**Dataset and Exploration**

Our primary goal is to predict the deforestation in Brazil’s Amazon rainforest. For this we collected two datasets from the ( [Terrabrasilis – Geographic Data Platform](http://terrabrasilis.dpi.inpe.br/app/dashboard/deforestation/biomes/legal_amazon/rates))).

**Dataset 01**: This contains state wise deforestation increment data for five ecoregions in Brazil from 2001 to 2021. The ecoregions are Pantanal, Cerrado, Caatinga, Mata Atlantica and Pampa. The dataset has 811 rows and 4 features. Figure 1 shows how the dataset looks like.

Text

Description automatically generated Chart

Description automatically generated

*Figure 1: First 5 rows in Dataset 01 Figure 2: Box plot for dataset 01*

Chart, histogram

Description automatically generated Square

Description automatically generated

*Figure 3: Distribution of ‘areakm’ in dataset 01 Figure 4: Correlation matrix of dataset 01*

According to Figure 2, feature ‘areakm’ has a considerable number of outliers over the upper bound. This is because some forest areas are larger than the rest. Looking at Figure 3 we can see that the distribution of area is skewed towards the right. Observing heatmap in Figure 4 we can see that ‘year’ and ‘areakm’ have a negative correlation. This negative correlation can be observed in Figure 5 as the deforestation increment eventually decreases.

Chart, line chart

Description automatically generated Table

Description automatically generated

*Figure 5: Variation of deforestation region wise Figure 6: First 5 rows in Dataset 01*

**Dataset 02**: This contains municipality wise accumulated deforestation data related to 8 states in Brazil from 2007 to 2022. The states are Acre, Amapa, Amazonas, Maranhao, Mato Grosso, Rondonia, Roraima and Tocantins. The dataset has 6640 rows and 5 features. Figure 6 shows how the dataset looks like.

Chart, box and whisker chart

Description automatically generated Chart, histogram

Description automatically generated

*Figure 7: Box plot for dataset 02 Figure 8: Distribution of ‘areakm’ in dataset 02*

According to Figure 7, feature ‘areakm’ has a considerable number of outliers over the upper bound. This is because some forest areas are larger than the rest. Looking at Figure 8 we can see that the distribution of area is skewed towards the right. Observing heatmap in Figure 9 we can see that ‘year’ and ‘areakm’ have a positive correlation. As the accumulated deforestation area increases each year. Figure 11 shows the autocorrelation plot for the average deforestation of state Acre. There is a high degree of autocorrelation between consecutive observations. The data is not random and has some relationship.

**Analysis:**

Chart, treemap chart

Description automatically generated Chart, histogram

Description automatically generated

*Figure 9: Correlation matrix of dataset 02 Figure 10: Variation of deforestation for state Acre*  Chart, line chart

Description automatically generated Chart

Description automatically generated

*Figure 11: Autocorrelation plot for the series of state Acre Figure 12: Heatmap for dataset 03*

**Dataset 03:** This dataset has information related to GDP, Labor force and Rainfall etc. in Brazil. Our next approach is to try to analyze to find any correlation with deforestation.

**Baseline Model**

We tried fitting models for the two datasets separately. For dataset 01 we fitted a Linear Regression model which gave us a mean accuracy of 0.483. This model we obtained at first is almost meaningless.

In dataset 02 for convenience in analysis, we took the mean deforestation over the years in state Acre and trained an ARIMA model as the baseline. We got an RMSE of 11.524 and according to Figure 13 we can see that the expected value and rolling forecast are quite aligned.

Chart, line chart

Description automatically generated Chart, line chart

Description automatically generated

*Figure 13: Plot of trend in the dataset 02 Figure 14: Expected value vs Rolling forecast comparison.*

*Chart, line chart

Description automatically generated*

*Figure 15: Detrended time series.*

By looking at the detrended model in Figure 12 we can see it takes a parabolic shape, which might suggest a polynomial model could fit the data better.

**Conclusions**

Out of the two datasets for deforestation we concluded to move on with Dataset 02 as it has more data points, and it contains information at municipality level. To get the sense of the first dataset, we can calculate the yearly increment in deforestation as the predicted feature.