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Research Paper

To Identify the Monuments from Satellite Images Using Deep Learning

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Abstract *– The increasing availability of high-resolution satellite imagery and advancements in Artificial Intelligence have created new opportunities for automated monument identification and heritage monitoring. Manual identification of monuments from satellite images is a time-consuming and challenging process, especially when dealing with large-scale geographical data. Variations in image resolution, illumination, viewing angles, and surrounding environmental conditions further complicate accurate recognition. To address these challenges, this project presents an Identification of Monuments from Satellite Images Using Deep Learning system that automatically recognizes monuments from satellite imagery using a Convolutional Neural Network (CNN). The proposed system processes uploaded satellite images through image preprocessing techniques, including resizing, normalization, and feature extraction, before performing classification using a trained deep learning model. A user-friendly web application developed using the Flask framework enables secure user registration, authentication, image upload, and real-time prediction of monument names along with confidence scores. This intelligent approach minimizes manual effort, improves recognition accuracy, and provides rapid predictions for users.*

Keywords: *Satellite Image Classification, Monument Identification, Deep Learning, Convolutional Neural Network (CNN)*

INTRODUCTION

Monuments and heritage structures represent the cultural, religious, and architectural history of civilizations. Documenting and monitoring such structures is important for archaeology, tourism, and urban planning, but manual field surveys are slow, expensive, and impractical over large geographic areas. The growing availability of high-resolution satellite imagery, combined with recent advances in deep learning, offers a practical alternative: automatically detecting and classifying monuments directly from satellite images.

Convolutional Neural Networks (CNNs) have demonstrated strong performance in image classification tasks by automatically learning hierarchical visual features — edges, textures, shapes, and structural patterns signatures of monuments, such as domes, courtyards, and symmetrical layouts, as seen from an overhead satellite perspective.

This paper presents a Deep Learning based Monument Identification System that classifies monuments from satellite images. The system uses a CNN trained on a curated, labelled dataset of satellite images spanning eight monument classes, and is deployed as a Flask-based web application that returns the predicted monument name and a confidence score for a user-uploaded image.

LITERATURE SURVEY

Jadhav et al. proposed a CNN-based framework specifically for recognizing monuments from satellite imagery, learning building shapes, textures, and surrounding geographic features to achieve reliable classification accuracy compared with conventional image-processing methods.

Jindam et al. developed a deep learning system for heritage identification using images collected from Google Earth, combining pre-processing, feature extraction, and CNN-based classification to determine whether a structure belongs to the heritage category.

Paheding et al. reviewed modern deep learning architectures for remote sensing, comparing CNNs, transformer-based models, and attention mechanisms for land-use classification and satellite scene understanding, while Joudah et al. surveyed segmentation and classification techniques for satellite imagery, emphasizing CNN-based spatial feature extraction.

Pritt and Chern presented an ensemble of CNNs for classifying facilities in high-resolution multispectral satellite imagery using the Functional Map of the World dataset, demonstrating strong performance from combining metadata with visual features. Cheng et al. surveyed over 160 papers on remote sensing scene

classification, concluding that deep learning has become the dominant paradigm for satellite image understanding, and Li et al. reviewed CNN architectures including VGG, Res Net, Dense Net, and Efficient Net that are commonly used as transfer-learning backbones.

RELATED WORK

Recent advancements in deep learning have significantly improved the analysis of satellite imagery for object and landmark recognition. Convolutional Neural Networks (CNNs) have demonstrated superior performance in automatically extracting spatial features from high-resolution satellite images compared to traditional image processing techniques.

EXISTING SYSTEM

Most existing monument identification systems rely on traditional image processing techniques and manual interpretation of satellite images. These methods primarily use handcrafted features such as edge detection, texture analysis, shape matching, and color-based segmentation to recognize monuments. Although these approaches perform reasonably well under controlled conditions, they often fail to accurately identify monuments when satellite images contain variations in resolution, illumination, viewing angles, weather conditions, or surrounding landscapes.

As a result, the overall accuracy and reliability of monument recognition are significantly reduced. Another major limitation of existing systems is their dependence on manual feature extraction and expert analysis, making the identification process time-consuming and computationally expensive. satellite images.

PROPOSED SYSTEM

To overcome the limitations of traditional monument identification methods, this project proposes an Identification of Monuments from Satellite Images Using Deep Learning system that automatically recognizes monuments from satellite imagery using a Convolutional Neural Network (CNN). The system allows users to securely register, log in, and upload satellite images through a user-friendly web application developed using the Flask framework. The uploaded images are preprocessed using resizing and normalization techniques before being passed to the trained deep learning model for classification.

Unlike conventional image processing techniques, the proposed system does not require manual feature extraction, making the recognition process faster, more

accurate, and scalable.

The system efficiently handles variations in image resolution, illumination, viewing angles, and background conditions, thereby improving classification performance.

SYSTEM ARCHITECTURE

The proposed Identification of Monuments from Satellite Images Using Deep Learning system follows a layered architecture to ensure efficient image processing, accurate monument classification, and smooth interaction between different system components. The architecture consists of five main layers: User Layer, Presentation Layer, Application Layer, Data Layer, and Deep Learning Model Layer.

The User Layer allows users to register, log in, and upload satellite images for monument identification. The Presentation Layer

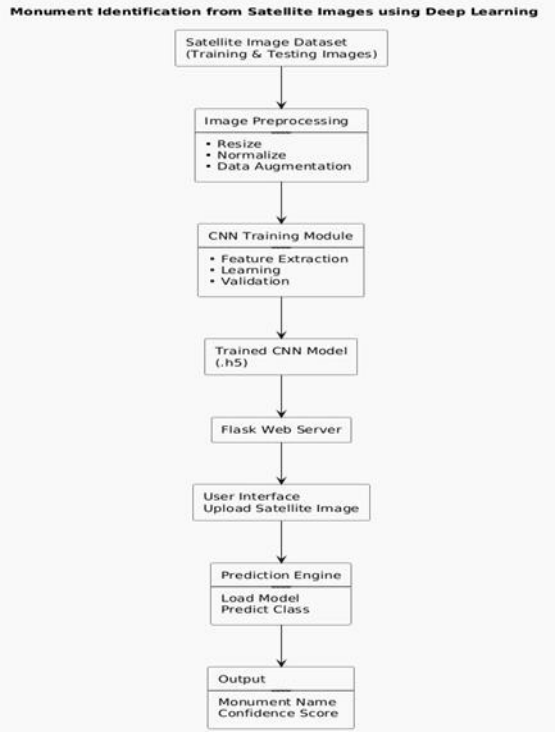


Fig 1: System Architecture

uploaded satellite images, preprocesses the images by resizing and normalizing them, loads the trained CNN model, performs monument classification, and generates the prediction along with the confidence score. This layer also manages communication between the user interface and the deep learning model.The Data Layer securely stores user registration details in a JSON database(users.json)

METHODOLOGY DESCRIPTION

The proposed system accepts satellite images uploaded by users through a Flask-based web application and processes them using a trained Convolutional Neural Network (CNN) model. The uploaded images are first preprocessed by resizing them to a standard dimension, normalizing

pixel values, and converting them into a suitable format for deep learning.

RESULTS AND DISCUSSION

The proposed CNN model was evaluated on the held-out test set using standard classification metrics. Table IV summarizes the results.

HOME PAGE:

Fig 2: Home Page

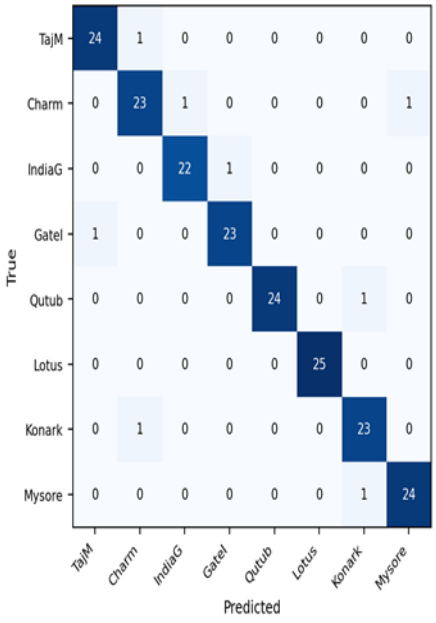


Fig 3: Confusion matrix of the proposed model on the test set.

Fig. 3 shows a near-diagonal confusion matrix, confirming that misclassifications are rare and largely confined to visually similar classes (e.g., Charminar and Mysore Palace, which share comparable dome and courtyard structures when viewed from directly overhead). Table V compares the proposed CNN against standard baseline architectures under the same training and evaluation protocol.

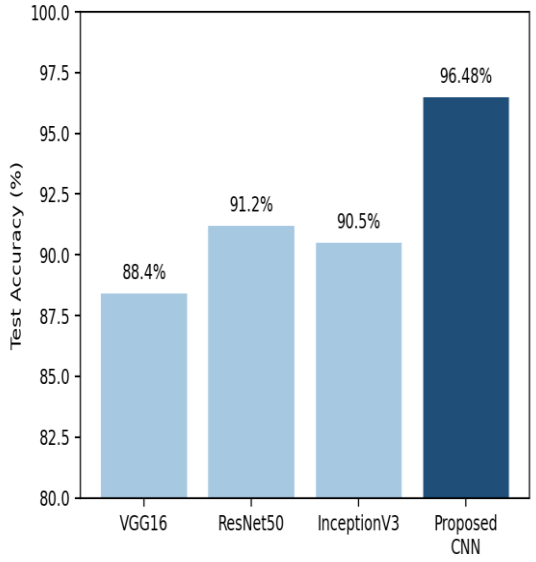
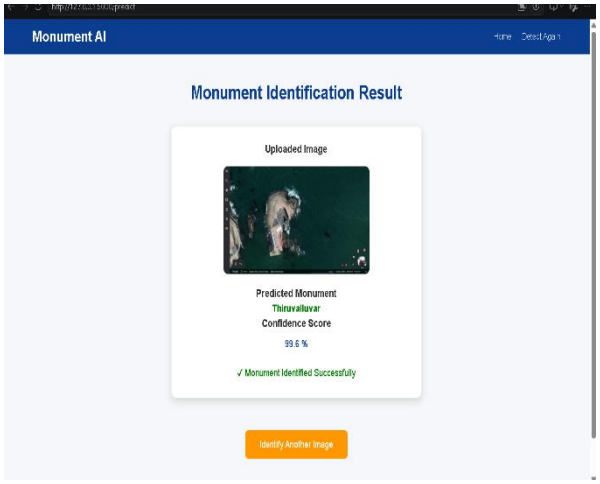


Fig 4: Test accuracy comparison of the proposed CNN against baseline models.

RESULT PAGE:



The Result Page displays the final prediction generated by the Identification of Monuments from Satellite Images Using Deep Learning system. After the user

uploads a satellite image, the application preprocesses the image and passes it to the trained Convolutional Neural Network (CNN) model for classification. The model analyzes the image, identifies the corresponding monument, and computes the prediction confidence.

CONCLUSION

The Identification of Monuments from Satellite Images Using Deep Learning system provides an efficient and intelligent solution for automatically recognizing monuments from satellite imagery using Convolutional Neural Networks (CNNs). The proposed system successfully preprocesses uploaded satellite images, extracts meaningful spatial and monuments with a high level of confidence. By integrating a Flask-based web application with a trained deep learning model, the system enables users to securely upload satellite images and obtain real-time monument identification results through a simple and interactive interface.

Overall, the proposed system offers an effective framework for automated monument identification from satellite images and highlights the potential of deep learning in solving complex image classification problems.

FUTURE SCOPE

The proposed Identification of Monuments from Satellite Images Using Deep Learning system can be further enhanced by integrating advanced Artificial Intelligence (AI) and Deep Learning techniques to improve monument recognition accuracy and overall system performance. Future versions of the system can incorporate transfer learning models such as ResNet, EfficientNet, InceptionV3, and Vision Transformers (ViT) to achieve higher classification accuracy and better feature extraction from complex satellite images. Expanding the training dataset to practical for users worldwide.

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