


Data Collection and Preprocessing Phase

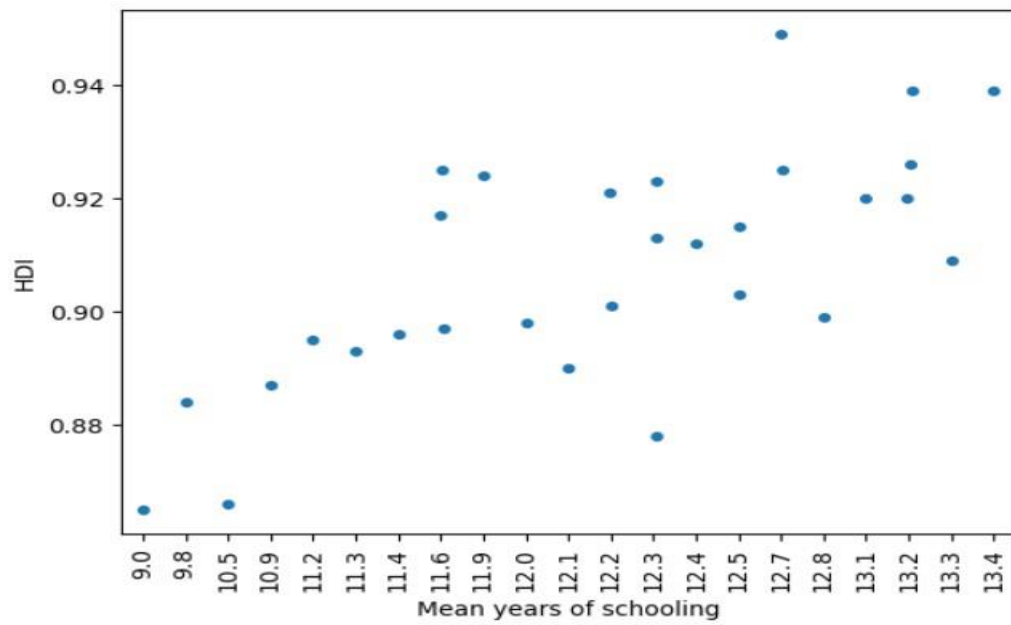
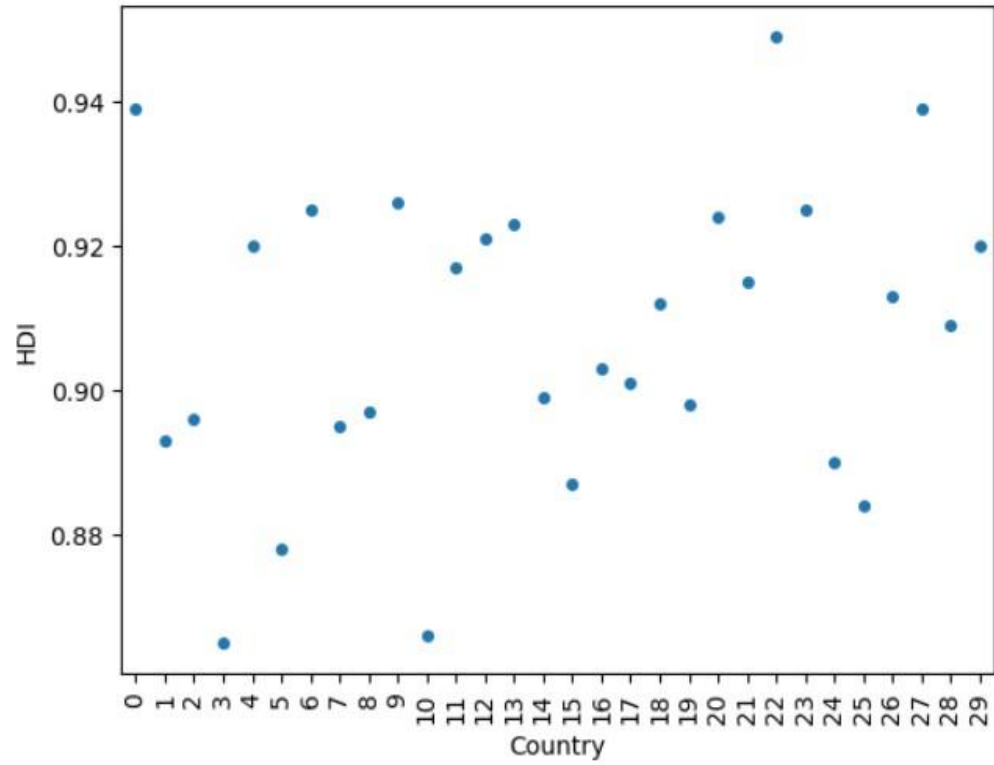
Date	28 June 2024
Team ID	739773
Project Title	A Comprehensive Measure Of Well-Being:A Human Development Using Machine Learning
Maximum Marks	6 Marks

Data Exploration and Preprocessing Report

Dataset variables will be statistically analyzed to identify patterns and outliers, with Python employed for preprocessing tasks like normalization and feature engineering. Data cleaning will address missing values and outliers, ensuring quality for subsequent analysis and modeling, and forming a strong foundation for insights and predictions.

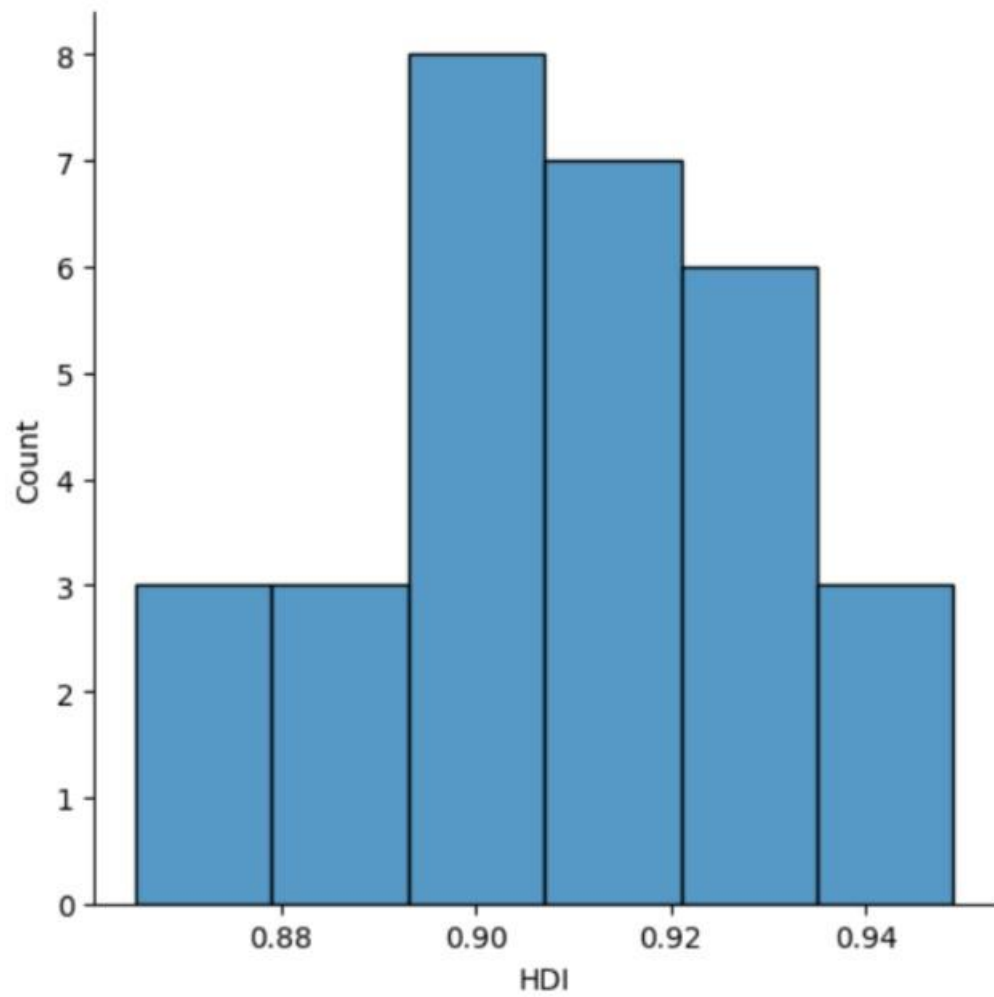
Section	Description																																																																																																																																																																	
Data Overview	<div>Descriptive Analysis:-</div> <div><pre>[] data.describe()</pre></div> <div></div> <table><thead><tr><th></th><th>Unnamed: 0</th><th>Id</th><th>HDI Rank</th><th>HDI</th><th>Life expectancy</th><th>Mean years of schooling</th><th>Gross national income (GNI) per capita</th><th>GNI per capita rank minus HDI rank</th><th>Change in HDI rank 2010-2015</th><th>Average annual HDI growth 1990-2000</th><th>Coefficient of human inequality</th><th>Inequality in life expectancy (%) 2010-2015</th><th>Inequality-adjusted life expectancy index</th><th>Inequality in education(%)</th><th>Inequality-adjusted education index</th><th>Inequality in income (%)</th></tr></thead><tbody><tr><td>count</td><td>195.000000</td><td>195.000000</td><td>188.000000</td><td>188.000000</td><td>190.000000</td><td>188.000000</td><td>193.000000</td><td>188.000000</td><td>188.000000</td><td>144.000000</td><td>...</td><td>151.000000</td><td>185.000000</td><td>185.000000</td><td>160.000000</td><td>158.000000</td><td>154.000000</td></tr><tr><td>mean</td><td>97.000000</td><td>98.000000</td><td>94.319149</td><td>0.698835</td><td>71.267368</td><td>8.371277</td><td>17239.502591</td><td>2.239362</td><td>-0.021277</td><td>0.773611</td><td>...</td><td>20.609934</td><td>17.155135</td><td>0.666151</td><td>20.278125</td><td>0.527722</td><td>24.115584</td></tr><tr><td>std</td><td>56.435804</td><td>56.435804</td><td>54.435501</td><td>0.155153</td><td>8.328811</td><td>3.098028</td><td>19052.801649</td><td>17.309425</td><td>5.440940</td><td>0.762704</td><td>...</td><td>10.210353</td><td>12.197865</td><td>0.190741</td><td>14.631437</td><td>0.224236</td><td>10.511501</td></tr><tr><td>min</td><td>0.000000</td><td>1.000000</td><td>1.000000</td><td>0.352000</td><td>48.900000</td><td>1.400000</td><td>294.000000</td><td>-79.000000</td><td>-35.000000</td><td>-1.550000</td><td>...</td><td>5.300000</td><td>2.600000</td><td>0.263000</td><td>1.400000</td><td>0.134000</td><td>8.900000</td></tr><tr><td>25%</td><td>48.500000</td><td>49.500000</td><td>47.750000</td><td>0.577750</td><td>65.550000</td><td>6.075000</td><td>3527.000000</td><td>-7.000000</td><td>-2.000000</td><td>0.425000</td><td>...</td><td>10.950000</td><td>6.700000</td><td>0.524000</td><td>6.575000</td><td>0.324000</td><td>16.300000</td></tr><tr><td>50%</td><td>97.000000</td><td>98.000000</td><td>94.500000</td><td>0.728500</td><td>73.300000</td><td>8.650000</td><td>10383.000000</td><td>4.000000</td><td>0.000000</td><td>0.760000</td><td>...</td><td>20.200000</td><td>13.600000</td><td>0.707000</td><td>17.450000</td><td>0.527000</td><td>21.300000</td></tr><tr><td>75%</td><td>145.500000</td><td>146.500000</td><td>139.750000</td><td>0.811250</td><td>77.000000</td><td>11.125000</td><td>23394.000000</td><td>13.000000</td><td>2.000000</td><td>1.150000</td><td>...</td><td>29.500000</td><td>26.100000</td><td>0.813000</td><td>34.525000</td><td>0.732250</td><td>29.475000</td></tr><tr><td>max</td><td>194.000000</td><td>195.000000</td><td>188.000000</td><td>0.949000</td><td>84.200000</td><td>13.400000</td><td>129916.000000</td><td>48.000000</td><td>15.000000</td><td>3.630000</td><td>...</td><td>44.800000</td><td>46.200000</td><td>0.959000</td><td>48.300000</td><td>0.921000</td><td>56.400000</td></tr></tbody></table>		Unnamed: 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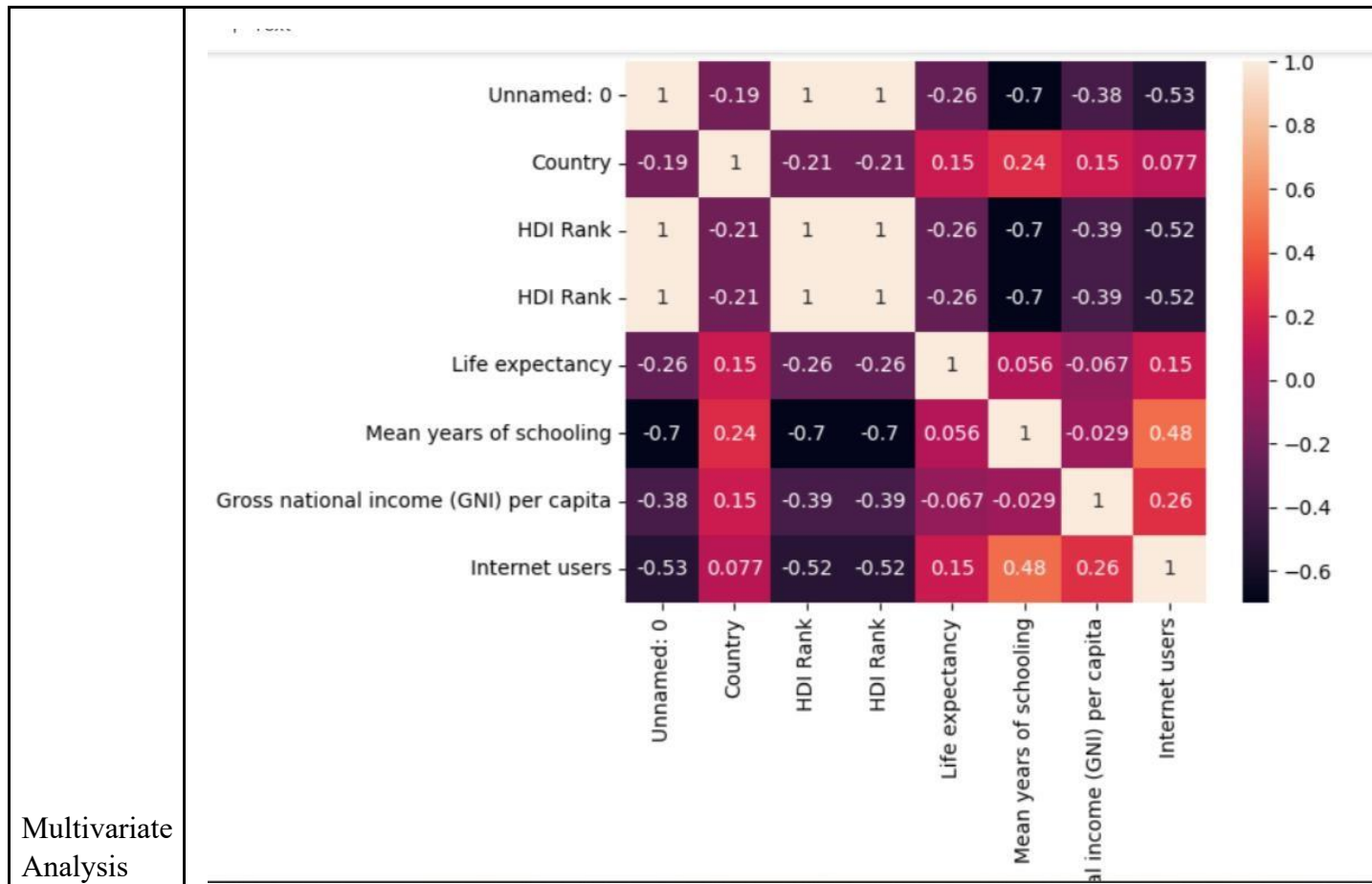
Univariate Analysis	
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Bivariate
Analysis

<seaborn.axisgrid.FacetGrid at 0x7f8c97cdbfd0>





Outliers and Anomalies	-
Data Preprocessing Code Screenshots	

Loading Data

```
[4] data=pd.read_csv("/content/HDI.csv")
```

```
[5] data.head()
```

Unnamed: 0	Id	Country	HDI Rank	HDI	Life expectancy	Mean years of schooling	Gross national income (GNI) per capita	GNI per capita rank	Change in HDI rank	Coefficient of human inequality	Inequality in life expectancy (%)	Inequality-adjusted life expectancy index	Inequality in education (%)	Inequality-adjusted income index	Inequality in income (%)	Inequality-adjusted income index
0	0	1	Norway	1.0	0.949	81.7	12.7	67614.0	5.0	0.0	...	5.4	3.3	0.918	2.4	0.894
1	1	2	Australia	2.0	0.939	82.5	13.2	42822.0	19.0	1.0	...	8.0	4.3	0.921	1.9	0.921
2	2	3	Switzerland	2.0	0.939	83.1	13.4	56364.0	7.0	0.0	...	8.4	3.8	0.934	5.7	0.840
3	3	4	Germany	4.0	0.926	81.1	13.2	45000.0	13.0	0.0	...	7.0	3.7	0.905	2.6	0.891
4	4	5	Denmark	5.0	0.925	80.4	12.7	44519.0	13.0	2.0	...	7.0	3.8	0.894	3.0	0.896

5 rows × 17 columns

Handling Missing Data

```
[18] data_filled = data_encoded.fillna(data_encoded.mean())
```

```
data_filled.fillna(data_filled.mean(),inplace=True)
```

Unnamed: 0	Id	Country	HDI Rank	HDI	Life expectancy	Mean years of schooling	Gross national income (GNI) per capita	GNI per capita rank	Change in HDI rank	Coefficient of human inequality	Inequality in life expectancy (%)	Inequality-adjusted life expectancy index	Inequality in education (%)	Inequality-adjusted education index	Inequality in income (%)	Inequality-adjusted income index	Income inequality (Quintile ratio) 2010-2015	Income inequality (Palma ratio) 2010-2015
0	0	1	22	1.0	0.949	81.7	12.7	67614.0	5.0	0.0	...	5.400	3.300000	0.918000	2.400	0.89400	10.400	0.88200
1	1	2	0	2.0	0.939	82.5	13.2	42822.0	19.0	1.0	...	8.000	4.300000	0.921000	1.900	0.92100	17.700	0.75300
2	2	3	27	2.0	0.939	83.1	13.4	56364.0	7.0	0.0	...	8.400	3.800000	0.934000	5.700	0.84000	15.700	0.80600
3	3	4	9	4.0	0.926	81.1	13.2	45000.0	13.0	0.0	...	7.000	3.700000	0.905000	2.600	0.89100	14.800	0.78700
4	4	5	6	5.0	0.925	80.4	12.7	44519.0	13.0	2.0	...	7.000	3.800000	0.894000	3.000	0.89600	14.300	0.78900

Data Transformation

```
import pandas as pd
from sklearn.preprocessing import OneHotEncoder

# Identify categorical columns
categorical_columns = data.select_dtypes(include=['object']).columns

# Apply One-Hot Encoding to categorical columns
data_encoded = pd.get_dummies(data, columns=categorical_columns, drop_first=True)

# Display the first few rows of the encoded dataset
data_encoded.head()
```

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0	0	1	22	1.0	0.949	81.7	12.7	67614.0	5.0	0.0	...	5.4	3.3	0.918	2.4	0.894	10.4	0.882
1	1	2	0	2.0	0.939	82.5	13.2	42822.0	19.0	1.0	...	8.0	4.3	0.921	1.9	0.921	17.7	0.753
2	2	3	27	2.0	0.939	83.1	13.4	56364.0	7.0	0.0	...	8.4	3.8	0.934	5.7	0.840	15.7	0.806
3	3	4	9	4.0	0.926	81.1	13.2	45000.0	13.0	0.0	...	7.0	3.7	0.905	2.6	0.891	14.8	0.787
4	4	5	6	5.0	0.925	80.4	12.7	44519.0	13.0	2.0	...	7.0	3.8	0.894	3.0	0.896	14.3	0.789

5 rows × 19 columns

Feature Engineering	Attached the codes in final submission.
Save Processed Data	-