



ECONOMIC FREEDOM AND GDP PER CAPITA

"GROUP RANDOM"

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OUR DATASETS:

Index of Economic Freedom by [heritage.org](https://www.heritage.org):

12 features in 4 categories:

- Rule of law (property rights, judicial effectiveness, and government integrity);
- Government size (tax burden, government spending, and fiscal health);
- Regulatory efficiency (business freedom, labor freedom, and monetary freedom)
- Market openness (trade freedom, investment freedom, and financial freedom).

In addition, we have GDP per capita and unemployment collected in 2018.

DATA CLEANING AND EXPLORATORY ANALYSIS

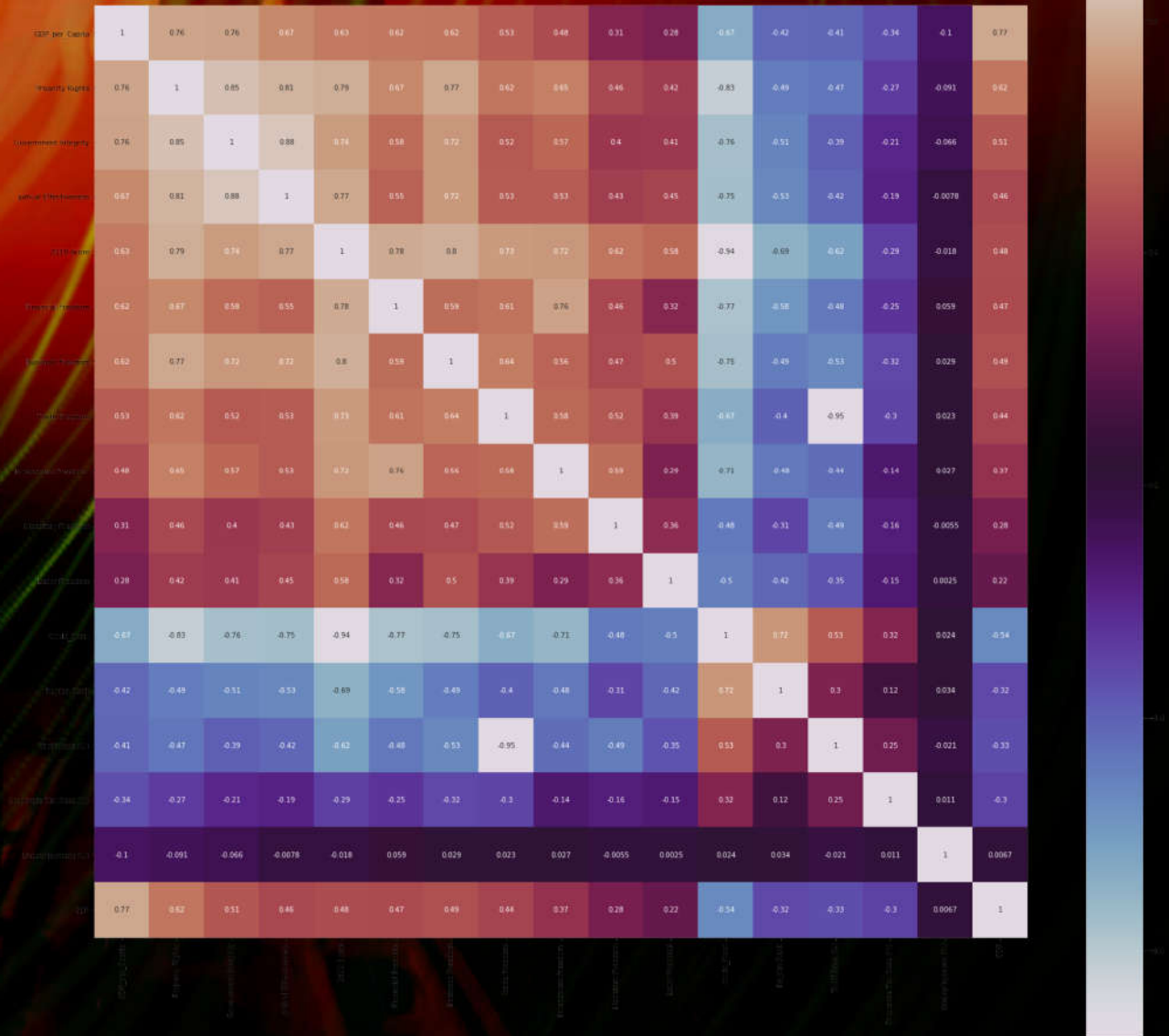
- We replaced the null values for each feature with median values specified by countries' region
- We detected the outliers such as United Arab Emirates in GDP (7 values removed)
- We created a binary data for GDP to be able to use in logistic regression and kNN. (high GDP =1, low=0)

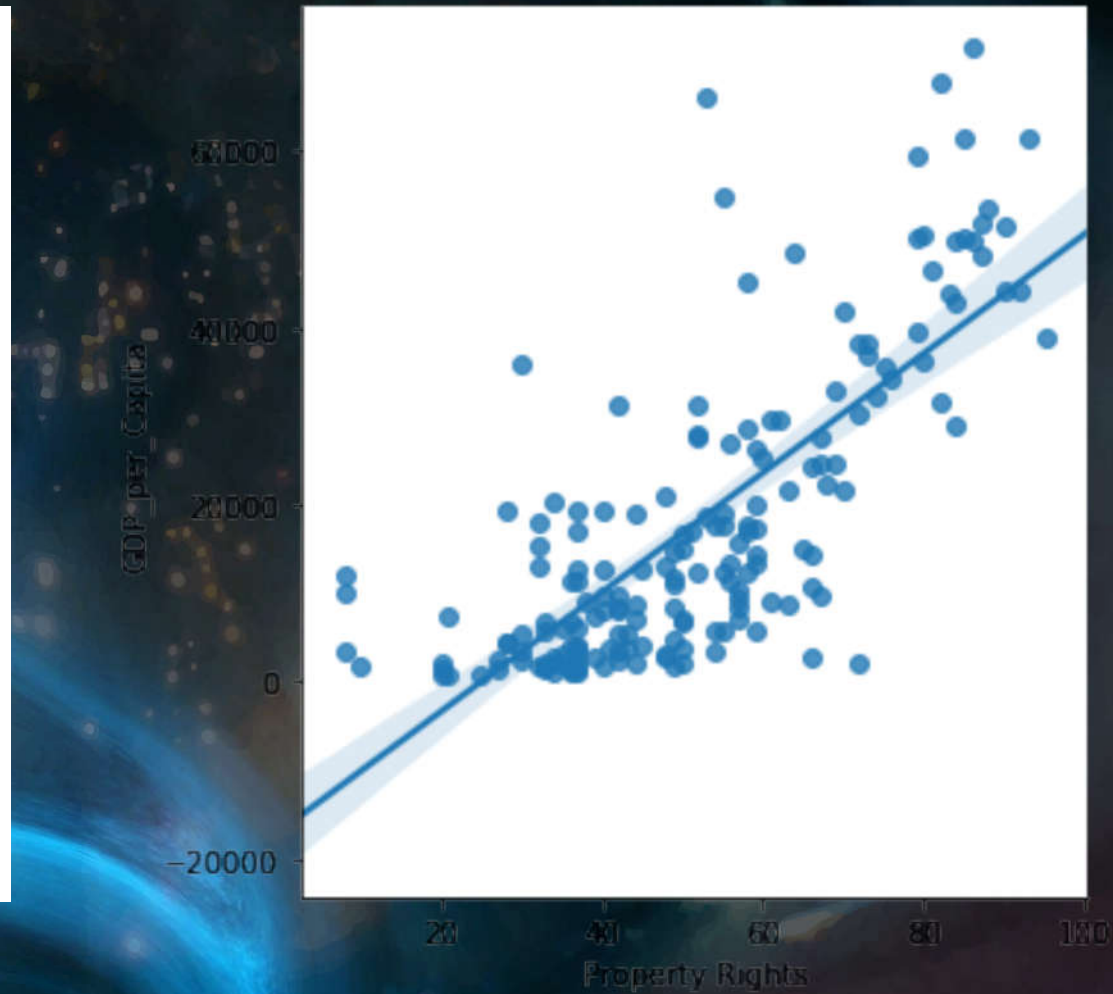
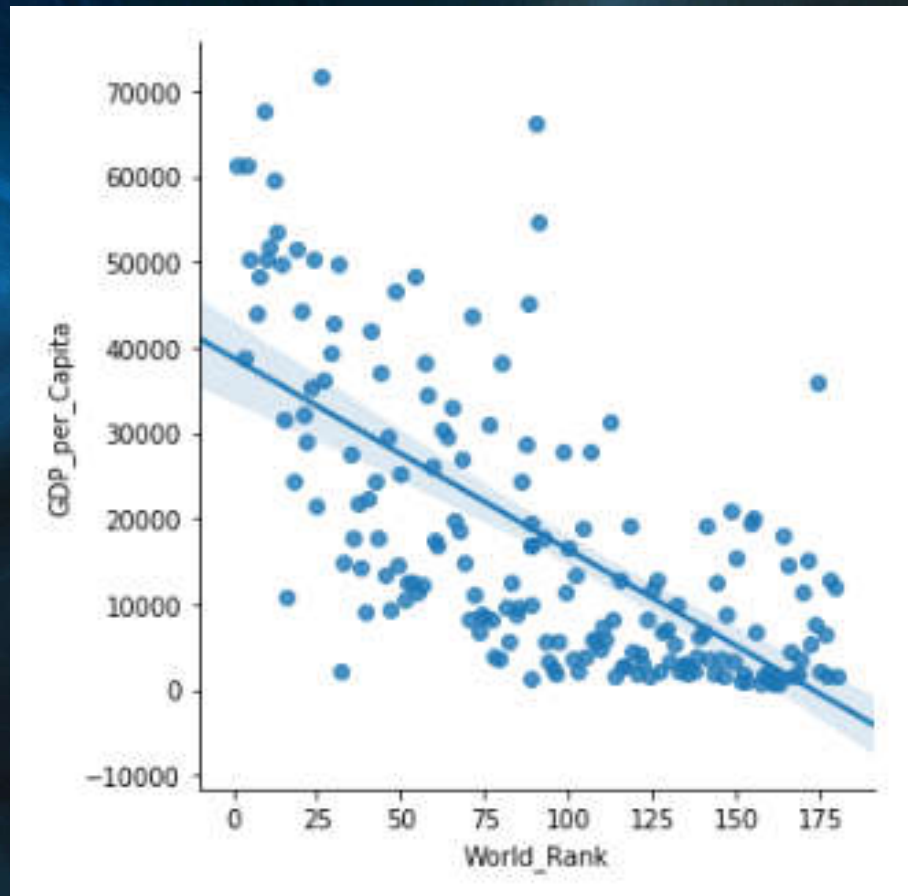
| | World_Rank | Region Rank | 2019 Score | Property Rights | Judicial Effectiveness | Government Integrity | Tax Burden | Gov't Spending | Fiscal Health | Business Freedom | ... | Financial Freedom | Tariff Rat (%) |
|-------|------------|-------------|------------|-----------------|------------------------|----------------------|------------|----------------|---------------|------------------|-----|-------------------|----------------|
| count | 179.000000 | 179.000000 | 179.000000 | 179.000000 | 179.000000 | 179.000000 | 179.000000 | 179.000000 | 179.000000 | 179.000000 | ... | 179.000000 | 179.000000 |
| mean | 92.905028 | 20.737430 | 60.256983 | 51.608939 | 44.173184 | 40.597765 | 77.335196 | 64.083799 | 65.268156 | 63.089385 | ... | 48.156425 | 6.20111 |
| std | 50.759478 | 12.637482 | 10.869548 | 19.202151 | 17.753878 | 19.065976 | 13.216199 | 23.202303 | 31.780774 | 15.774850 | ... | 19.093446 | 5.50217 |
| min | 1.000000 | 1.000000 | 6.000000 | 8.000000 | 5.000000 | 8.000000 | 0.000000 | 0.000000 | 0.000000 | 5.000000 | ... | 0.000000 | 0.000000 |
| 25% | 50.500000 | 10.000000 | 54.000000 | 37.000000 | 31.000000 | 26.000000 | 71.000000 | 51.500000 | 38.500000 | 54.000000 | ... | 30.000000 | 2.000000 |
| 50% | 92.000000 | 20.000000 | 61.000000 | 50.000000 | 43.000000 | 36.000000 | 79.000000 | 69.000000 | 80.000000 | 63.000000 | ... | 50.000000 | 5.000000 |
| 75% | 135.500000 | 31.000000 | 67.000000 | 64.500000 | 53.500000 | 50.000000 | 86.000000 | 81.500000 | 90.000000 | 74.500000 | ... | 60.000000 | 9.000000 |
| max | 180.000000 | 47.000000 | 90.000000 | 95.000000 | 87.000000 | 97.000000 | 100.000000 | 97.000000 | 100.000000 | 96.000000 | ... | 90.000000 | 50.000000 |

8 rows × 24 columns

HEATMAP OF CORRELATIONS BETWEEN OUR VARIABLES

We removed 4 features from variables to avoid of multicollinearity







LINEAR REGRESSION MODEL

Mean Squared Error: 83632588.6137833

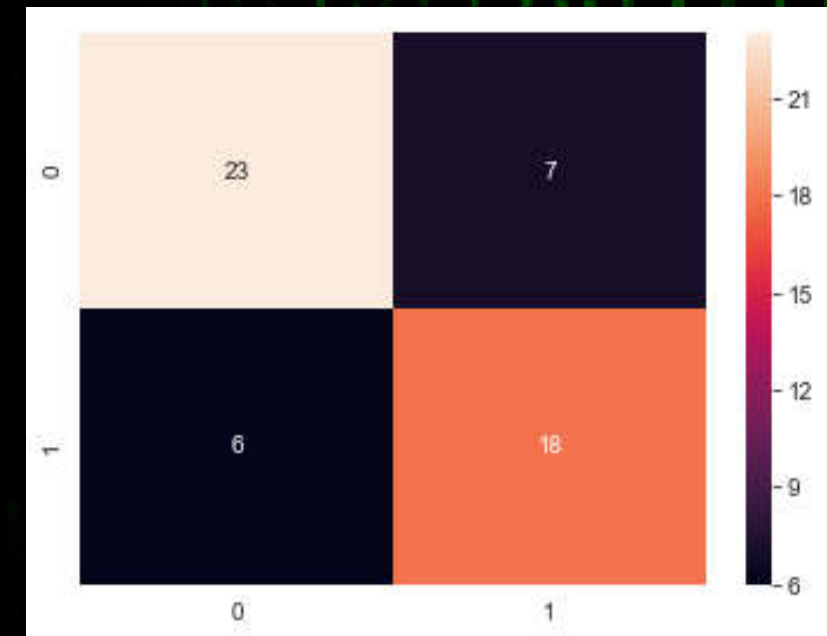
R^2 : 0.7372751953265584

| | coefficients |
|------------------------|--------------|
| Property Rights | 321.132156 |
| Financial Freedom | 242.439665 |
| Trade Freedom | 95.455376 |
| Investment Freedom | -111.812723 |
| Monetary Freedom | -57.320367 |
| Labor Freedom | -31.992999 |
| World_Rank | 8.066796 |
| Region Rank | 0.382555 |
| Tariff Rate (%) | 7.195379 |
| Corporate Tax Rate (%) | -99.948264 |
| Unemployment (%) | -328.506359 |
| GDP | 15662.609573 |

LOGISTIC REGRESSION MODEL

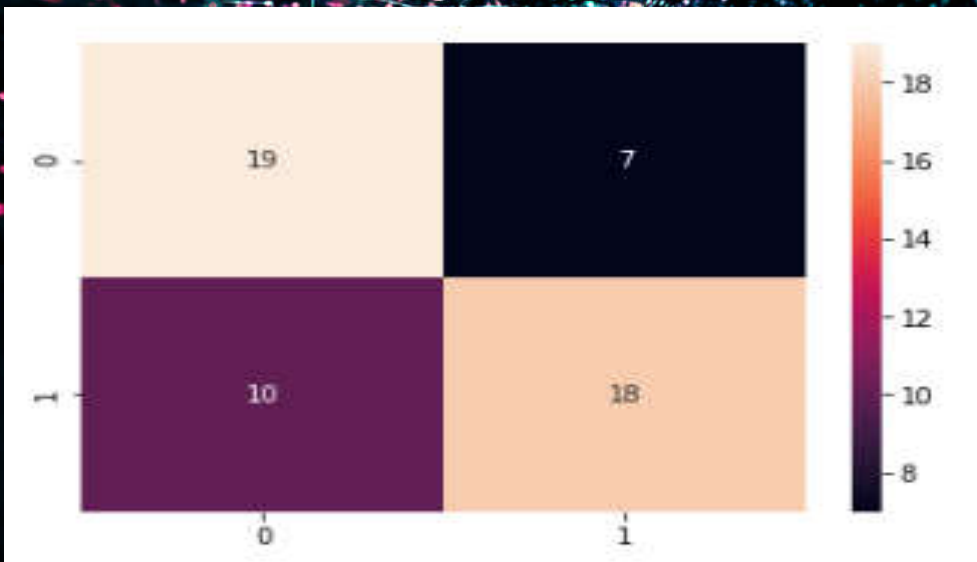
We found that the group of “property rights”, “financial freedom”, “trade freedom”, and “investment freedom” and a second group of all these variables together with “monetary freedom” give the best results with accuracy score of “0.796”.

| | precision | recall | f1-score | support |
|--------------|-----------|--------|----------|---------|
| 0 | 0.79 | 0.77 | 0.78 | 30 |
| 1 | 0.72 | 0.75 | 0.73 | 24 |
| accuracy | | | 0.76 | 54 |
| macro avg | 0.76 | 0.76 | 0.76 | 54 |
| weighted avg | 0.76 | 0.76 | 0.76 | 54 |

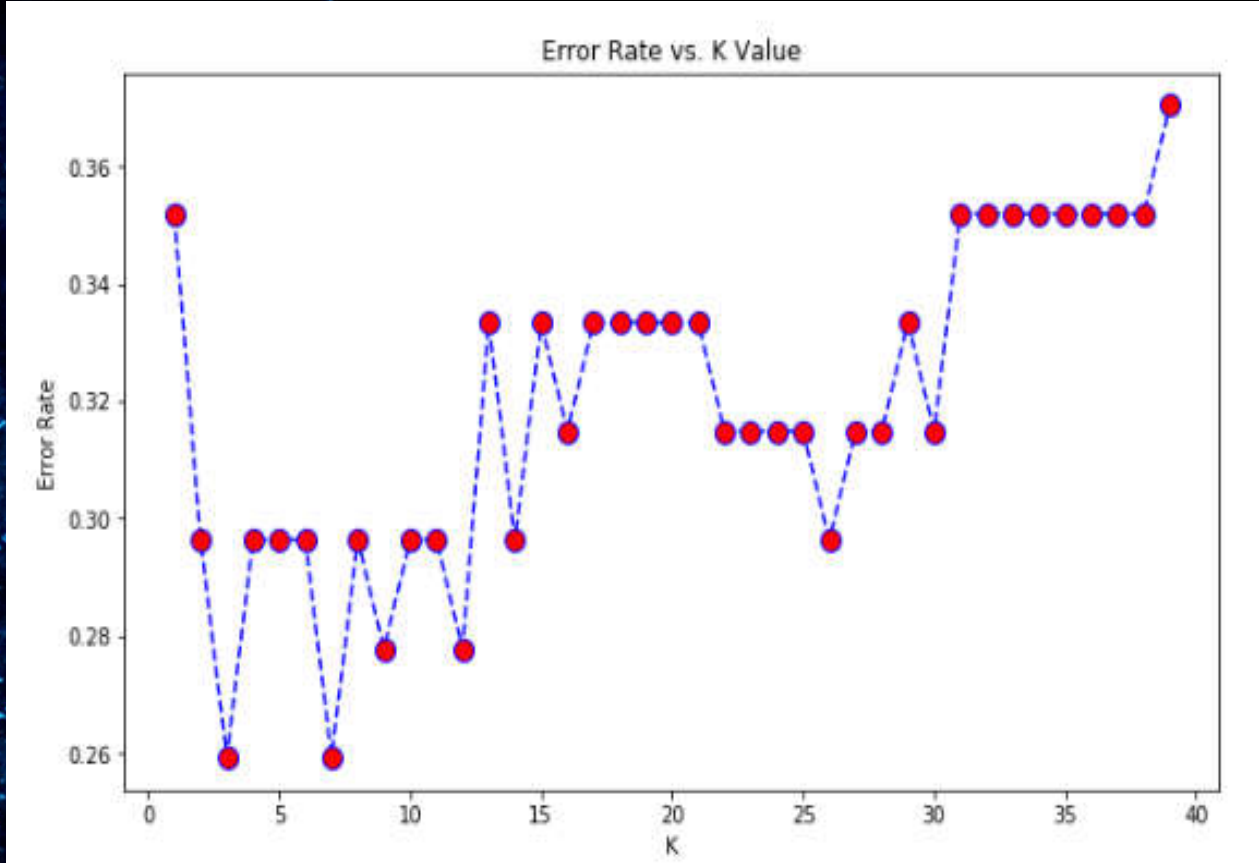
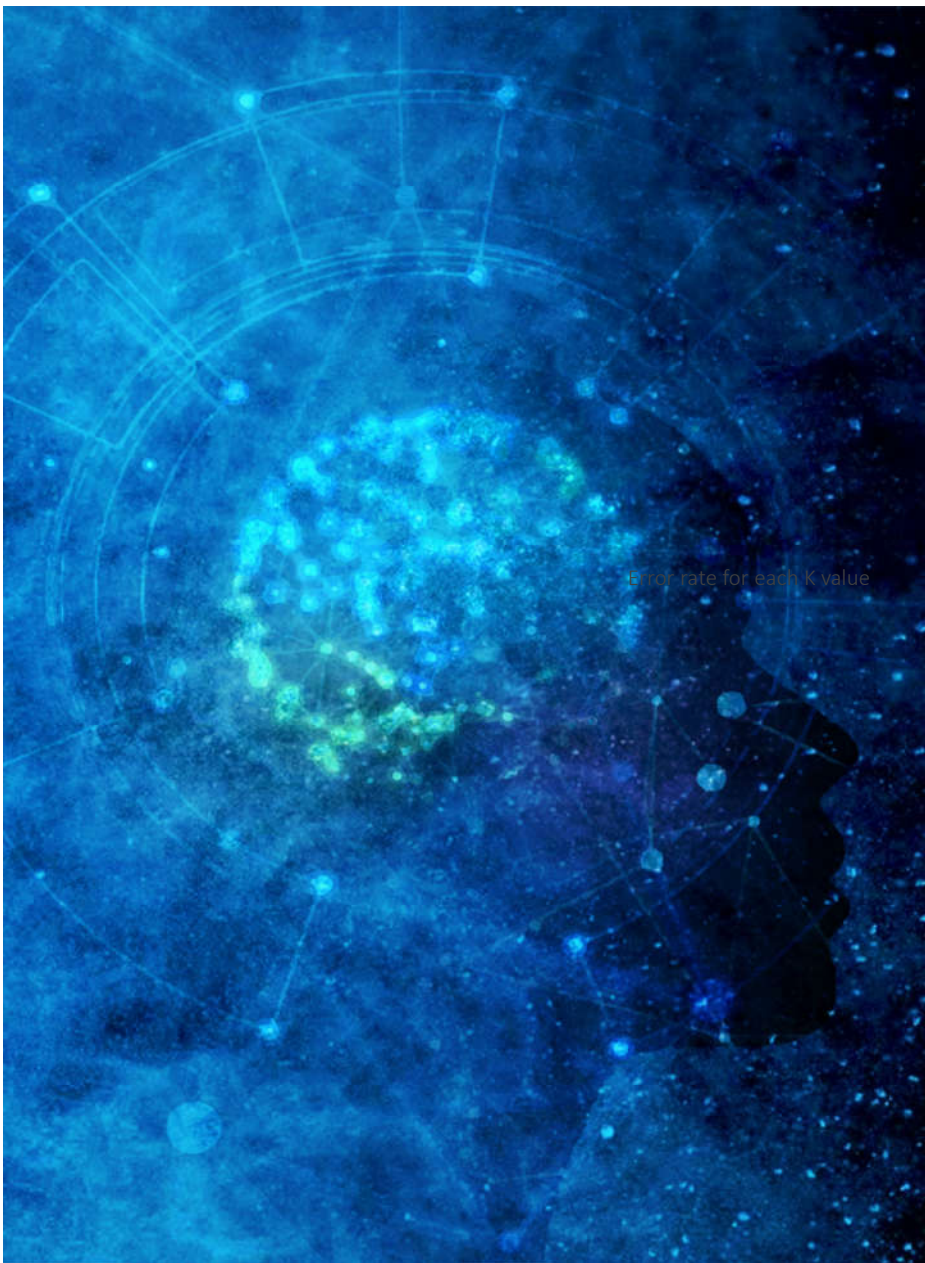


K-NEAREST NEIGHBORS MODEL

We found that
“property rights” alone
gives the highest
accuracy score with
0.815 with k value 27.



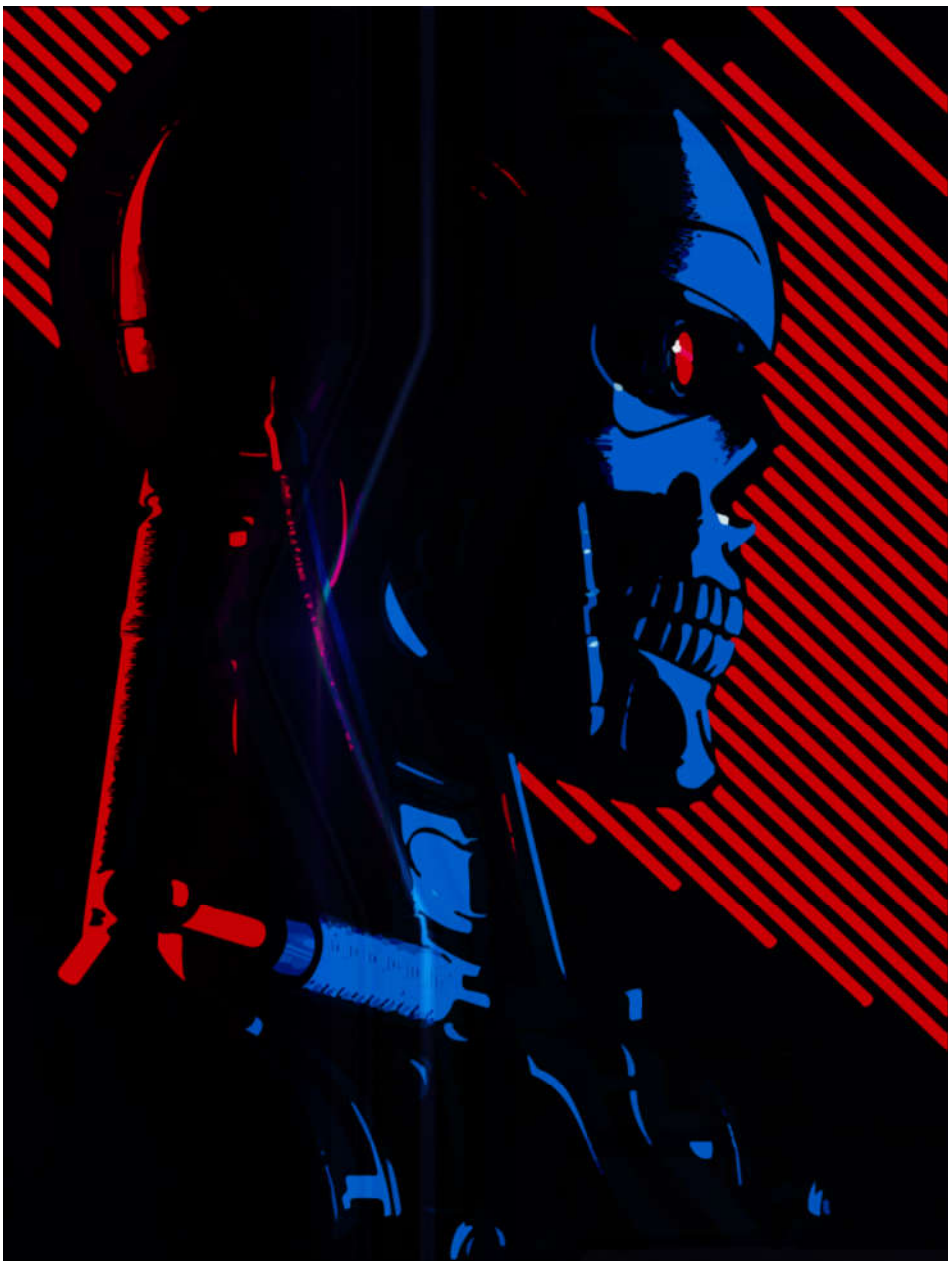
| | precision | recall | f1-score | support |
|--------------|-----------|--------|----------|---------|
| 0 | 0.65 | 0.77 | 0.70 | 26 |
| 1 | 0.74 | 0.61 | 0.67 | 28 |
| micro avg | 0.69 | 0.69 | 0.69 | 54 |
| macro avg | 0.69 | 0.69 | 0.68 | 54 |
| weighted avg | 0.69 | 0.69 | 0.68 | 54 |





CONCLUSION

- For each model “property rights” gave the best result
- A combination of “property rights”, “financial freedom”, “trade freedom”, “investment freedom” and “monetary freedom” give highest accuracy in logistic regression
- “Property rights” alone gives the best result for kNN
- Compared to kNN, logistic regression gives higher f-1 scores



"In God we Trust,
all others bring data"

-W. Edwards Deming