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Project : Spotle.ai – NASSCOM Community AI Internship program

Declaration

We certify that

- The work contained in this report is original and has been done by me.
- I have followed the guidelines provided by the authority in preparing the report.
- Whenever, I have used materials (data, theoretical analysis, figures, and text) from other sources, I have given due credit to them by giving their details in the references.
- Neither this project nor any part of it has been submitted for any degree or academic award elsewhere.

Arunabha Sarkar

Signature

Acknowledgement

First and foremost, I would like to express deepest gratitude to the authority spotle.ai – Nasscom Community to give us such a good project.

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Arunabha Sarkar

Date-14/07/2021

Abstract

Ensuring food security ought to be an issue of great importance for a country like India where more than one-third of the population is estimated to be absolutely poor and one-half of all children are malnourished in one way or another. Within season crop production forecasts are widely recognized as an important input in analyzing food balance sheets and anticipating production shortfalls. Though crop production estimation and assessment are done worldwide on a regional extent, advance yield prediction over space and lead-times is less popular especially in India. Limited spread of observatories, lack of infrastructure in the observatories, dynamicity of weather, availability of less efficient process-based approaches to predict the turbulence of weather, heterogeneity in agriculture, lacking in integration of processes, etc pose constraints making it a risky field with not much effective methodology developed till date. In past, the most attempts are made to forecast the crop yield in purely statistical and semi-statistical basis, which proved to be very biased to the location and the year they are developed.

This project aims at developing a more scientific approach to forecast the crop yield on regional scale and at various time leads within the growing season. The objective is to develop a robust methodology to forecast the yield at high resolution spatially and temporally with a known level of accuracy and build a prediction model of crop production.

Contents

Introduction

Agriculture produce is subjected to various risks, which are not only confined to production risk pertaining to weather, pest but also the demand and supply of various countries, other policy and economic factors. With restricted knowledge to understand and comprehend the information, farmers can incur huge losses by selling their produce in distress. Farmers no longer have to contend with just local markets. They also have to account for competition from the world over.

The authority gave us a dataset contains information on crop covered area (Hectare) and production (Tonnes) for 122 different crops in 33 states of India across 14 years (2000-2013). Using this dataset, we have to study and analyses crop production, production contribution to State/country, performance, and high yield production order for crops, crop growing pattern and diversification. Also, you have to forecast the product of the crop for future periods, which can be used to formulate crop-related schemes.

Pre-requisites

Prerequisites for our project are -

a) python3 or jupyter notebook should be installed.

b) Following packages should be installed –

- cv2
- numpy
- pandas
- matplotlib. pyplot
- tflearn

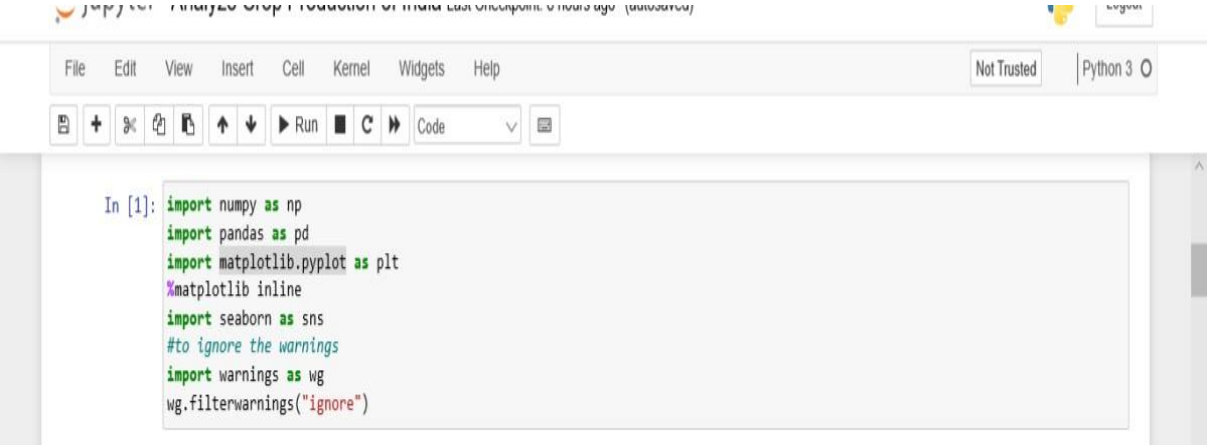
c) **Crop Prediction Dataset**:*https://cdn.spotle.ai/datasets/state-wise-crop-production-India.zip*

Steps for the Code

- ***Write a comparative study on Rice production between Odisha and West Bengal.***

Step–1: Importing Libraries

In the first step, we will be importing all the respective libraries as mentioned above.



Step-2: Importing the Dataset

In this step, we will import our given dataset.

```
import warnings as wg
wg.filterwarnings("ignore")
```

```
#reading data from file
url="https://cdn.spotle.ai/datasets/state-wise-crop-production-India.zip"
df=pd.read_csv(url)
```

Step-3: Creating Dataframe

According to the above question, we have to do a comparison of rice production between West Bengal and Odisha. For this, at first, we have to create a dataframe for rice crop.

```
rice_df=df[df['Crop']=='Rice']
```

Now we have to create a dataframe for West Bengal Rice Production.

```
In [16]: west_bengal_rice_production_df=rice_df[df['State']=='West Bengal']
         west_bengal_rice_production_df
```

Out[16]:

	State	Year	Crop	Area	Production
10211	West Bengal	2000	Rice	5435323.0	12428038.0
10250	West Bengal	2001	Rice	5503087.0	13815548.0
10289	West Bengal	2002	Rice	5842127.0	14389238.0
10328	West Bengal	2003	Rice	5856607.0	14662239.0
10366	West Bengal	2004	Rice	5783613.0	14884889.0
10405	West Bengal	2005	Rice	5782949.0	14510742.0
10444	West Bengal	2006	Rice	5687028.0	14745892.0
10482	West Bengal	2007	Rice	5719755.0	14719520.0
10522	West Bengal	2008	Rice	5935696.0	15037240.0
10556	West Bengal	2009	Rice	5630095.0	14340605.0
10590	West Bengal	2010	Rice	4944146.0	13389610.0
10624	West Bengal	2011	Rice	5433700.0	14605766.0
10658	West Bengal	2012	Rice	5444318.0	14946735.0
10693	West Bengal	2013	Rice	5513687.0	15376869.0

Step-4: Creating List for the Production Year & Production

Now, we create two lists. One is for West Bengal Crop Production Year and another one is for the Production of Rice in West Bengal.

```
df_west_bengal_rice_production_year=[2000,2001,2002,2003,2004,2005,2006,2006,2007,2008,2009,
                                     2010,2011,2012,2013]
df_west_bengal_rice_production=[12428038.0,13815548.0,14389238.0,14662239.0,14884889.0,14510742.0,14745892.0,
                1471920.0,15037240.0,14340605.0,13389610.0,14605766.0,1496735.0,15376869.0]
```

Step-5: Code for Odisha

Similar way we have to do the same thing for Odisha.

```
In [19]: rice_df=df[df['Crop']=='Rice']
         odisha_rice_production_df=rice_df[df['State']=='Odisha']
         odisha_rice_production_df
```

Out[19]:

	State	Year	Crop	Area	Production
6738	Odisha	2000	Rice	4433520.0	4613380.0
6773	Odisha	2001	Rice	4500000.0	7220000.0
6807	Odisha	2002	Rice	4273000.0	3278000.0
6841	Odisha	2003	Rice	4501000.0	6801000.0
6873	Odisha	2004	Rice	4492000.0	6536000.0
6892	Odisha	2005	Rice	4479000.0	6858000.0
6905	Odisha	2006	Rice	4451000.0	6823000.0
6918	Odisha	2007	Rice	4452000.0	7540000.0
6931	Odisha	2008	Rice	4455000.0	6812000.0
6944	Odisha	2009	Rice	4365000.0	6913000.0
6957	Odisha	2010	Rice	4226000.0	6824000.0
6971	Odisha	2011	Rice	4005000.0	5806000.0
6984	Odisha	2012	Rice	12378000.0	9496000.0
6997	Odisha	2013	Rice	4180000.0	7610000.0

Analyze Crop Production of India Last Checkpoint: 8 hours ago (autosaved)

View Insert Cell Kernel Widgets Help

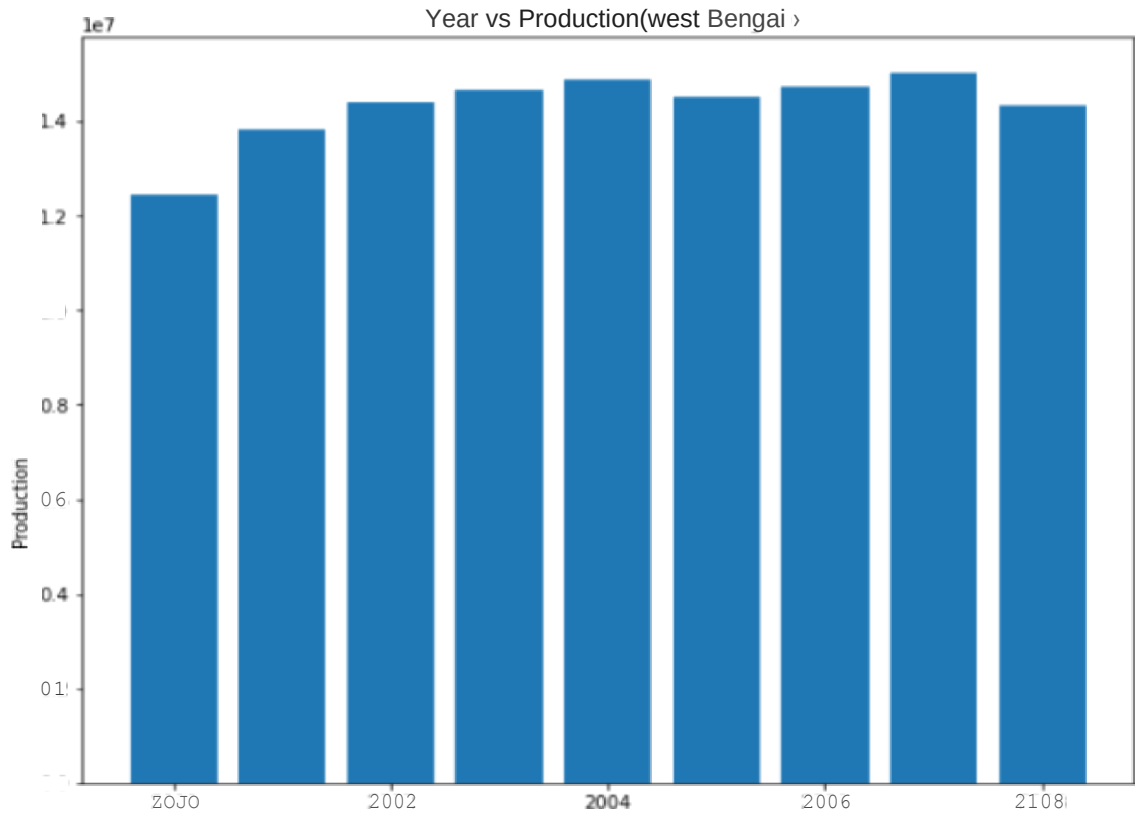
Run Code

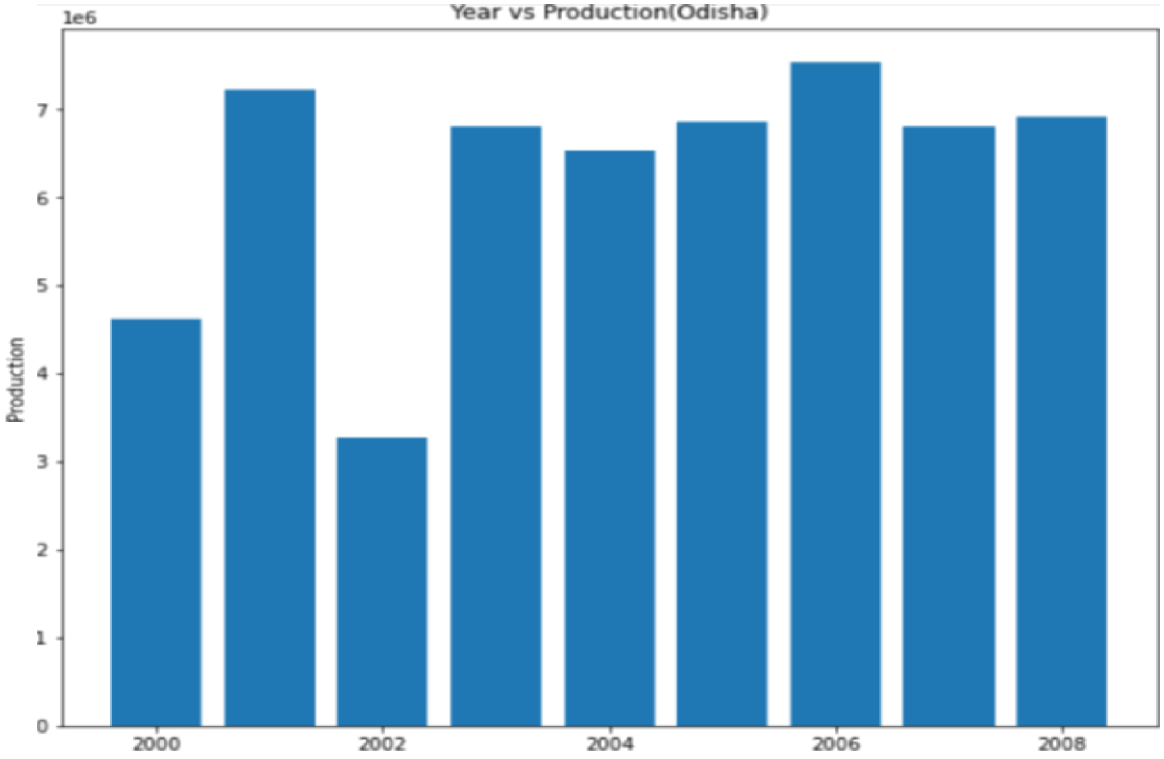
```
df_odisha_rice_production_year=[2000,2001,2002,2003,2004,2005,2006,2006,2007,2008,2009,2010,2011,2012,2013]
df_odisha_rice_production=[4613380.0,7220000.0,3278000.0,6801000.0,6536000.0,6858000.0,
                           6823000.0,7540000.0,6812000.0,6913000.0,6824000.0,5806000.0,9496000.0,7610000.0]
```

Step-6: Making Plot of rice production of the two states:

Now, we will set a plot for rice production of these two states.

```
In [25]: plt.figure(figsize=(16,9))
         plt.bar(df_west_bengal_rice_production_year[0:10],df_west_bengal_rice_production[0:10])
         plt.title('Year vs Production(West Bengal)')
         plt.xlabel('Year')
         plt.ylabel('Production')
         plt.show()
         plt.figure(figsize=(16,9))
         plt.bar(df_odisha_rice_production_year[0:10],df_odisha_rice_production[0:10])
         plt.title('Year vs Production(Odisha)')
         plt.xlabel('Year')
         plt.ylabel('Production')
         plt.show()
```


Year vs Production(west Bengai ›
1e7
1.4
1.2
0.8
Production
0.4
2002
2004
2006


Year vs Production(Odisha)
1e6
7
6
5
4
Production
3
2
1
0
2000
2002
2004
2006
2008

4.Report

Introduction

India is the world's second largest producer of rice, and the largest exporter of rice in the world. Production increased from 53.6 million tons in FY 1980 to 120 million tons in FY2020-21. Most of this increase was the result of an increase in yields; the number of hectares did not increase during this period.

Rice is one of the chief grains of India. Moreover, this country has the largest area under rice cultivation, as it is one of the principal foods crops. It is, in fact, the dominant crop of the country. India is one of the leading producers of this crop. Rice is the basic food crop and being a tropical plant, it flourishes comfortably in hot and humid climate. Rice is mainly grown in rain-fed areas that receive heavy annual rainfall. That is why it is fundamentally a khari crop in India. It demands temperature of around 25 degrees Celsius and above, and rainfall of more than 100 cm. Rice is also grown through irrigation in those areas that receive comparatively less rainfall. Rice is the staple food of eastern and southern parts of India.

In eastern India the main rice producer states are West Bengal, Bihar, Odisha, Assam, etc. In some states like West Bengal, Assam and Odisha two crops of rice are raised in a year. Winter season in northwestern India is extremely cold for rice. Rice is considered as the master crop of coastal India and in some regions of eastern India, where during the summer and monsoon seasons, both high temperature and heavy rainfall provide ideal conditions for the cultivation of rice. Almost all parts of India are suitable for raising rice during the summer season provided that the water is available. Thus, rice is also raised even in those parts of western Uttar Pradesh, Punjab and Haryana where low level areas are waterlogged during the summer monsoon rainy season.

Irrigation Infrastructure and Water Control:

The eastern India is endowed with rich water resources. The perennial rivers such as the Brahmaputra in Assam, the Ganga in Uttar Pradesh, Bihar and West Bengal and the Mahanadi in Orissa are among the large river systems in the country along with an interwoven network of tributaries traversing across the region. This apart, the region receives adequate rainfall ranging from the average of 1000 mm to 2500 mm annually, and also has abundant and rich untapped ground water resources. But this valuable resource is rarely used to production purposes in systematic manner. The development of water resource has been generally poor in the region. Figure 4 shows the comparative picture of extent of irrigated areas and rainfed areas in the selected districts. It clearly shows that except a few cases, rainfed systems dominated the region. There are however, some pockets of development of irrigation. The expansion of well irrigation in West Bengal (24 Parganas and Dinajpur) and Eastern Uttar

Pradesh (Maharjganj and Bahraich) and of late in Assam has given rich dividend in productivity improvement. It implies that the appropriate policy measures in irrigation development will make big difference to the production of rice in eastern India.

***Rice by Culture*:**

Winter rice is the main crop in eastern India. Unfortunately, most of the rice areas have been highly risk prone and affected by floods as well as droughts, which resulted in low productivity. It is in this context, the introduction of Boro rice (summer rice) in West Bengal, Assam, parts of Bihar and Orissa has emerged as a useful alternative. Boro rice enjoys the advantage of a flood-free crop as well as high-yielding potential to improve the overall rice yield. The extent of area under boro rice was particularly high in 24-Parganas with 41 per cent of total rice area and the corresponding percentage of 38 per cent in Dinajpur (Table 2). The same was 15 per cent in Nagaon and 11 per cent in Golaghat. The area under Boro rice has further expanded in Assam in recent years. The trend in expansion of area under Boro rice was more conspicuous in flood-prone areas, where farmers treated it as a mechanism of risk management. Therefore, it is not surprising that the Boro area has expanded in the non-traditional areas of eastern Uttar Pradesh, Bihar and Orissa also. The yield premium of Boro rice was at least double the yield of autumn as well as winter rice. Another advantage of expansion of Boro rice is that it helps in tackling the problem of vast rabi fallow.

Result & Discussion:

According to the dataset the result which we have get is like this-

In 2000 West Bengal produced 12428038.0tonns rice where Odisha produced 4613380.0tonns rice. The graph also showed West Bengal's high production of rice. Similarly in 2001 West Bengal's production is 13815548.0tonns where Odisha's production is 7220000.0tonns. We can see Odisha's highest rice production came on the year 2012 which is 9496000.0tonns whereas West Bengal's highest production came on 2013 on which is 15376869.0tonns. We can clearly observe that West Bengal's rice production is always above 1cr. Tons which is obviously greater than Odisha. Our graph is the prove of that.

5.Conclusion

The findings of the study show that the rice production system in eastern India has been undergoing tremendous dynamism. Production practices changed, adoption 127 of modern varieties accelerated and there is improvement in yield too. The innovation of Boro rice is gaining importance in West Bengal and Orissa, which has benefited the region significantly. This summer rice is particularly crucial for the flood-prone areas in these states. Due to these desirable properties, summer rice has become a farmers' friendly alternative in the areas with dependable irrigation facility. Therefore, it has raised many policy challenges in developing ecosystem specific varieties, irrigation facility and other input support systems. Along with summer rice, there are also other changes in the overall rice production system, including considerable improvement in total rice yield, particularly in West Bengal. The pattern of growth also improved. But the weirdest concern is that the change is not uniform across the region. There are many districts, particularly in Orissa, where the change has been very slow and productivity unchanged. Therefore, there is need for differentiated policy interventions across the region to break the yield barrier. While research on yield improvement is high priority in these areas, but in other areas where yield level has increased, emphasis on resource use efficiency has become more crucial.

6.References

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