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Department of Computer Science and Engineering

Satellite Image Classification Using CNNs

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Problem Statement and Motivation

- raditional land classification methods are time-consuming, prone to human error, and lack scalability.

- Our project aims to automate land-type identification from satellite images using CNN to enhance both speed and accuracy.

- Manual classification lacks consistency and scalability across regions.

Existing System

- Current systems rely on manual interpretation or basic image processing techniques.
- These methods are inefficient for large datasets and fail with complex land-use patterns.
- Many traditional methods don’t effectively capture spatial features.
- Real-time analysis is not feasible in most legacy systems.

Objectives

- Classify satellite images into predefined land use categories.
- Develop a CNN-based model with high accuracy and reliability.
- Deploy a simple interface for testing classification results.

Abstract

- We use CNN to classify satellite images into land types like forest, industrial, and residential.
- EuroSAT dataset is used to train and validate the model.
- CNNs learn hierarchical features from images directly.
- The system supports 10 land cover classes using EuroSAT.

Proposed System

- Satellite images are processed and passed into a CNN for classification.
- The system extracts visual features and classifies them into land types.
- Includes dropout and augmentation to improve robustness.
- Batch processing of multiple images is supported.

System Architecture

- Dataset Acquisition (EuroSAT)
- Preprocessing (resize, normalize)
- CNN Model (training & feature extraction)
- Model Evaluation
- Output – Prediction of Land Type
- Training metrics monitored for performance optimization.

List of Modules

1. Dataset Loader & Preprocessing
2. CNN Model Training
3. Evaluation & Metrics Display
4. Image Prediction Interface
5. Data Augmentation Module
6. Visualization Module

Functional Description

- **Preprocessing**: Resize, normalize images for model input.
- **Training**: CNN learns spatial and color features.
- **Prediction**: Uses softmax output to classify image.
- **Evaluation**: Accuracy, precision, confusion matrix.
- **Data Augmentation**: Adds variety (rotate/flip) for better generalization.
- **Visualization**: Displays predicted class with confidence score.

Implementation & Results of Module

- Implemented in Python using TensorFlow/Keras.
- Accuracy achieved: ~90% on validation dataset.
- Results shown through confusion matrix and sample predictions.
- Model trained with early stopping to prevent overfitting.
- Validation accuracy stabilized after 25–30 epochs.

Conclusion & Future Work

- CNNs effectively classify satellite land types with high accuracy.
- The model can help in city planning and disaster management.
- Extend to time-series data for environmental change detection.
- Optimize model for edge devices and real-time use cases.

References

- EuroSAT Dataset – https://github.com/phelber/eurosat
- TensorFlow CNN Guide – https://www.tensorflow.org
- IEEE Access: Deep Learning for Remote Sensing
- Elsevier: Comparative Review on Land Use Classification
- Research papers on Satellite Image Classification

Thank You