

Topic 17:

1. **Title:***Social Impact Analysis using NTL data on various socio-economic factors*
2. **Description:**The significance of nighttime light data in socio-economic research has grown substantially, providing valuable insights across diverse domains. Extensive research has been conducted using nighttime light (NTL) data to examine Urbanization, Socio-Economic activities, and Environmental Changes. Enhanced products, advanced algorithms for analyzing nighttime lights, along with the integration of other Earth observations data and computing platforms, present great potential for understanding environmental changes. Study of NTL data focusing on the impact of electrification on Rural sectors, Education, Agriculture activities, Settlements Expansion, and Patterns can be taken up.
3. **Objectives:**
 - a. Investigating the electrification status through Night Time Lights (NTL) data, and analyzing its correlation with educational outcomes, agricultural activities or any other parameters in a specific State or District, especially in rural areas.
 - b. Using the Night Time Lights (NTL) data, along with GDP data at both national and state levels, electricity consumption figures, and various other socioeconomic parameters, formulate an algorithm computing quarterly state-level contributions to the national GDP.
 - c. Timeseries analysis of any socio-economic parameters using the NTL data.
 - d. Study the distribution and density of night-time lights in rural areas to understand the population distribution, settlement patterns, and expansion dynamics.
4. **Expected Outcomes:**
 - a. Comprehensive understanding of status of electrification of rural areas in specific State or District. Correlation of electrification increase and its impact on the agriculture activities, literacy, percentage increase in education results and their economic conditions.
 - b. State level GDP results Quarterly and contribution to national level.
 - c. Analyzing trends and relationships among these parameters providing comprehensive understanding of the social and economic dynamics of any region.
 - d. Assessment of Urbanization trends, Infrastructure growth, population density, migration and employment.
5. **Relevant data and steps to get the data from Bhuvan/other sources:**
 - a. NASA Black Marble derived products of NTL data can be downloaded from LAADS DAAC
 - b. Annual composites of NTL data for India (5 Years: 2018 – 2022) are provided for reference
 - c. GDP data can be taken from RBI Handbook Statistics of India
 - d. Electricity consumption, Energy Metric data from POSOCO
 - e. State/District level socio-economic data from respective State government portals
6. **Steps to be followed for achieving the objectives:**
 - a. Temporal Data Collection and Preprocessing:
 - i. Download and preprocess NTL data State/District wise.
 - ii. Data augmentation for generation of composite for the required period from Daily/Monthly composites to generate Quarterly data sets.
 - iii. NTL Statistics based on the administrative region considered
 - b. Implementation of Temporal Machine Learning Models:
 - i. Choose machine learning models suitable for handling time series analysis. Ensure selected models can adapt to changing patterns and provide accurate predictions.

- ii. Train the models using historical temporal data, validate their performance, and fine-tune parameters to optimize predictive accuracy.
- c. Regression analysis and correlation:
 - i. Correlation of NTL data with Socio-Economic parameters
 - ii. Comparison of different regression methods and assessment of models predicting the data accurately.
 - iii. Compare the results with published Statistics from authorized sources.

7. Evaluation:

- a. Developer side Test: Split the collected data into 70% Training 20% Validation 10% Testing.
- b. User side Test: Evaluate model with data existing at User end
- c. Methodology used in analyzing the impact of electrification/any outcome with NTL data using correlation techniques with RMSE score

Bhuvan/NRSC/ISRO