Poverty Probability Prediction

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Introduction

This project presents an analysis on data concerning the Poverty Probability Index (PPI) of individuals. By exploring the relationships between characteristics of the individuals and their PPI, we extract useful information that would allow us to make prediction of an individual's probability of poverty based on its socioeconomic indicators.

About Dataset

The dataset retrieved from the PPI website and Financial Inclusion Insights household surveys conducted by InterMedia contains PPI data along with **59** features of 12,600 individuals across 7 different countries. Original sources of the dataset include data from The World Bank. The PPI is a measure to identify an individual's probability of living below the poverty line at the $2.50/day threshold.

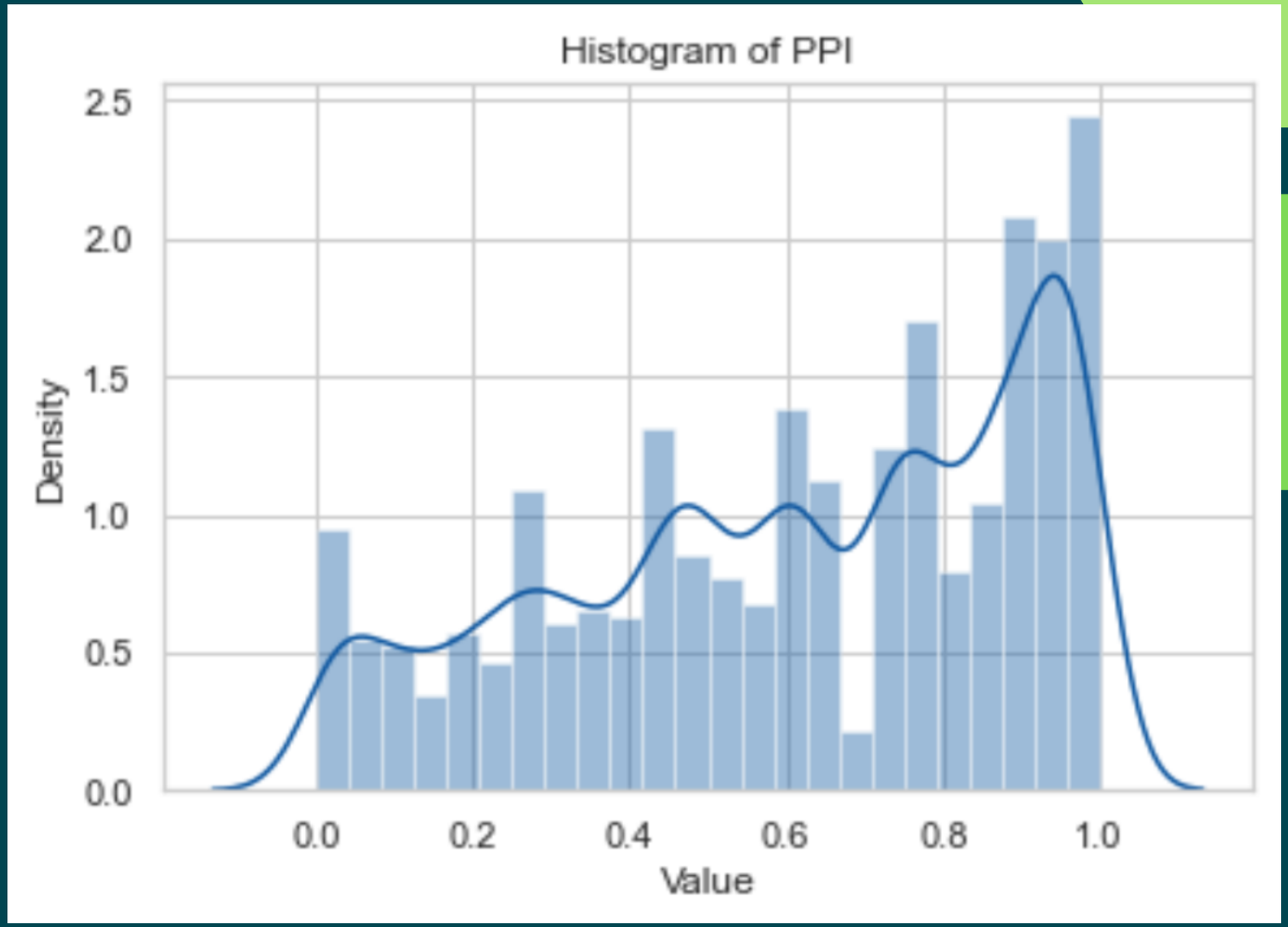
Methodology

- The first part of the report is an exploratory data analysis, where we calculate summary statistics and create data visualizations of the data that identify potential relationships between individuals' characteristics and their PPI.
- In the second part, we create a predictive machine learning model that predicts the PPI of individuals, based on the information extracted in the first part.

Exploratory Data Analysis

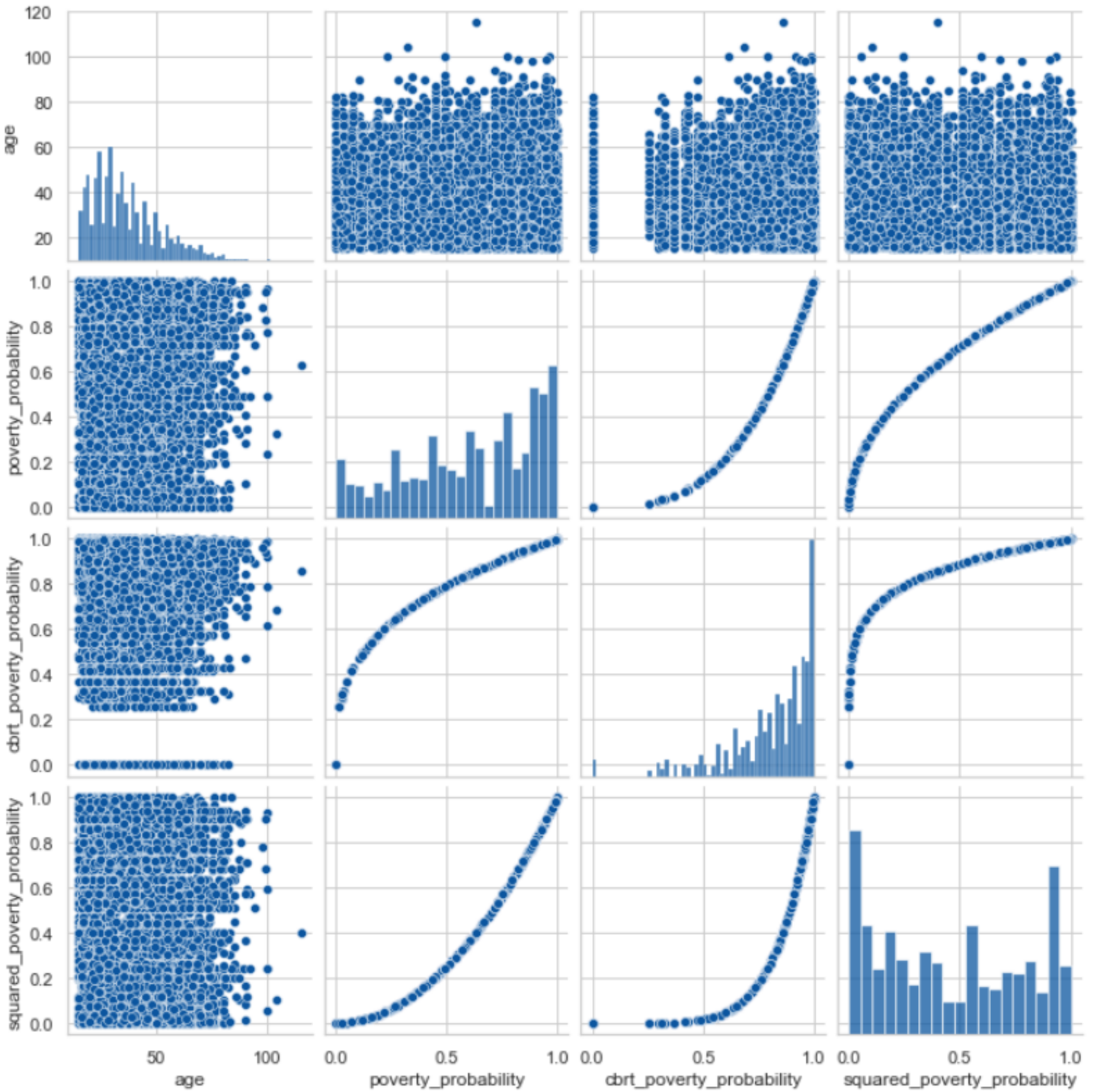
- Data Pre-processing
- Exploring PPI
- Exploring Numeric Features
- Exploring Categorical Features

Target Variable

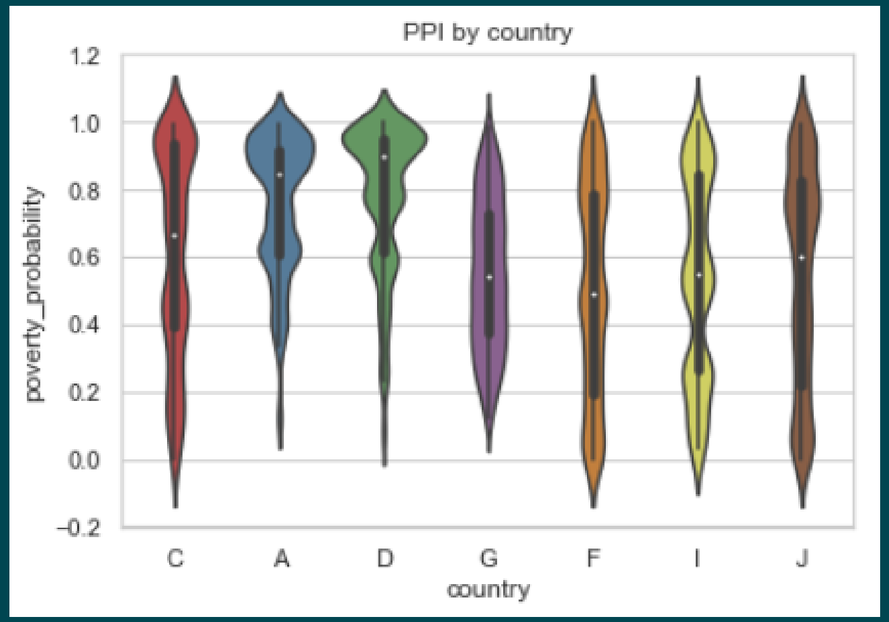


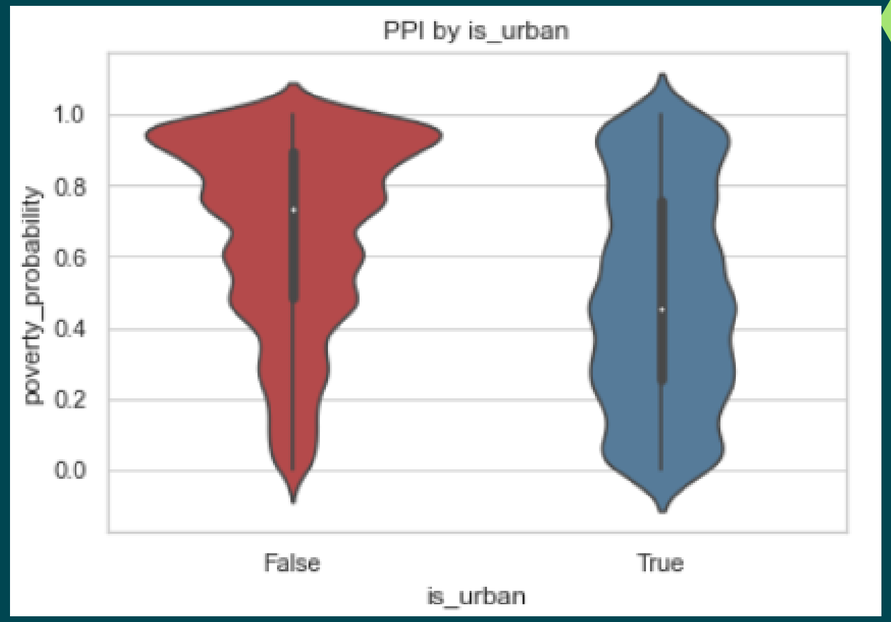
Numerical Variables

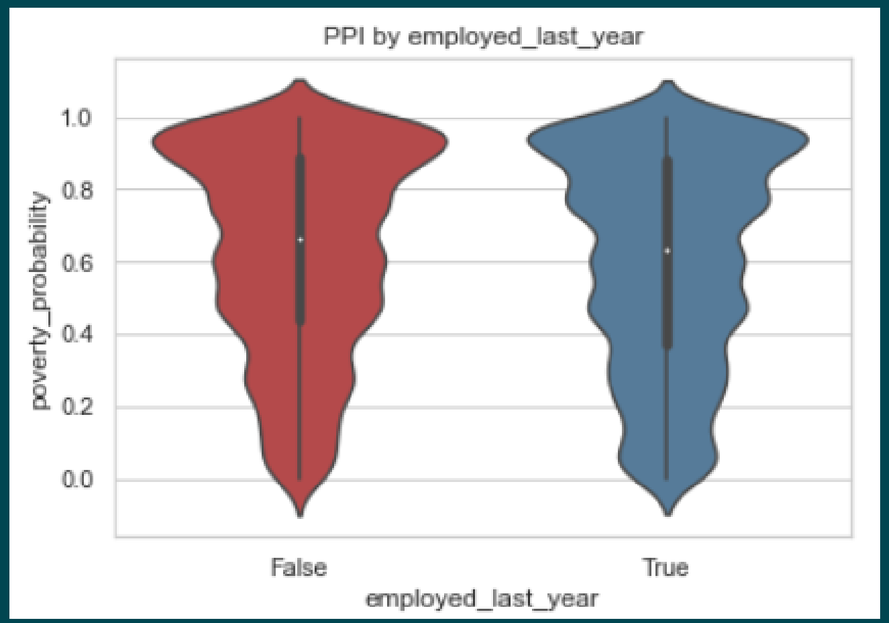
Scatter plot to check Linear relationship with Target Variable

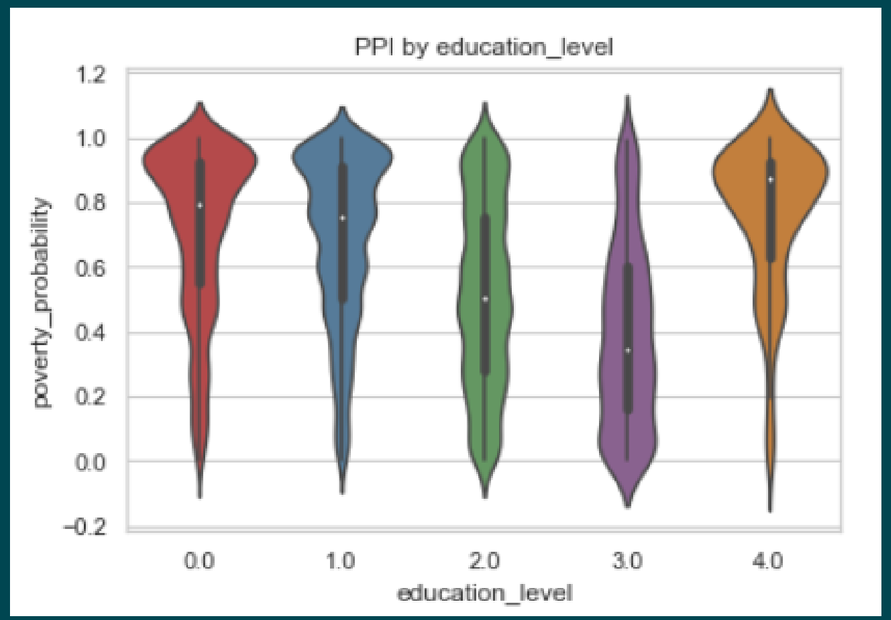


Categorical Variables

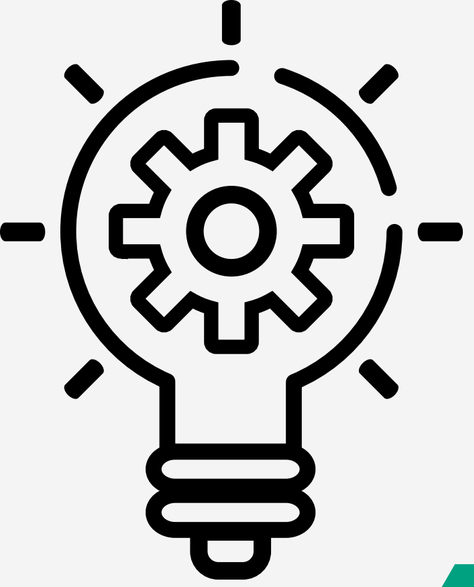








Violin plot to check spread within the variable



Feature Engineering

- Variables Encoding
- Eliminating Low variance features
- Recursive Feature Elimination
- Rescaling Numeric Features

Regression

OLS Regression Results

Dep. Variable:	poverty_probability	R-squared:	0.187
Model:	OLS	Adj. R-squared:	0.187
Method:	Least Squares	F-statistic:	362.9
Date:	Tue, 31 Jan 2023	Prob (F-statistic):	0.00
Time:	14:30:53	Log-Likelihood:	-1037.8
No. Observations:	12600	AIC:	2094.
Df Residuals:	12591	BIC:	2161.
Df Model:	8		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	0.7766	0.007	113.068	0.000	0.763	0.790
education_level	-0.0479	0.003	-16.415	0.000	-0.054	-0.042
is_urban	-0.1254	0.005	-24.073	0.000	-0.136	-0.115
phone_technology	-0.0334	0.003	-13.323	0.000	-0.038	-0.029
formal_savings	-0.0746	0.006	-13.200	0.000	-0.086	-0.064
literacy	-0.0020	0.006	-0.355	0.722	-0.013	0.009
has_investment	-0.0452	0.005	-8.545	0.000	-0.056	-0.035
married	0.0305	0.005	6.151	0.000	0.021	0.040
female	-0.0018	0.005	-0.362	0.717	-0.011	0.008

Gradient Boosting

```
GBoost = GradientBoostingRegressor(objective='regression', num_leaves = 32,
                                   learning_rate=0.01)
```

Hyperparameter Tuning

```
GBoost = GradientBoostingRegressor(n_estimators= 2000, learning_rate=0.01,
                                   max_depth=5, max_features='sqrt',
                                   min_samples_leaf=7, min_samples_split=15,
                                   loss='ls', random_state = 1)
```

Result

```
GBoost.fit(x_train, y_train)
gb_pred = GBoost.predict(x_test)
print("R Square Value: ",rsquare(y_test, gb_pred))
```

```
R Square Value:  0.20829142122005928
```