Topic- 15

1. **Title*:* Radiometric Normalization of Temporal Satellite Data Using DL/ML for Seamless Mosaic Creation**

2. **Description**: Bhuvan hosts a diverse range of Indian remote sensing satellite images, spanning spatial resolutions from 50 meters to 50 centimetres. To enhance visualization on the Earth Observation portal, a contrast enhanced country-wide mosaic has been created. These images, acquired over time spans ranging from one month to few years, depend on the acquisition capabilities of satellites to cover the entirety of the Indian landmass. The upcoming challenge lies in the radiometric normalization of these datasets to generate a cohesive and seamless mosaic

3. **Objectives**: To develop robust radiometric normalized methods to generate seamless mosaic
   - **Develop a Novel Algorithm**
     - Explore robust methods to address the limitations of existing image-normalization methods for seamless mosaic creation.
   - **Quantitative and Qualitative Improvement**
     - Improve image consistency both quantitatively and qualitatively.
     - Enhance the overall quality of normalized images.
   - **Minimize Errors in Multi-temporal, Multi resolution satellite Images**
     - Target the reduction of radiometric differences and adjustments in multitemporal / multi resolution satellite images as well as in the mosaicked image.
   - **Testing on Diverse Datasets**
     - Evaluate the proposed method on multitemporal, multi resolution images with complex features.
     - Assess the algorithm's effectiveness in handling diverse environmental conditions, including seasonal changes, water, topography, desert, snow, and cloud cover.
   - **Demonstrate Significant Improvement**
     - Showcase significant improvements in image consistency achieved by the proposed method/algorithms in mosaic creation

4. **Expected Outcomes:**
   - Robust radiometric normalization algorithms
   - Radiometric Normalized mosaicked Image

5. **Relevant data and steps to get the data from Bhuvan/ other sources:**
   - Satellite data will be made available in Bhuvan portal and other open source datasets may be used for the relevant tasks.

6. **Steps to be followed for achieving the objectives**
   - **Data downloading from portal**
     - Download the data from the portal.
   - **Algorithm Selection**
     - Develop appropriate DL/ML algorithms for radiometric normalization. Common techniques include regression models, neural networks, and deep learning architectures.

- **Model Training**
  - Implement approach, where the DL/ML model learns the radiometric normalization The model should be predict normalized pixel values based on input features.
- **Temporal Adjustment**
  - The model should learn to adjust pixel values based on the time of acquisition.
- **Spatial Normalization**
  - Address spatial variations in pixel values, especially in the case of multi-resolution datasets. The model to align pixel values across different spatial resolutions.
- **Iterative Refinement**
  - Fine-tune the DL/ML model iteratively based on validation results. Adjust model hyper parameters, architecture to enhance its performance.
- **MosaicCreation**
  - After Normalization and contrast enhancement appropriate techniques should be applied to create normalized mosaicked images.
- **Cross-Validation**
  - Validate the proposed model on a separate dataset to ensure its generalization to new, unseen data. This step is crucial for assessing the model's effectiveness in real-world scenarios.

7. Evaluation:

- Radiometric seamless will judged based on visual appearance.
- Geometrical Coverage
- Seasonal Coverage/Temporal coverage will be analyzed
- Code Complexity in terms of Time and space optimization
- Evaluation Metrics