Analysis of Economy using Nighttime Light

Debashish Paik & Rohan Naskar

Literature review

1) Illuminating Economic Growth https://www.imf.org/en/Publications/WP/Issues/2019/04/09/Illuminating-Economic-Growth-46670

2) Indian economy and Nighttime Lights https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9410767

3) Spatial distribution of GDP based on integrated NPS-VIIRS nighttime light and MODIS EVI data: a case study of Turkey. https://link.springer.com/article/10.1007/s10668-020-01058-5 Book Title

Related works

The paper[1] by Yingyao Hu and Jiaxiong Yao finds a non-linear relationship between the GDP and the Nighttime lights. The paper proves that nighttime lights are a better measure of GDP, and it works really well in middle-income countries. Another aspect of the nighttime lights is that it helps us analyse economic development even if the official data is not available. This kind of situation is well addressed in the paper[4] by J.C. Cuaresma and others, where he used the nighttime light data and GDP of southern parts of China to predict North Korea's GDP, stating that both regions have a similar level of luminosity. The paper [2] by Jeet Agnihotri and Subhankar Mishra provides a model, of how the GDP is dependent on the Luminosity and the population and year of different countries. The paper[3] by Ustaoglu and others analyse the agricultural and non-agricultural GDP of Turkey, using the NPP-VIIRS images and MODIS vegetation index and CORINE data

Experiment Section

Dataset:

- Data was collected from DMSP-OSL, VIIRS for intensity of nighttime light of the world.
- GDP and population data for countries is taken from World Bank.

Experiment Section

Model used:

Here mainly we are dealing with data that are not linear. So, we used polynomial regression on the

dataset. Polynomial regression is a supervised regression algorithm that models a non-linear relation-

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ship between the dependent variable(which may be single or maybe multiple) and the independent

variable.

Here we only deal with two dependent variable and thus the polynomial is given by,

$$y = a_1x_1+ a_2x_2 + a_3x_1x^2 + a_4x_1^2 + a_5x_2^2$$

Experiment Section

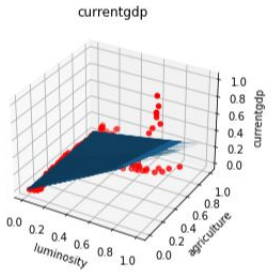
Nighttime Light image of some parts of Europe and Africa

Experiment Section

In [19]:
```
xx1, yy1 = np.meshgrid(lum, agri)
a=poly_reg(tempdf.iloc[:,:2],tempdf.iloc[:,2])
z1= (xx1*a[0][1]) + (yy1*a[0][2]) + xx1*xx1*a[0][3] + xx1*yy1*a[0][4] + yy1*yy1*a[0][5] + a[1]

fig = plt.figure()
ax = fig.add_subplot(111,projection='3d')
ax.plot_surface(xx1, yy1, z1)
ax.scatter(lum,agri ,gdp,color='red')
ax.set_xlabel('luminosity')
ax.set_ylabel('agriculture')
ax.set_zlabel('currentgdp')
plt.title('currentgdp')
plt.show()
```

```
(poly deg 2) linear model coeff (w):
[ 0.          0.671933   -0.0012364   0.0436987  -0.4763995   0.02218316]
(poly deg 2) linear model intercept (b): 0.004
(poly deg 2) R-squared score (training): 0.470
(poly deg 2) R-squared score (test): 0.454
```



The plot shows the relation of GDP against the variables luminosity and agricultural land cover.

Plans

At present, we have learned how to implement regression model for basic data set. We are planning to train on multiple data set to check its accuracy.

Further we are planning to look on the agriculture dataset to see correlation with economy (paper3)

Finally we will aim to use both nighttime light and agricultural land data to analyse economies of different countries.