INTERIM REPORT

Research Methods - 7COM1085-0105-2023

**GROUP 18**

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# **1. Introduction**

In recent years, satellite imaging has become increasingly important for monitoring environmental changes, particularly deforestation, which is critical for environmental conservation and land management. Traditional methods for manually interpreting satellite photos are time-consuming and error prone. However, advances in deep learning, specifically Convolutional Neural Networks (CNNs), offer a viable solution. CNNs automatically learn hierarchical features from raw picture data, allowing them to successfully capture complicated patterns and spatial connections. This introduction lays the framework for investigating CNNs' potential advantages in deforestation detection over other deep learning approaches, providing a more reliable and scalable solution to global deforestation monitoring. In this interim report, we outline our methodologies for evaluating CNNs' effectiveness, including our research question, context, and protocols. We also detail the search string devised for literature review and discuss the criteria for paper selection, aiming to contribute to the advancement of environmental monitoring and conservation efforts.

# **2. Background**

Deforestation has arisen as a major environmental concern due to its far-reaching consequences for climate change and ecological balance. Studies that provide advanced approaches for detecting deforestation are notable contributions in this sector. According to (Das, et al., 2024) a specialised convolutional neural network (CNN) model for properly identifying deforested areas in the Amazon Rainforest. This model combines updated SegNet designs with ResNet18 and ShuffleNet, which improves computational efficiency and segmentation accuracy. The study by (Katarki, et al., 2019) emphasises the importance of tackling deforestation's negative effects on global climate and ecosystems. Convolutional Neural Networks are used in this approach to automatically detect deforestation patterns from multispectral satellite data. These endeavours highlight the critical role of technology in reducing deforestation and preserving environmental integrity.

In line with these improvements, this paper examines the efficacy of CNNs in detecting deforestation in satellite imagery when compared to other deep learning methods. The goal of this research is to close methodological gaps and develop viable ways for detecting exact deforestation.

# **3. Literature Review Protocol**

## **3.1 Research Question, Context and PICO**

What improvements can be observed in the detection of deforestation in satellite imagery by utilizing Convolutional Neural Networks (CNNs) compared to other deep learning methods?

**Context:** Environmental impact of deforestation and satellite imagery availability necessitate effective detection methods.

**Population:** Regions affected by deforestation.

**Intervention:** Utilizing CNNs for deforestation detection in satellite imagery.

**Comparison:** Compare CNNs to other methods for deforestation detection.

**Outcome:** Observing improvements in deforestation detection accuracy, efficiency, and scalability with CNNs compared to other deep learning methods.

## 3.2 Search String

The search string that we’ve used in IEEE explorer command search is:

("convolutional neural network" OR "cnn" OR "deep learning" OR "machine learning" OR "artificial intelligence") AND ("deforestation" OR "forest degradation" OR "forest loss") AND ("satellite imagery" OR "image\*")

The number of papers returned for the search string is 153.

## 3.3 Inclusion and Exclusion Criteria

Include that:

* Studies that include CNN algorithm for detecting deforestation.
* Research that compares CNN algorithm with other deep learning algorithms.
* Research that shows empirical evidence of using CNN.
* Studies that directly address the research question and provide insights into specific improvements.

Exclude any:

* Studies that solely focus on CNN without comparing their performance to other deep learning methods.
* Research that does not specifically address the impact of using CNN in detecting deforestation.
* Studies that are in different languages other than English to maintain consistency and access.

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| **Table 1: PROTOCOL Part 1: RESEARCH QUESTION with PICO ELEMENTS** | |
| Elements | Content |
| Topic: | Enhancing deforestation detection accuracy using Convolutional Neural Networks and comparing it with other deep learning methods. |
| Research Question: | What improvements can be observed in the detection of deforestation in satellite imagery by utilizing Convolutional Neural Networks (CNNs) compared to other deep learning methods? |
| Context: | Environmental impact of deforestation and satellite imagery availability necessitate effective detection methods. |
| Population: | Regions affected by deforestation |
| Intervention: | Utilizing CNNs for deforestation detection in satellite imagery. |
| Comparison: | Compare CNNs to other methods for deforestation detection. |
| Outcome: | Observing improvements in deforestation detection accuracy, efficiency, and scalability with CNNs compared to other deep learning methods. |

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| --- | --- |
| **TABLE 2: PROTOCOL Part 2 – SEARCH STRINGS and INCLUSION/EXCLUSION CRITERIA** | |
| Elements | Content |
| Search string: | ("convolutional neural network" OR "cnn" OR "deep learning" OR "machine learning" OR "artificial intelligence") AND ("deforestation" OR "forest degradation" OR "forest loss") AND ("satellite imagery" OR "image\*") |
| No. of papers: | 153 |
| Inclusion Criteria: | * Studies that include CNN algorithm for detecting deforestation. * Research that compares CNN algorithm with other deep learning algorithms. * Research that shows empirical evidence of using CNN. * Studies that directly address the research question and provide insights into specific improvements. |
| Exclusion Criteria: | * Studies that solely focus on CNN without comparing their performance to other deep learning methods. * Research that does not specifically address the impact of using CNN in detecting deforestation. * Studies that are in different languages other than English to maintain consistency and access. |

# Bibliography

Das, P. K., Sahu, A., Xavy, D. V. & Meher, S., 2024. A Deforestation Detection Network Using Deep Learning-Based Semantic Segmentation. *IEEE Sensors Letters,* 8(1), p. 4.

Katarki, G., Ranmale, H., Bidari, I. & Chickerur, S., 2019. Estimating Change Detection of Forest Area using Satellite Imagery. *2019 International Conference on Data Science and Communication (IconDSC),* p. 8.