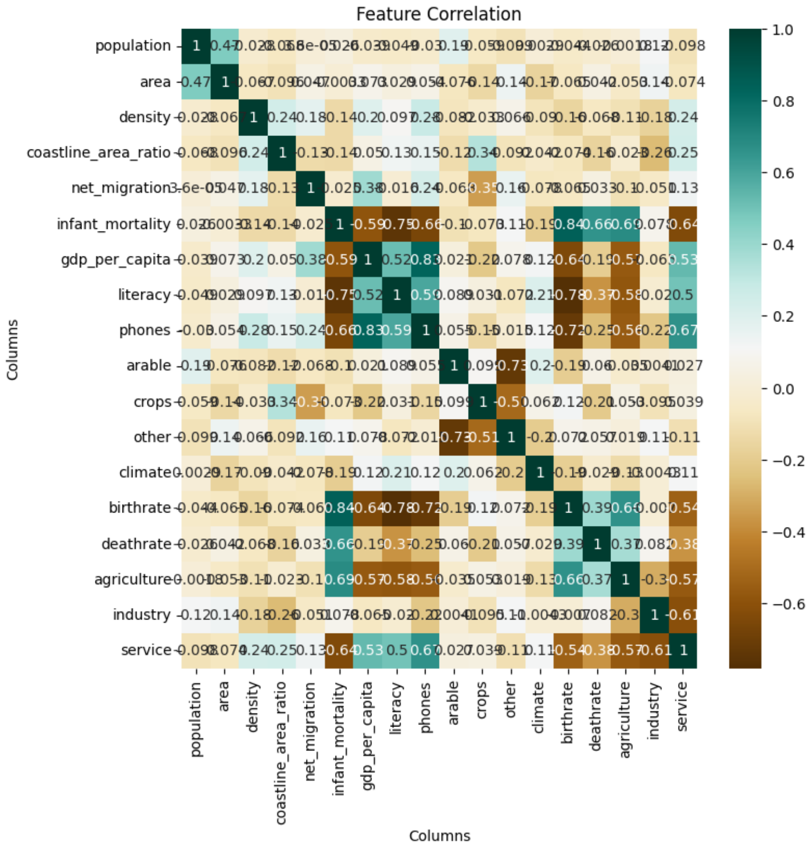
Data Collection and Preprocessing Phase

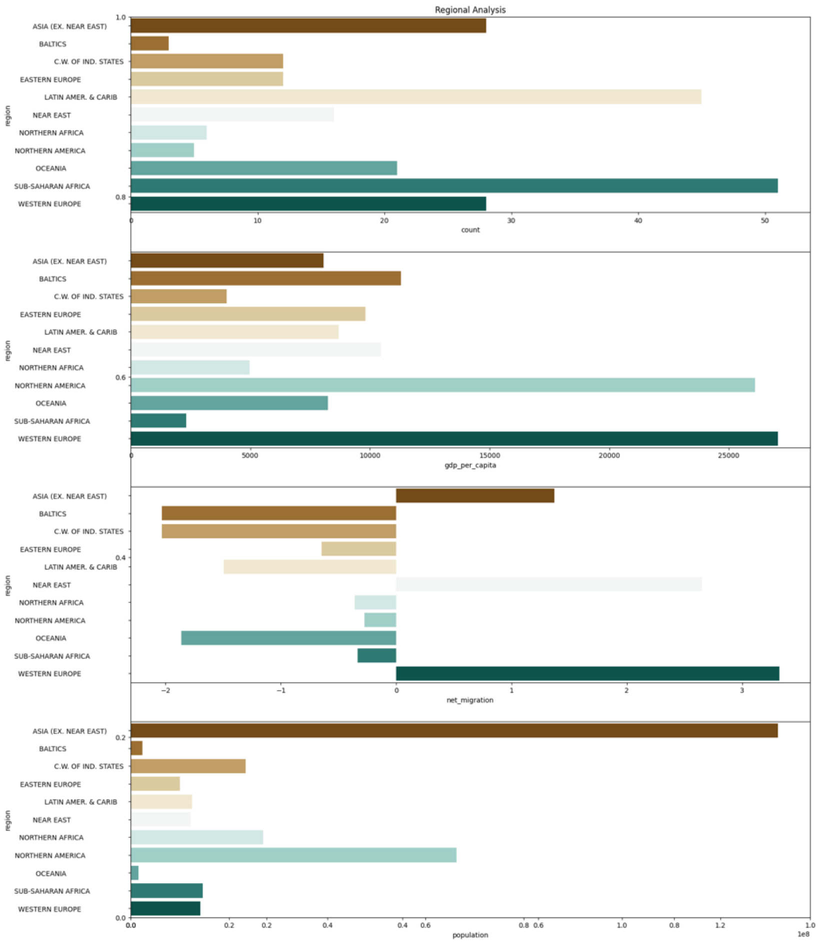
Date	9 JULY 2024
Team ID	739880
Project Title	Leveraging machine learning for GDP per capita prediction
Maximum Marks	6 Marks

Preprocessing Template

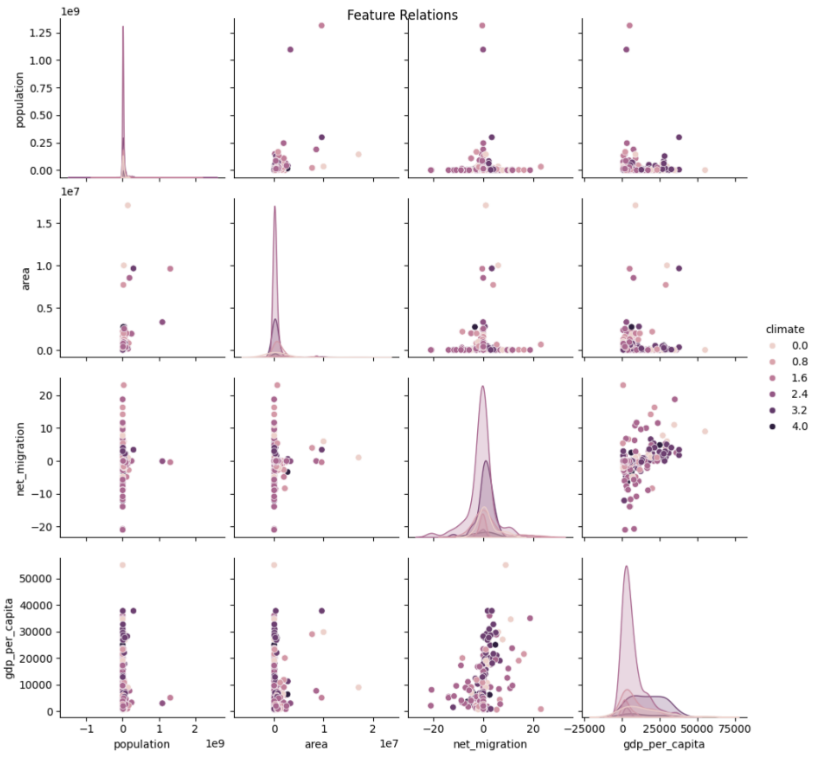
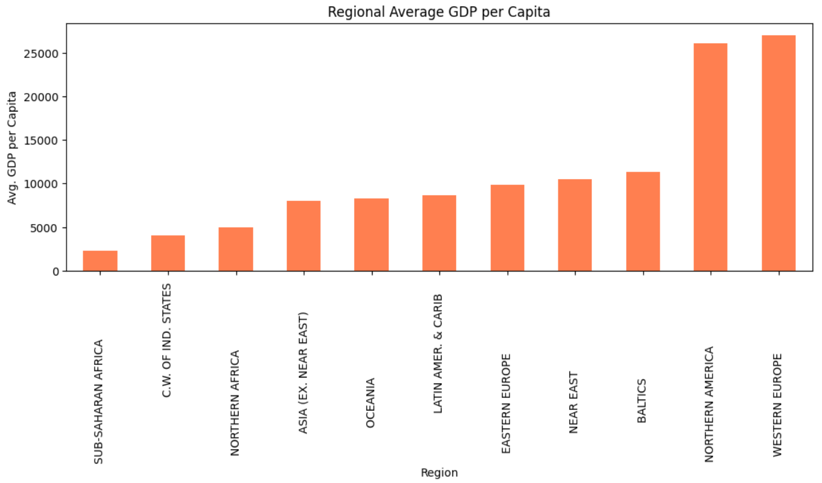
The images will be preprocessed by resizing, normalizing, augmenting, denoising, adjusting contrast, detecting edges, converting color space, cropping, batch normalizing, and whitening data. These steps will enhance data quality, promote model generalization, and improve convergence during neural network training, ensuring robust and efficient performance across various computer vision tasks.

Section	**Description**
Data Overview	Basics statistics, dimensions and structure of the data.

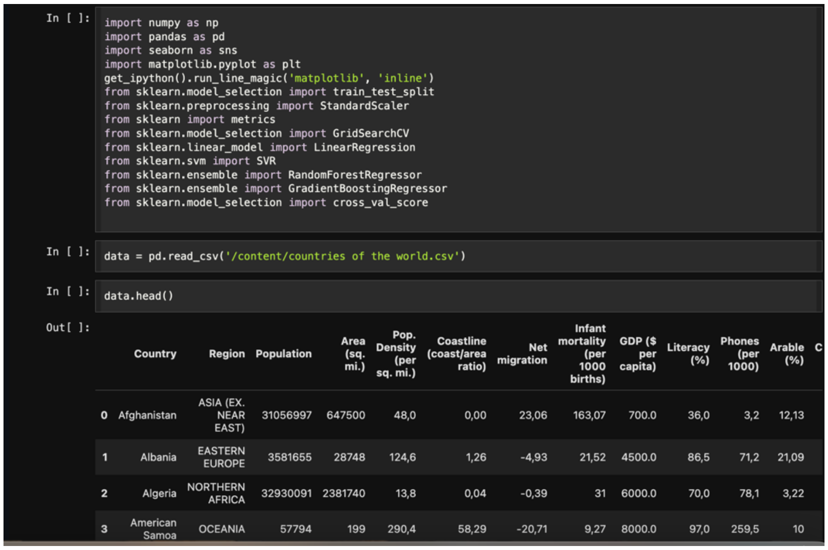
Bivariate Analysis	

<table>
<tr>
<td>Bivariate Analysis</td>
<td>


</td>
</tr>
</table>

Multivariate Analysis	
Univariate Analysis	
Data Preprocessing Code Screenshots	

Loading Data



```
In [ ]: import numpy as np
        import pandas as pd
        import seaborn as sns
        import matplotlib.pyplot as plt
        get_ipython().run_line_magic('matplotlib', 'inline')
        from sklearn.model_selection import train_test_split
        from sklearn.preprocessing import StandardScaler
        from sklearn import metrics
        from sklearn.model_selection import GridSearchCV
        from sklearn.linear_model import LinearRegression
        from sklearn.svm import SVR
        from sklearn.ensemble import RandomForestRegressor
        from sklearn.ensemble import GradientBoostingRegressor
        from sklearn.model_selection import cross_val_score
```

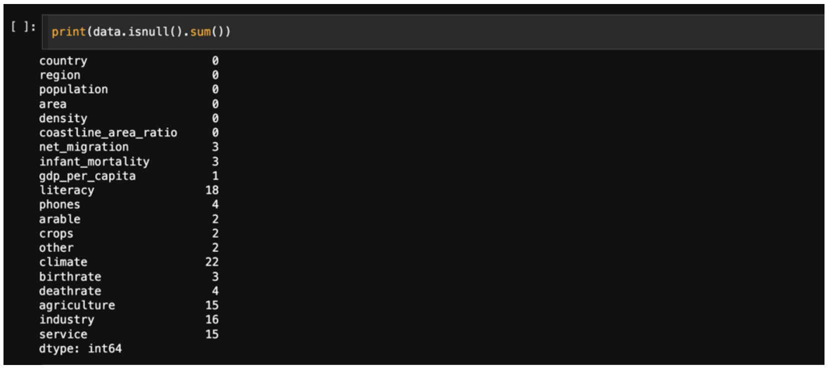
```
In [ ]: data = pd.read_csv('/content/countries of the world.csv')
```

```
In [ ]: data.head()
```

Out[ ]:

	Country	Region	Population	Area (sq. mi.)	Pop. Density (per sq. mi.)	Coastline (coast/area ratio)	Net migration	Infant mortality (per 1000 births)	GDP ($ per capita)	Literacy (%)	Phones (per 1000)	Arable (%)	C
0	Afghanistan	ASIA (EX. NEAR EAST)	31056997	647500	48,0	0,00	23,06	163,07	700.0	36,0	3,2	12,13	
1	Albania	EASTERN EUROPE	3581655	28748	124,6	1,26	-4,93	21,52	4500.0	86,5	71,2	21,09	
2	Algeria	NORTHERN AFRICA	32930091	2381740	13,8	0,04	-0,39	31	6000.0	70,0	78,1	3,22	
3	American Samoa	OCEANIA	57794	199	290,4	58,29	-20,71	9,27	8000.0	97,0	259,5	10	

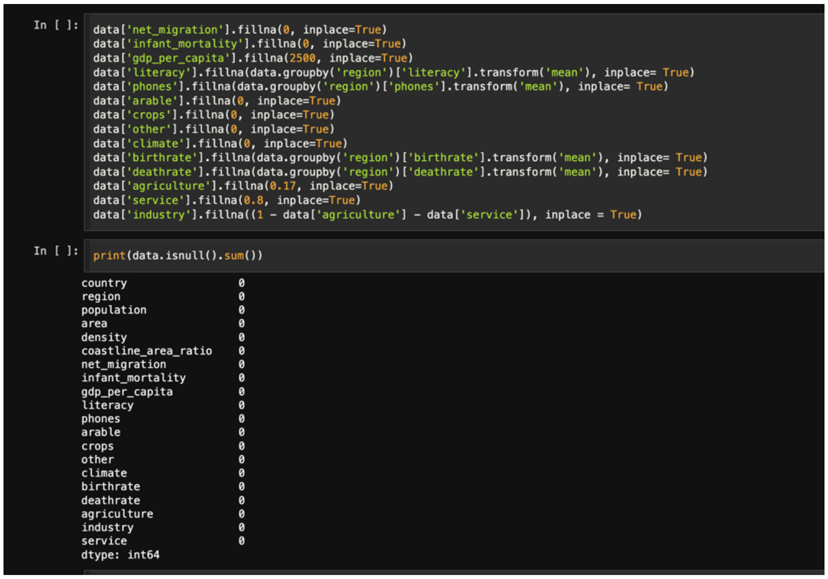
Handling Missing Data



```
[ ]: print(data.isnull().sum())

     country                0
     region                 0
     population             0
     area                   0
     density                0
     coastline_area_ratio   0
     net_migration          3
     infant_mortality       3
     gdp_per_capita         1
     literacy              18
     phones                 4
     arable                 2
     crops                  2
     other                  2
     climate               22
     birthrate              3
     deathrate              4
     agriculture           15
     industry              16
     service               15
     dtype: int64
```

Data Transformation



```
In [ ]: data['net_migration'].fillna(0, inplace=True)
        data['infant_mortality'].fillna(0, inplace=True)
        data['gdp_per_capita'].fillna(2500, inplace=True)
        data['literacy'].fillna(data.groupby('region')['literacy'].transform('mean'), inplace= True)
        data['phones'].fillna(data.groupby('region')['phones'].transform('mean'), inplace= True)
        data['arable'].fillna(0, inplace=True)
        data['crops'].fillna(0, inplace=True)
        data['other'].fillna(0, inplace=True)
        data['climate'].fillna(0, inplace=True)
        data['birthrate'].fillna(data.groupby('region')['birthrate'].transform('mean'), inplace= True)
        data['deathrate'].fillna(data.groupby('region')['deathrate'].transform('mean'), inplace= True)
        data['agriculture'].fillna(0.17, inplace=True)
        data['service'].fillna(0.8, inplace=True)
        data['industry'].fillna((1 - data['agriculture'] - data['service']), inplace = True)
```

```
In [ ]: print(data.isnull().sum())

        country                0
        region                 0
        population             0
        area                   0
        density                0
        coastline_area_ratio   0
        net_migration          0
        infant_mortality       0
        gdp_per_capita         0
        literacy               0
        phones                 0
        arable                 0
        crops                  0
        other                  0
        climate                0
        birthrate              0
        deathrate              0
        agriculture            0
        industry               0
        service                0
        dtype: int64
```