7PAM2000 APPLIED DATA SCIENCE 1

Assignment – 2: STATISTICS AND TRENDS

Analysing Climate Change Data: Discovering Population and Electricity Relating to Greenhouse Emission from World Bank Data Set

Abstract:

In this extensive analysis, correlations among crucial features in thirteen global countries, such as total population, population access to electricity, CO2 emission (kt), and methane emission, were investigated. The study delves into the underlying factors contributing to observed correlations within the dataset. The bar chart tracking total population availability from 1990 to 2015 reveals diverse trends, with India and China experiencing a consistent increase, while Germany and Japan demonstrate consistent throughout the years. Examination of China's correlation heatmap reveals that total population is linked to total greenhouse emission, increasingly impacting methane emissions and CO2 emissions. Germany, United States and Japan consistently records the highest amount of population accessing to the electricity, and surprisingly, India and Nigeria exhibit the lowest amount of population accessing to electricity among these countries. China stands out with a substantial increase in CO2 emission and methane emission. United States displays a negative trend in CO2 emission after 2000 and methane emissions after 2000 also and a slight increase after 2005, emphasizing environmental impact. Germany has a nearly steady line plot in case of both CO2 emission and methane emission. The findings illuminate intricate relationships between population, emissions, and electricity use trends across the studied countries.

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Link to GitHub Repository: https://github.com/SreegovindSreekumar/Assignment-2

World Bank Dataset: https://data.worldbank.org/topic/climate-change

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In this analysis data of nine different countries are selected and checking the interrelation between the following factors that affects climate change. The factors selected are: Total population, Energy use, CO2 emissions and Mortality rate.
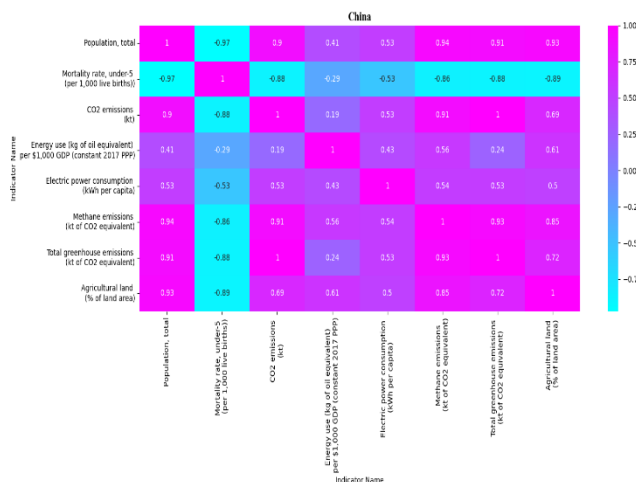
With the help of this analysis, a correlation between these factors can be found and it will be investigated.
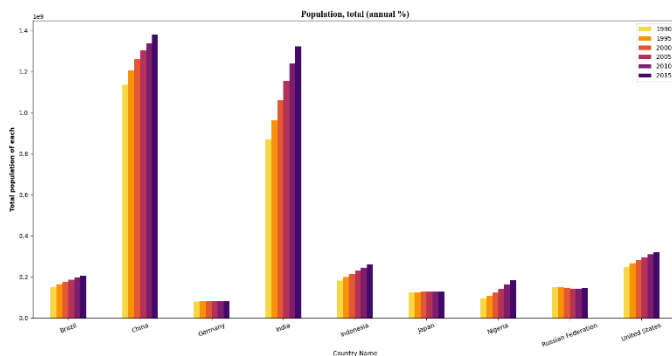
The graph above shows the population of nine different countries across the years from 1990 to 2015, having 5-year gap between each. From the graph we can clearly evaluate that India and China having the highest population and their population rise is also similar. Followed closely by United States which has a steady increase in its population throughout the years. Then comes Indonesia and Brazil. Germany has the least amount of population among the 9 countries and its population graph in nearly steady throughout the years. Japan population growth is also nearly steady like Germany.
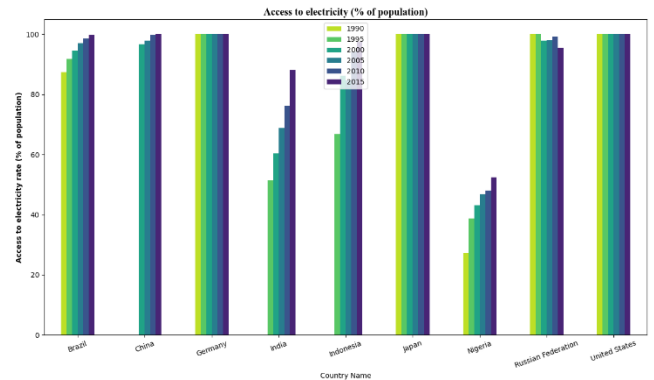
The graph that portrayed above shows the population that have the access to electricity of nine different countries throughout the years from 1990 to 2015 with having 5-year gap each. From the graph it is clear that, United States and Germany population are the two countries in which the entire population have the access to electricity throughout the years. The countries Brazil 80 % population has electricity in 1990, by the time 2015 its entire population has access to electricity. When it comes to India only 50% has access to electricity in 1990, whereas it gradually increases to 90% in 2015. Nigeria has the lowest population to access to electricity, in 1990 only 30% have electricity access and in 2015 around 50% has access to electricity.

When the amount of population consuming electricity increases, the amount of CO2 emission and methane emission increases which results in the increase in the greenhouse gas emission. Carbon dioxide and methane are the main contributors of the greenhouse gases. As the amount of greenhouse gases in the atmosphere increases, it directly impacts the climatic conditions. The change in climate can affect the humans and animals causing harmful health risks. It can also affect the environment which can impact the agriculture and food production.

From the above correlation heatmap of China, it can be evaluated that total population has a near perfect correlation with the amount of CO2 and methane emissions. The CO2 emission has perfect correlation with total greenhouse emission and near perfect with methane emissions with total greenhouse emission and near perfect with methane emissions methane.

As in the reports, the country with the highest amount of population is United States, Germany and Japan. These countries emit the highest amount of greenhouse gases, but India having 85% of the population having access to electricity produce a high amount of CO2 and methane emission.

Carbon Dioxide emissions(kt)

Methane emissions (kt of CO2 equivalent)
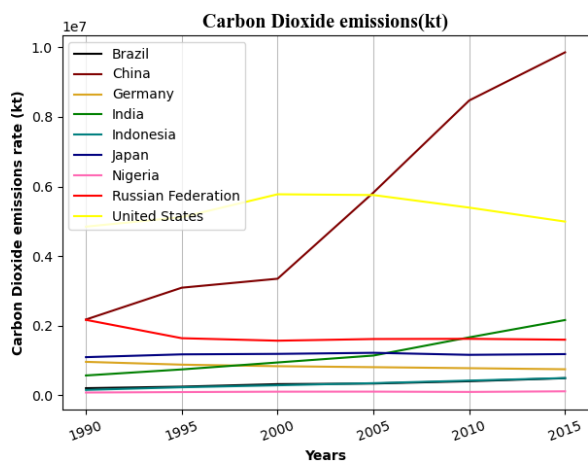
In this plot diagram it can be seen that China produces the highest amount of CO2, which is increasing throughout the years. Regardless being not a developed nation India also shows an upward trend in the emission of CO2, because of its highly intense population. Even-though having an increase in population, United States shows a gradual decrease in CO2 emission after the year 2000. Along with Mexico, Indonesia and Brazil also shows an increase in CO2 emissions.
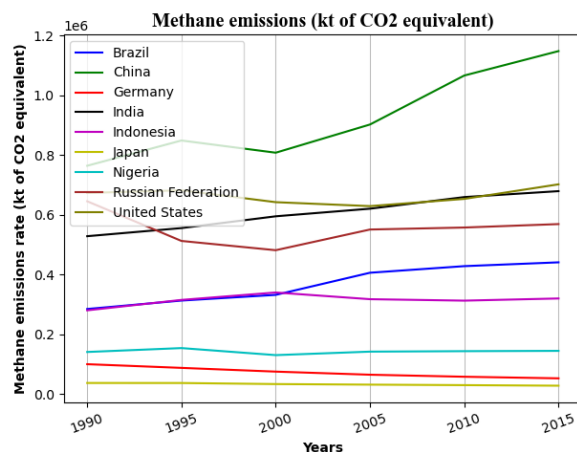
The plot diagram above illustrates the amount of methane emission of nine different countries over the years from 1990 to 2015, here China has highest amount of methane emission with nearly 1.2kt of methane. Followed by United States and India. Brazil also shows an increase in the methane emission. Where Russian Federation shows a decrease in the amount of methane in the year 2000, but then have a gradual increase in 2005 and onwards. Japan and Germany have a similar patters of methane emission throughout the years.

Russian Federation

Germany
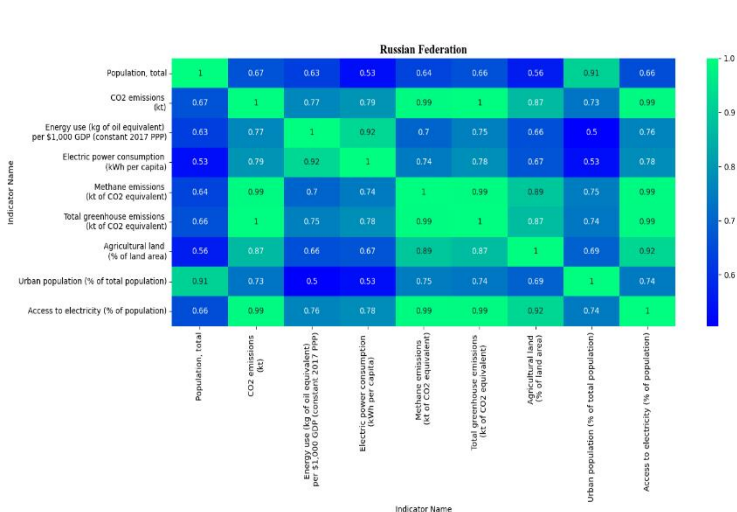
In this correlation heatmap of Russian Federation shown, a near to prefect correlation can be depicted with the amount of population that have access to the electricity and with the total greenhouse emissions. The amount of C02 emission and total greenhouse emission have a perfect correlation, while with the methane emission and total greenhouse emission has a correlation of near perfect. By this, it can be said that the amount of electricity consumed has a direct relation with the amount of greenhouse gas emission. The amount of CO2 and methane emission contribute to the total greenhouse gas emission in the atmosphere.
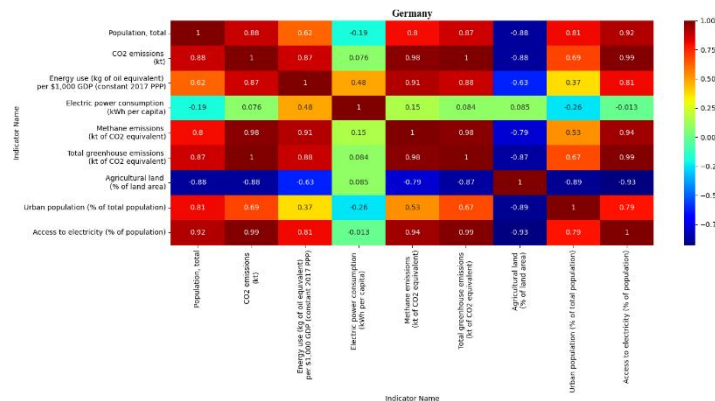
Here the correlation map of Germany is portrayed, the correlation between amount of energy use and methane emission is near perfect. While the correlation between energy use and CO2 emission is 0.87 and the correlation between energy use and total greenhouse emission is 0.88. Population access to electricity have a near perfect correlation with CO2 emission and methane emission.

So, from the two heat maps, Germany and Russian Federation it can be concluded that the percentage of population access to electricity has direct relation with C02 emission and methane emission. Therefore, the main effects of climate change are due to greenhouse gas emission which is by CO2 and methane emission. Both the CO2 and methane are the main contributors.