Topic 20:

Title: **Land Use Land Cover Level-2** classification using AIML

Description:

1) Automatic categorization and classification of Land Use Land Cover (LULC) is important for sustainable development, autonomous agriculture, and urban planning. The challenge before us revolves around creating an Automated LULC classification system. This specific task is formulated as a multi-class classification problem, requiring the development of a model that can precisely categorize various LULC Level-2 classes.

Objectives:

1. Develop robust DNN (Deep Neural Network)/ML (Machine Learning) models to predict LULC Level-2 classes using Satellite Datasets.

Expected Outcomes:

1. **Land Use Land Cover Level-2 classified map**
2. **Robust models to predict Level-2 LULC classes**
3. **Metrics, Graphs in case ground truth classes are given**.

Relevant Data and Steps to Get the Data:

1. Input: Sentinel-2A / Sentinel-2B (10 m resolution)
2. Bands: NIR, Red, Green
3. Level 2 classes:

LULC Type	Class Label
Agriculture Plantation	1
Aquaculture	2
Barren land	3
Canal / Drain	4
Crop Land	5
Fallow land	6
Forest	7
Forest Plantation	8
Gullied / Ravinous Land	9
Industrial area	10
Mining/Quarry	11
Reservoir / Tank	12
River / Stream	13
Rural	14
Salt Affected Land	15
Scrub land	16
Transportation	17
Urban	18

Steps to be Followed for Achieving the Objectives:

1. Collect yearly datasets and in each year seasonal datasets.
2. Collection / Manual generation of Level-2 Class labels
3. In case if the classes are collected from various sources, data cleaning to fit the labels to the training datasets need to be done
4. Challenges to address:

Challenges Involved	Innovative Aspects
Different patterns but fall in same LULC class, depends upon location	Localised model
Different patterns but fall in same LULC class, depends upon Seasons	Train using seasonal Datasets considering Kharif (Aug –Nov), Rabi (Jan- Mar) , Zaid (April- June)
Similar patterns but fall in different LULC class (Ex: SemiEvergreen, Decidious Forest)	Ensemble Learning (Train different models and select the majority)
Class Imbalance	Random Oversampling of the training set for weaker classes

5. **Model Development and Training:**
    a. Choose an appropriate machine learning or deep learning algorithm.
    b. Design and train the model using the training dataset.
    c. Fine-tune the model for optimal performance.
    d. Save the model weights.
    e. Plot the training loss, validation loss, training accuracy, and validation accuracy graph.
6. **Model Testing and Prediction:**
    a. Load the model weight.
    b. Use the trained model to predict LULC classes on test dataset.
    c. Generate Metrics (Accuracy, F1Score, Precision, Recall, IoU)
7. **Model Evaluation:**
    a. Model Accuracy: Minimum of 94%
    b. Intersection over Union (IoU): Minimum IoU: 50%

Evaluation:

- **Developer side Test:** Split the collected data into 70% Training 20% Validation 10% Testing. Model IoU should be minimum of 50%
- **User side Test**: Evaluate model with data existing at User end