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Poverty Prediction Using Satellite Image

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Abstract: This project aims to investigate the use of deep learning techniques, specifically Recurrent Neural Networks (RNNs), to forecast the socioeconomic deprivation status of an area utilizing orbital photography. The hypothesis is that by leveraging the information captured during the hours of daylight and the nocturnal period as observed in satellite imagery, it is possible to reliably estimate the affluence indicator of a metropolis.

The methodology involves training RNNs to learn the complex relationships between satellite imagery and the wealth index. By analyzing the visual features and patterns in the images, the RNN models are expected to capture important indicators of poverty and wealth. The models are trained using a large-scaledataset and evaluated based on their predictive accuracy. The results aims to deliver comprehensive insights into the efficacy of deep learning methodologies. andsatellite imagery for poverty prediction

Key words: Deep learning, poverty prediction, satellite imagery, Recurrent Neural Networks (RNNs), wealth index

I. INTRODUCTION

Poverty is a complex socio-economic issue that affects millions of people worldwide. Understanding the distribution and factors contributing to poverty is crucial for effective policy-making, resource allocation, and targeted interventions. Traditional methods of measuring poverty often rely on surveys, census data, and ground- level assessments, which has the potential to be considerably time-intensive, expensive, and limited in scope.

Over the last number of years, advancements in satellite imaging technology and the emergence of advancementsin deep learning methods have unlocked up new possibilities for analysing and understanding poverty on a largerscale. Satellite imagery provides a unique vantage point, offering a comprehensive view of regions and their characteristics. Deep learning algorithms, such as Recurrent Neural Networks (RNNs), have exhibited impressive abilities in recognizing patterns and characteristics from intricate data

This project seeks to investigate the feasibility of employing deep learning and satellite images to forecast the poverty level of an area. The hypothesis is that by analysing visual cues and patterns in satellite images, Yes, it is feasible engineer constructs proficient in accurately gauge a city's wealth index. The wealth index serves as a proxy for the poverty level, representing the socio-economic status of the population in a given area.

The intention behind this project is to train RNN models to get to know the intricate relationships between satellite imagery and the wealth index. By leveraging the temporal aspect of RNNs, these models can capture sequential information in the images and exploit long-term dependencies. Through an extensive training process, the models are expected to learn discriminative features that correlate with poverty or wealth indicators.

The outcomes of this research have the potential to offer valuable insights into poverty prediction using satelliteimagery

A. Aim

The objective of this endeavour is to investigate the feasibility and effectiveness of using deep learning and satellite imagery for poverty prediction. The objective is to create recurrent neural network models capable of consistently forecasting outcomes. the wealth index of a city focuses on the analysis of satellite images.

B. OBJECTIVES

Assemble a comprehensive dataset of daytime and nighttime satellite images along with the corresponding wealth index for a large number of cities spanning different continents.

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Train Recurrent Neural Networks (RNNs) using the collected dataset to learn the complex relationships between satellite imagery and the wealth index. Evaluate the trained models based on their predictive accuracy and performance metrics. Explore the constraints and difficulties associated with of using satellite imagery and DL techniques for poverty prediction.

II. LITERATURE SURVEY

A. EXISTING SYSTEM

Currently, the assessment of poverty levels heavily relies on Conventional techniques for gathering data, such assurveys and census data. These methods are often resource-intensive and may not provide a comprehensive understanding of poverty distribution across large regions. Ground-level assessments can also be challenging in remote or inaccessible areas. There exists a necessity for a more efficient and scalable approach to predict povertylevels.

B. PROPOSED SYSTEM

The proposed system aims to leverage deep learning techniques, specifically Recurrent Neural Networks (RNNs), in conjunction with satellite imagery, to predict the wealth index of cities. By analysing visual features and patterns in daytime and nighttime satellite images, the proposed system intends to capture indicators of poverty and wealth. This approach has the potential to provide a scalable and cost-effective method for poverty prediction.

C. FEASIBILITY STUDY

A feasibility study evaluates the viability and practicality of a proposed software project.

1) Technical Feasibility:

Assessment of available technology and tools: Evaluate the availability and suitability of the necessary hardware, software, and development tools required to implement the software system.

2) Economic Feasibility:

Cost estimation: Analyse the estimated costs associated with the development, deployment, and maintenance of the software system. This includes hardware, software, licensing, personnel, and ongoing operational costs.

3) Scheduling Feasibility:

Project timeline and milestones: Develop a realistic project timeline, considering the required tasks, resources, and dependencies. Identify critical milestones and Possible hazards that could influence the outcome project's completion

4) Operational Feasibility:

User requirements analysis: Perform a comprehensive assessment of the users' needs and demands, stakeholders, and target audience to guarantee that the proposed software system aligns with their expectations

III. SOFTWARE REQUIREMENTS SPECIFICATION

A. FUNCTIONAL REQUIREMENTS

Functional requirements define the specific functionalities and behaviours that the software system should exhibit to cater to the demands of its users and stakeholders. They describe the tasks, operations, and interactions that the infrastructure is mandated to facilitate. Herein are a number of illustrative exemplifications of functional requirements for a software system developed for poverty prediction from satellite imagery.

1) Image Acquisition:

The system should support the acquisition and storage of daytime satellite images for various cities.

2) Data Preprocessing:

The system should preprocess the acquired satellite images by applying resizing, normalization, and featureextraction techniques.

3) Training and Model Development:

The system should train Recurrent Neural Networks (RNNs) using the pre-processed satellite images and corresponding wealth indices.

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4) Prediction and Analysis:

The system is anticipated to furnish the aptitude to foresee the wealth index of a city given a satellite imageusing the trained RNN model.

5) User Interface:

The system should provide an intuitive and user-friendly interface for users to interact with the softwaresystem.

B. NON-FUNCTIONAL REQUIREMENTS

Non-functional requirements specify the qualities and constraints of the software paradigms that are not intrinsically linked to its specific functionalities. They define the overall characteristics and attributes that the system is expected to possess to meet user expectations. Below are several instances of non-functional requirements for a software system developed for forecasting socioeconomic deprivation from satellite imagery:

Performance

The system should process and predict poverty levels within an acceptable response time to ensure real-time ornear-real-time performance.

The system should be capable of handling a extensive volume Concerning satellite observations and their correlated data efficiently.

C. HARDWARE REQUIREMENTS

PROCESSOR: Inteli3

Hard-disk : 500gb RAM : 4GB Or Above

D. SOFTWARE REQUIREMENTS OPERATING SYSTEM : Windows 7 And AboveFRONT END : Html, CSS Tool : Jupyter Notebook LANGUAGE : Python Version 3.7

IV. SYSTEM ARCHITECTURE

A. SYSTEM ARCHITECTURE DIAGRAM

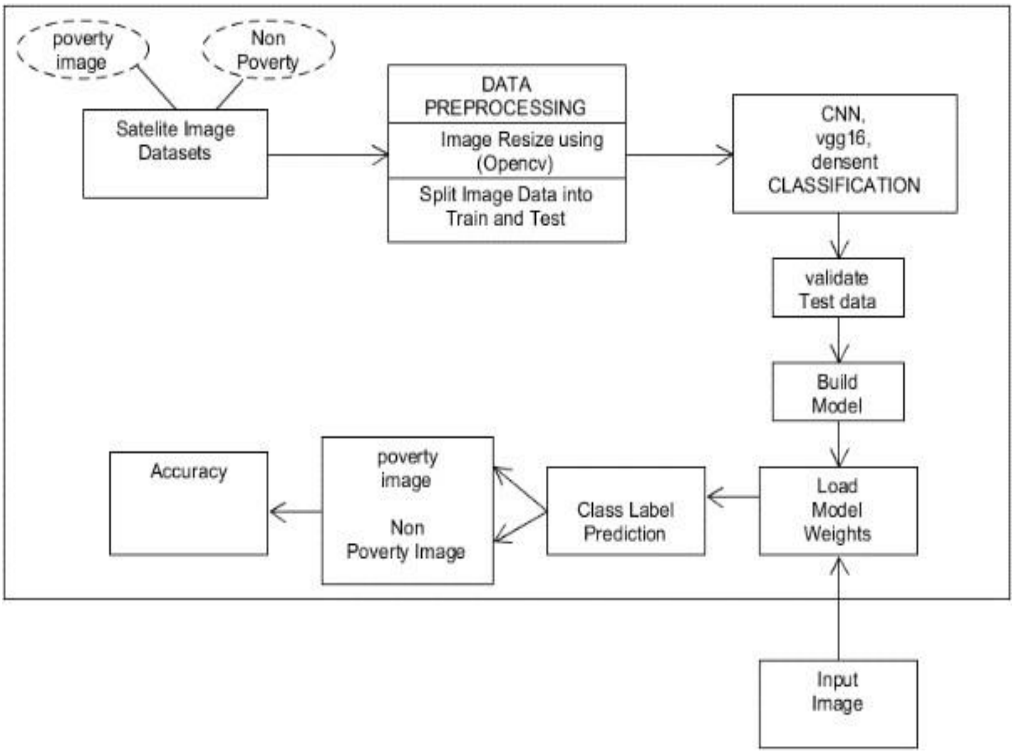

Fig. 1 System Architecture

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V. DETAIL DESIGN

A. ACTIVITY DIAGRAM

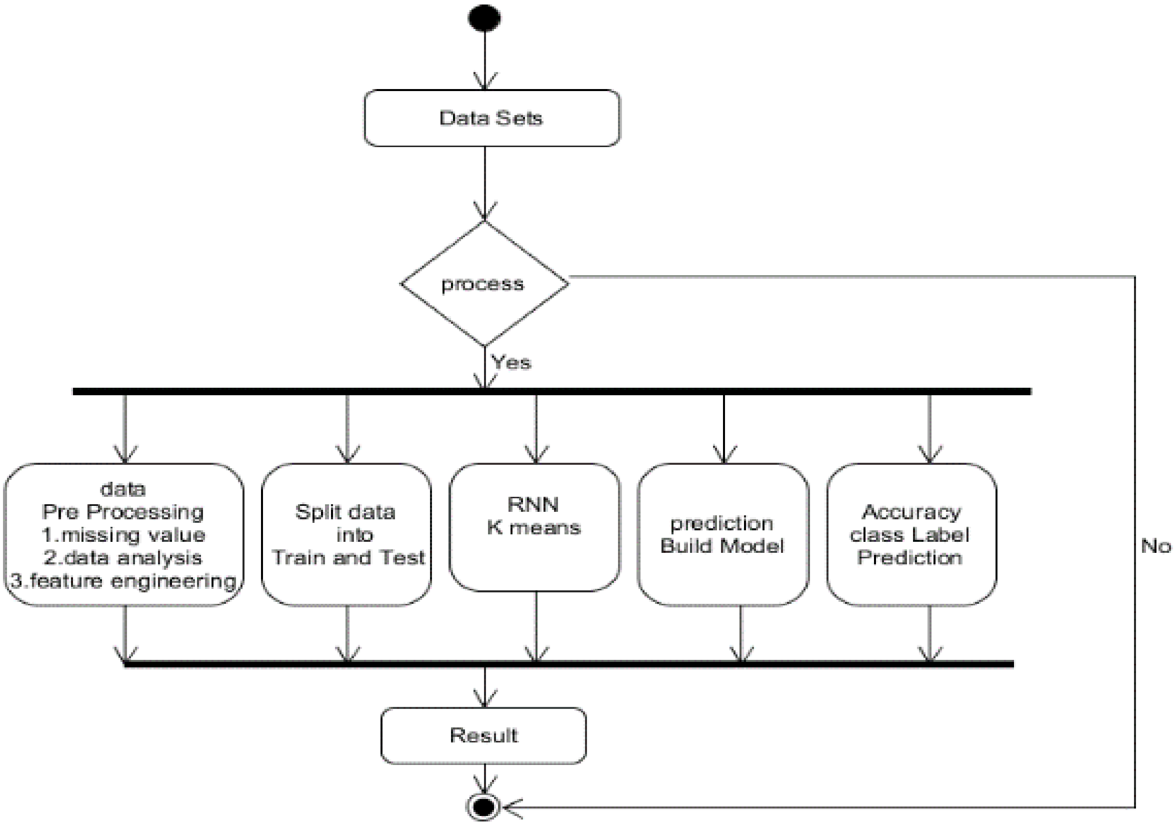

Fig. 2 Activity Diagram

B. DATAFLOW MODEL

1) DFD 0:

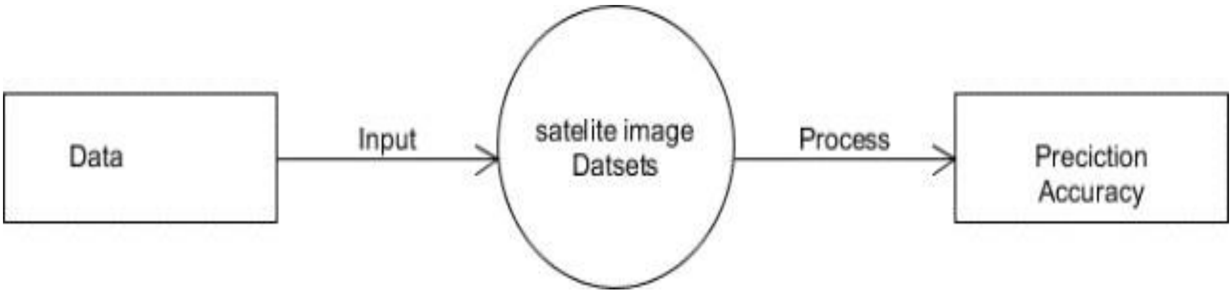

Fig. 3 Dataflow Diagram

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2) DFD 1:

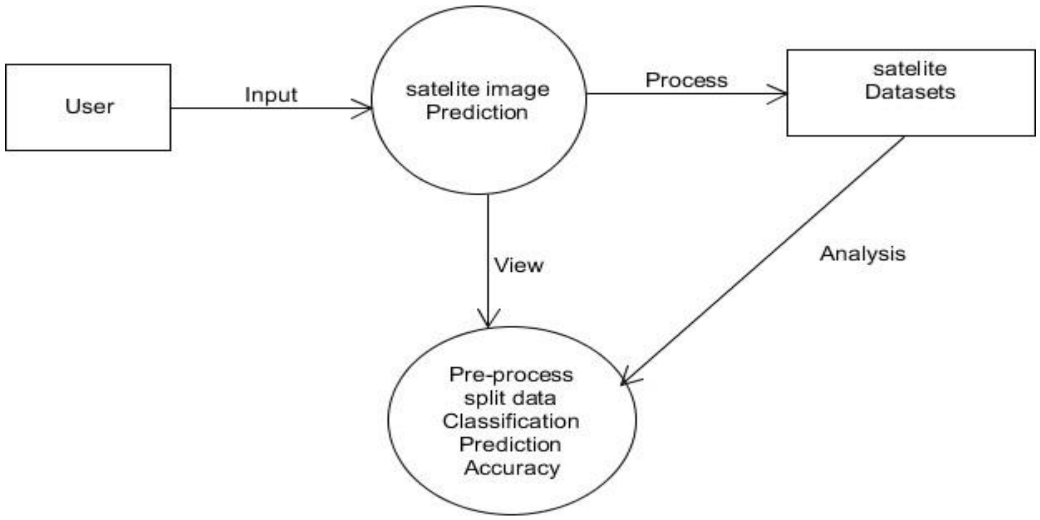

Fig. 4 Dataflow Diagram

C. USECASE DIAGRAM

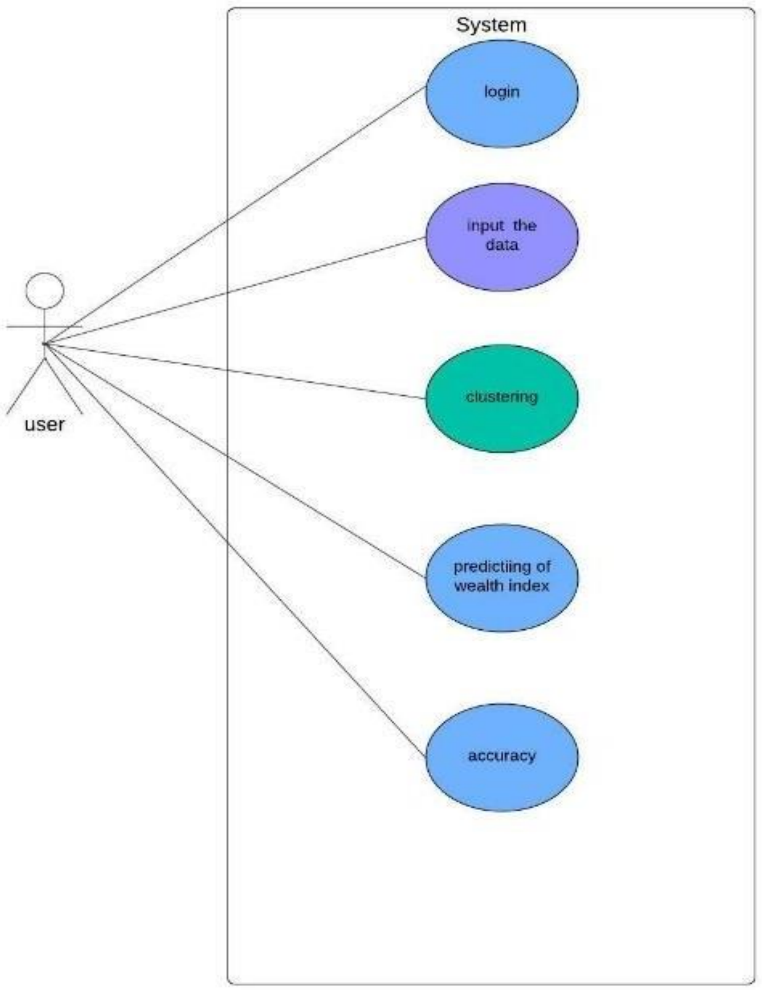

Fig. 5 Use case diagram

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D. SEQUENCE DIAGRAM

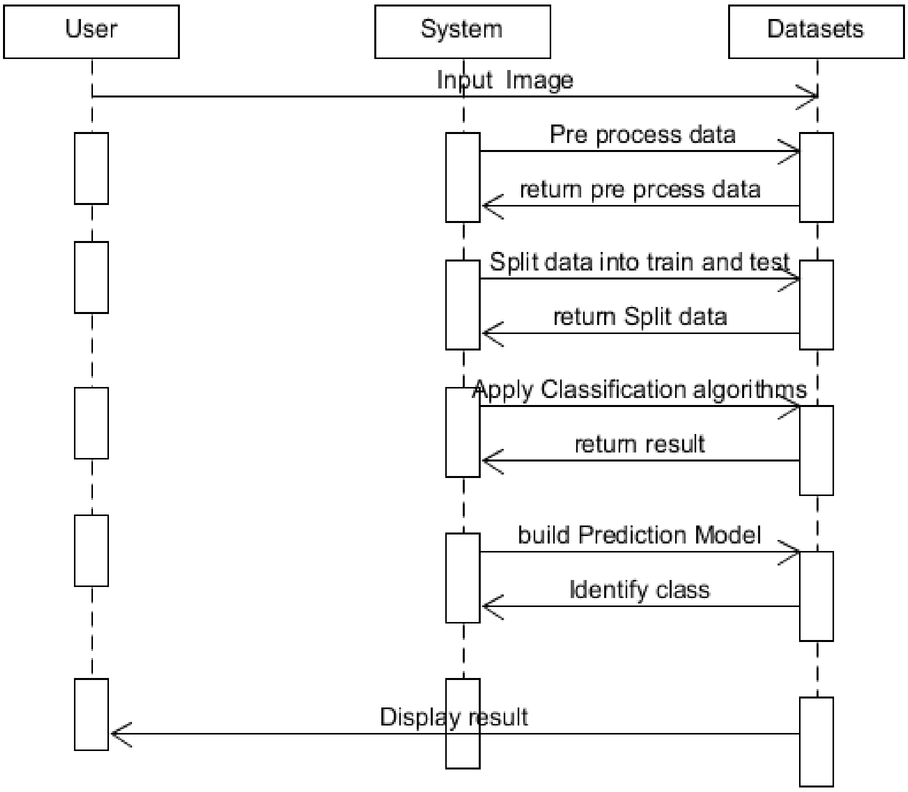

Fig. 6 Sequence Diagram

VI. CONCLUSION

In conclusion, the project aimed to engineer the evolution of software system for poverty prediction from satellite-based image analysis with deep learning techniques, specifically Recurrent Neural Networks (RNNs). The system successfully demonstrated the ability to leverage satellite imagery to predict the wealth index of cities across various regions. Through the assembly of a diverse dataset comprising daytime and nighttime satellite images along with corresponding wealth indices, the RNN models were trained and evaluated.

VII. FUTURE ENHANCEMENT

Looking ahead, several advancements can be integrated into the proposed system to further improve its accuracy and applicability. One promising direction is the incorporation of supplementary informational repositories, such as interaction with social networking platforms and utilization of mobile devices. patterns, and other geospatial data, to complement the satellite imagery. These diverse data inputs can provide a more nuanced understanding of socio-economic conditions.

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