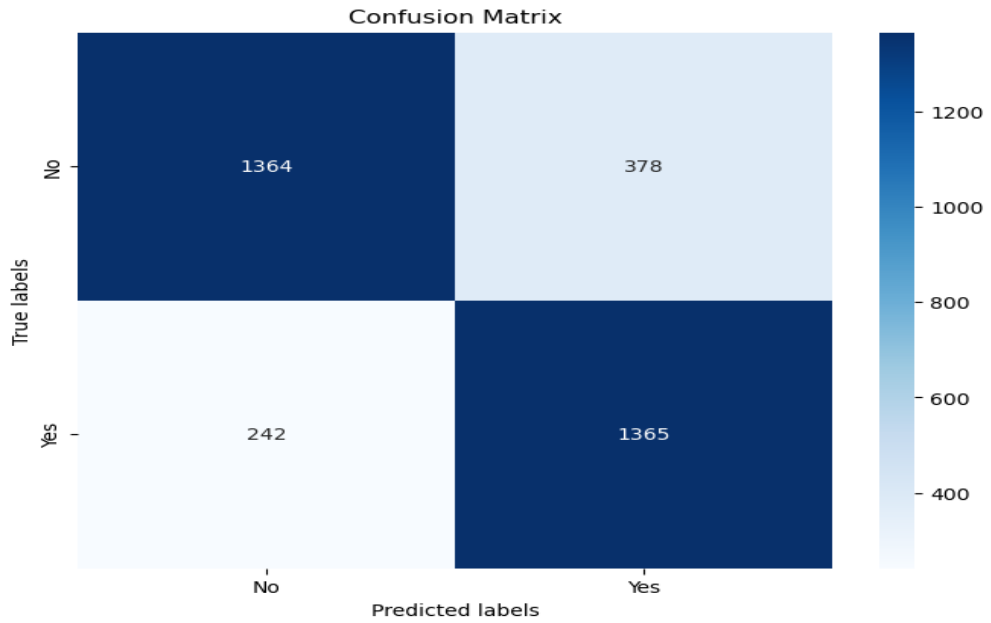
- Training for multiple epochs allows the model to see the entire dataset multiple times, enabling it to learn from the data and improve its performance over time.

2) Result Details:

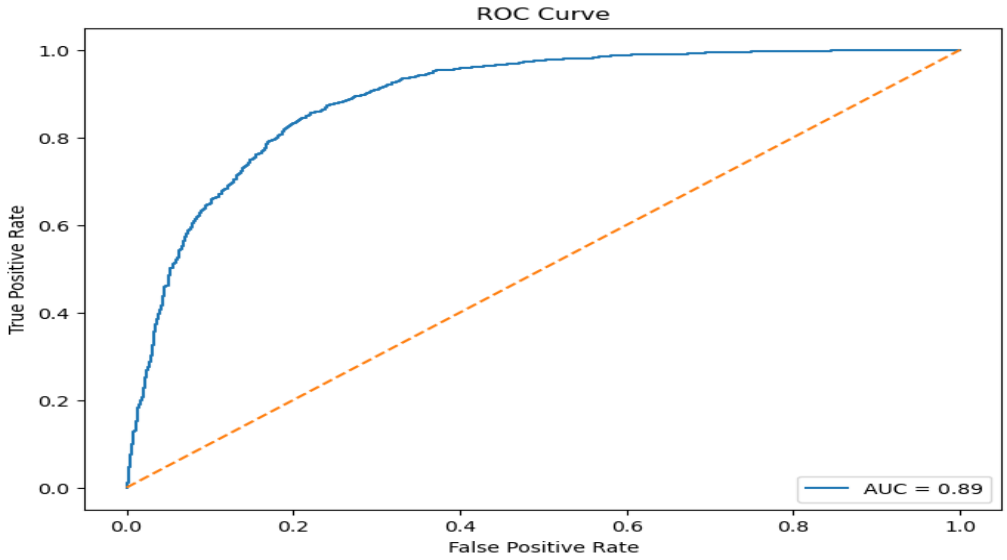
1) Model Accuracy :

- **Model accuracy**: 0.8109883666038513

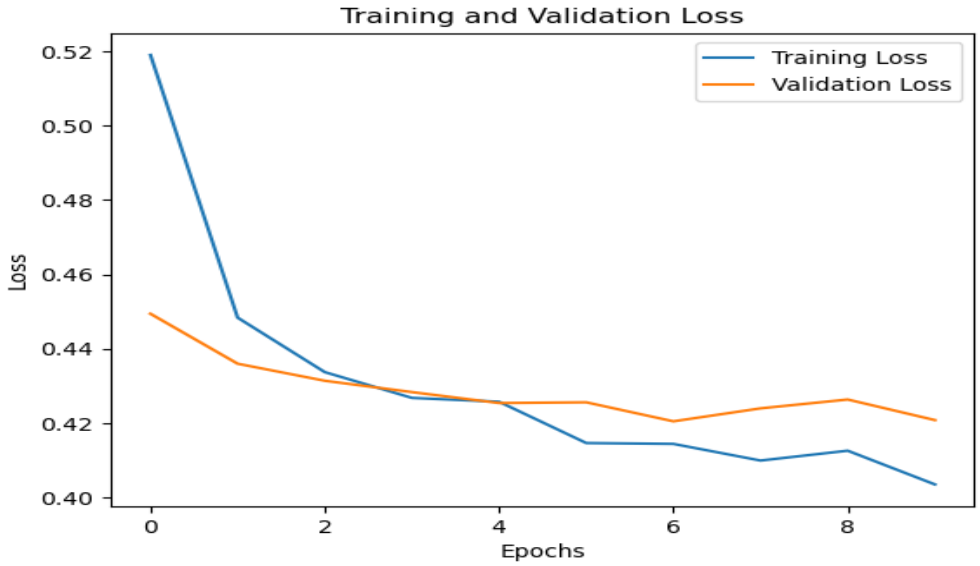
2) Confusion Matrix :



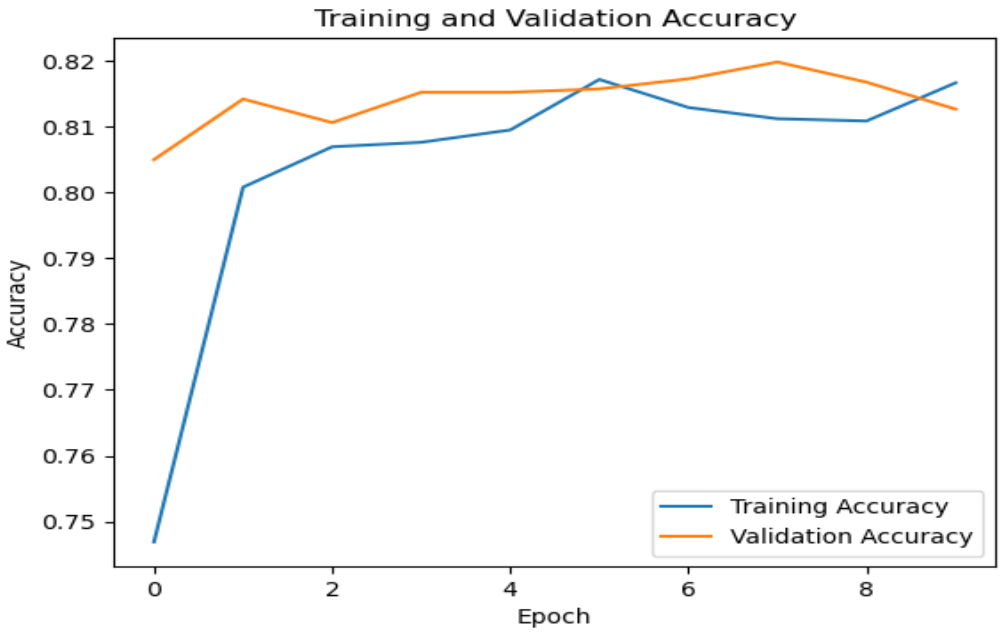
3) Receiver Operating Characteristic (ROC) Curve:



4) Training and Validation Loss :



5) Training and Validation Accuracy :



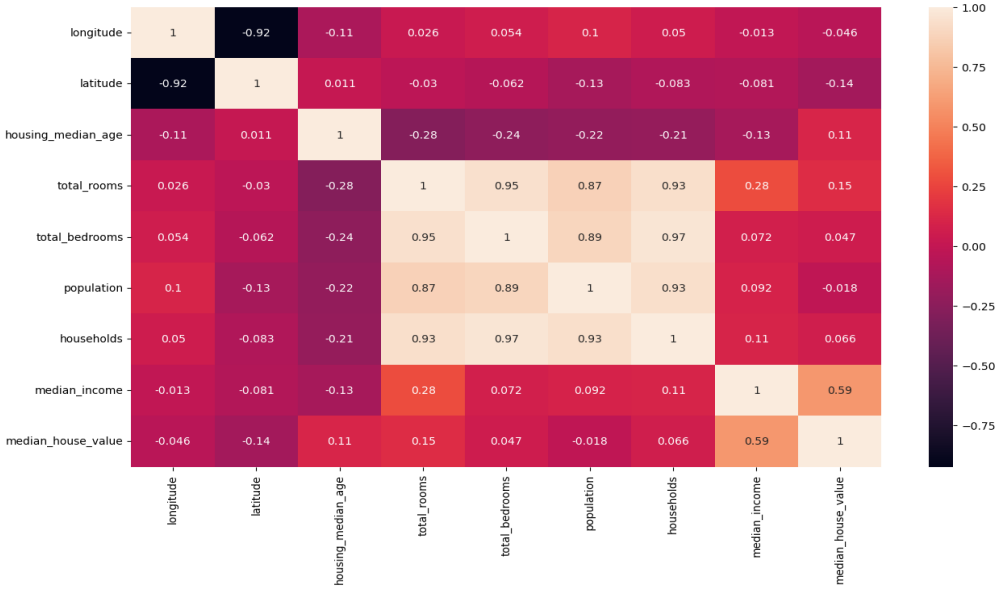
Regression dataset

Name :	• **California housing prices**
Total Size of Dataset :	• 20,640
Training Data Size :	• 16,512
Test Data Size :	• 4,128
Features :	• 9

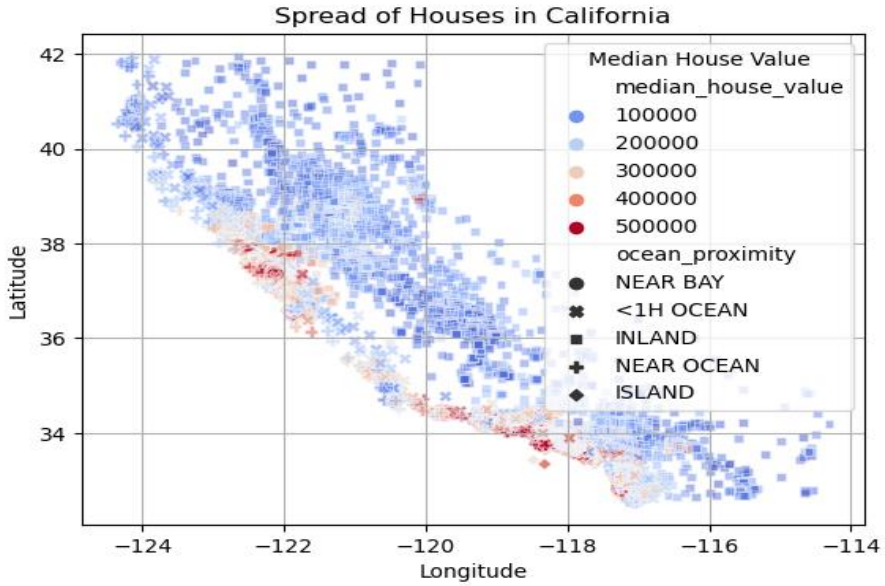
- after preprocessing I scaled the data and converted the categorical column by label encoder.

Data visualization:

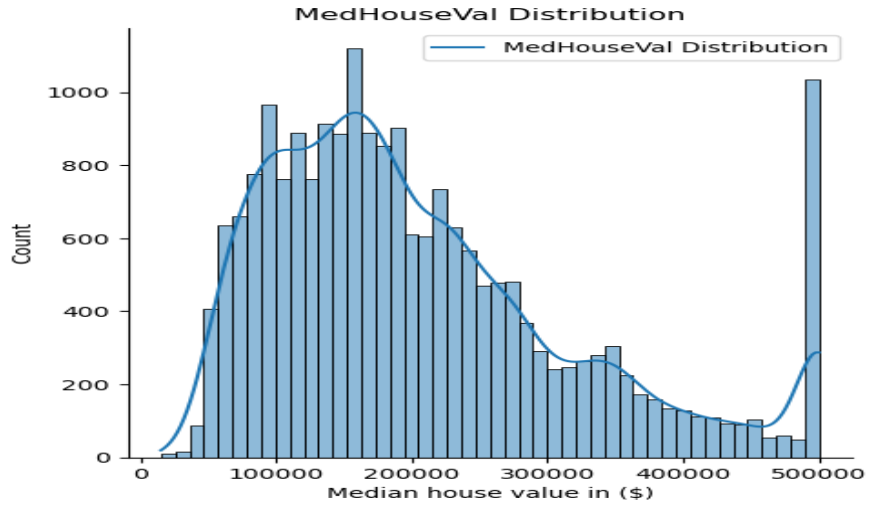
1) Heatmap :



2) Geographical Scatter Plot :

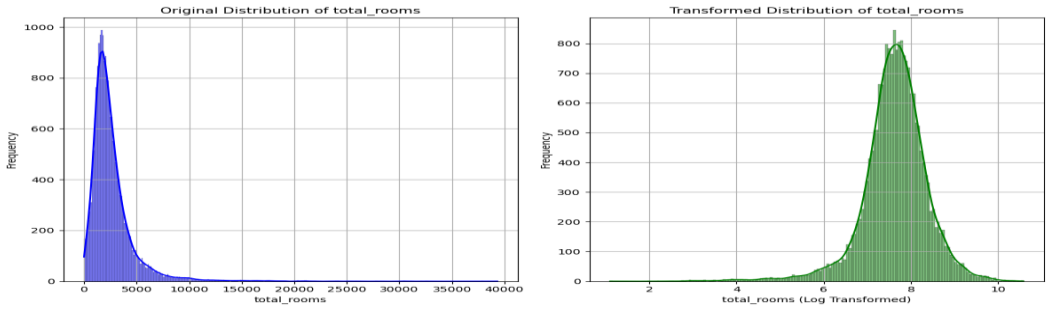


3) distribution plot represents the distribution of median house values Data :

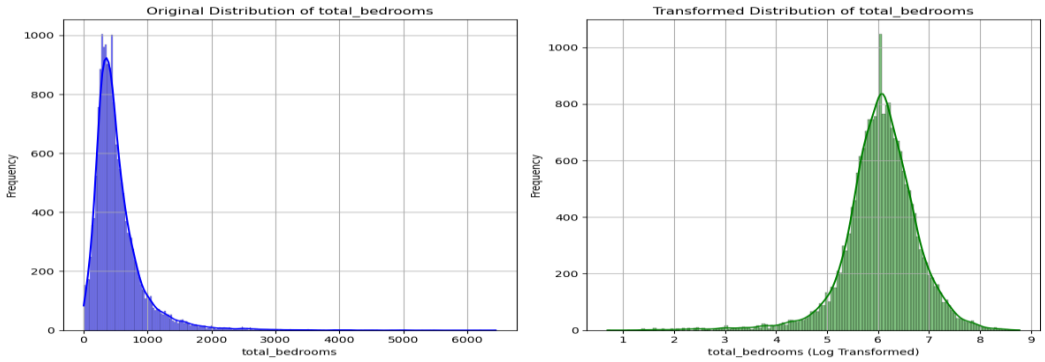


4) Log Transformation :

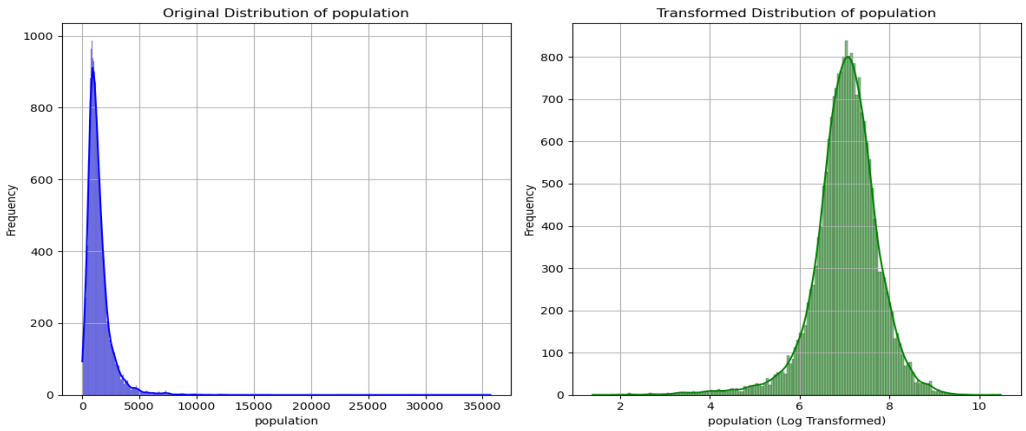
1)total_rooms:



2)total_bedrooms:

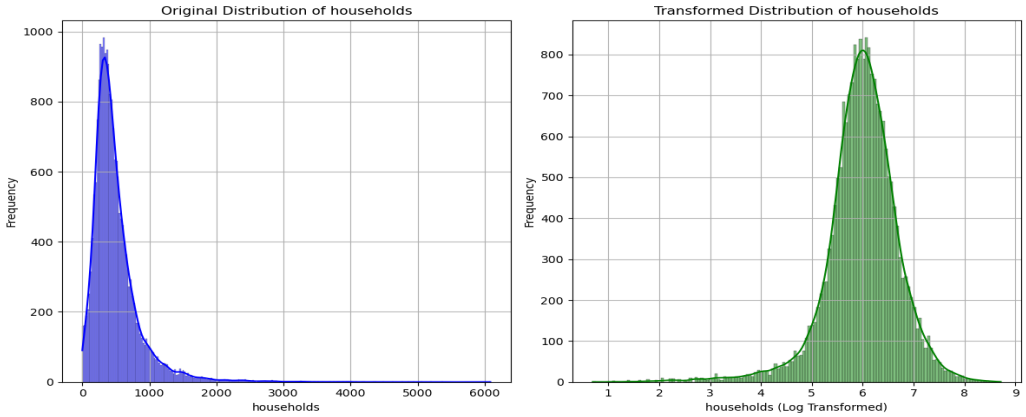


3)population:

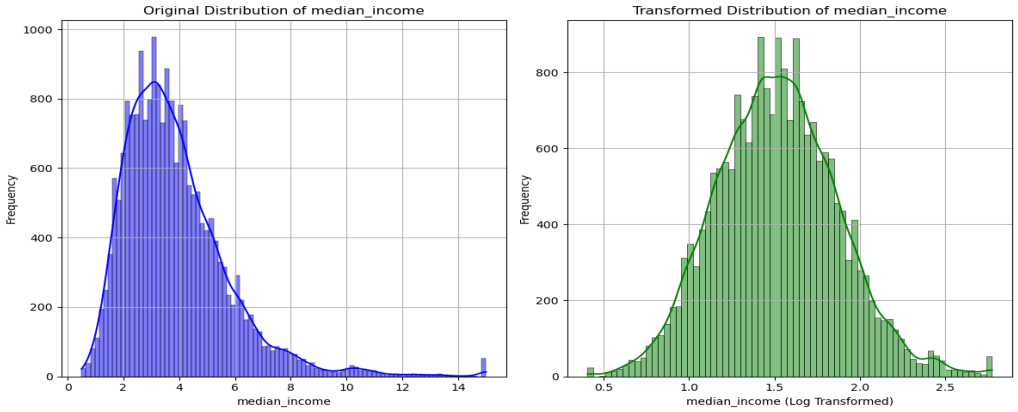


4) Log Transformation :

4) households:



5) median_income:



SVR Model:

1) Implementation Details :

1) Model Hyperparameters:

C	30
Gamma	'scale'
Kernel	'rbf'
Epsilon	0.2

2) Feature Extraction:

```
X_features = dataset.drop(['median_house_value'], axis = 1)  # Features ['longitude','latitude','housing_median_age','total_rooms','total_bedrooms'
                                                             #          'population','households','median_income','ocean_proximity']

y_target = dataset['median_house_value'] #Target
```

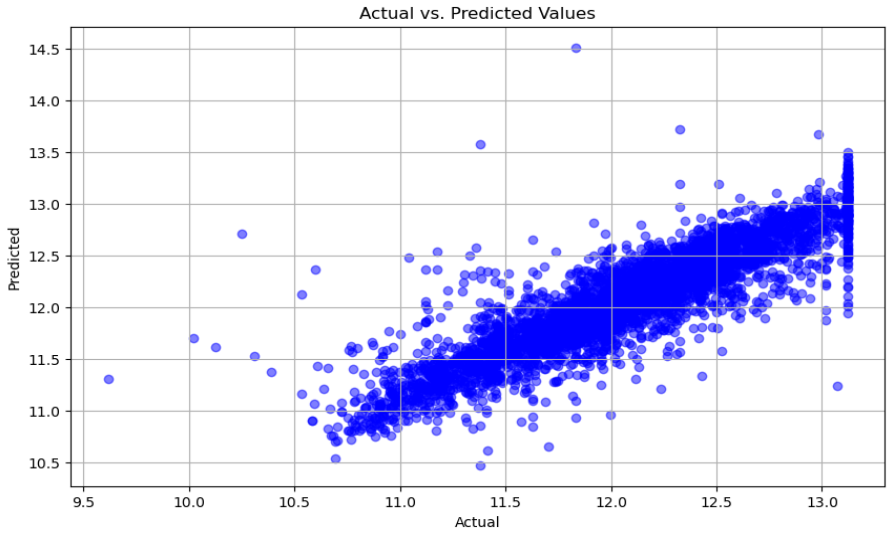
- Log transformation is applied to certain columns specified in log_columns.
- Label encoding is performed on the 'ocean_proximity' column using LabelEncoder from scikit-learn.

2) Result Details:

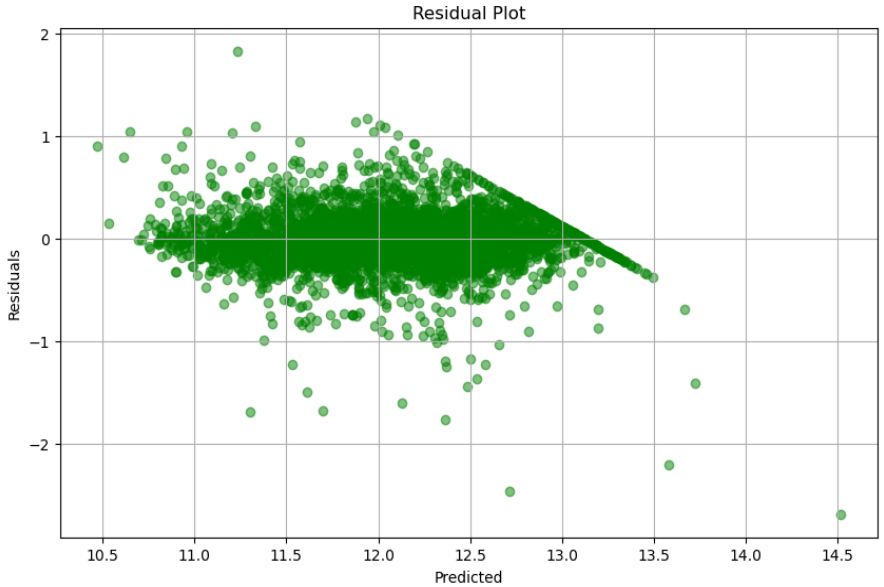
1) Model Accuracy :

- **train score**: 0.8588121584044552
- **test score:** 0.7800056178583221
- **Mean Squared Error:** 0.07180227341482881
- **R-squared:** 0.7800056178583221

2) Actual vs. Predicted Values:



3) Residual Plot:



4) Distribution of Residuals: