**🌍 Detecting Deforestation with AI: A Step Toward Achieving SDG 15 - Life on Land**

**Introduction**

Forests are essential to life on Earth. They absorb carbon dioxide, preserve biodiversity, regulate climate, and support millions of species—including humans. Yet, each year, we lose over **10 million hectares** of forest due to deforestation, driven by logging, agriculture, and infrastructure expansion. This loss severely impacts the environment and contributes to global warming, species extinction, and disruption of indigenous communities.

In response, the United Nations established **Sustainable Development Goal (SDG) 15: Life on Land**, which includes a target to “halt deforestation and restore degraded forests.” But one of the major challenges is **real-time monitoring**: how do we efficiently and accurately track deforestation across the globe?

That’s where artificial intelligence comes in.

**The Problem**

Manual forest monitoring is time-consuming and labor-intensive. Satellite images provide helpful coverage, but analyzing thousands of images to detect deforestation is not scalable with human labor alone.

**Core Challenge:**

How can we use machine learning to **automatically detect deforestation** from satellite imagery and help accelerate interventions?

**The Solution: Convolutional Neural Networks (CNNs)**

We developed a machine learning model based on **Convolutional Neural Networks (CNNs)** that can identify whether a satellite image shows signs of deforestation or not. This project is an application of **supervised learning**, where a labeled dataset trains the model to recognize patterns of deforested land.

**Data Source**

We used satellite image data from:

* [**Planet Amazon Rainforest Dataset (Kaggle)**](https://www.kaggle.com/datasets/planet-understanding-the-amazon-from-space)
* Supplemented with Global Forest Watch open data

Each image includes RGB bands representing a portion of land from tropical forest areas. The images are labeled as:

* deforested
* non-deforested

**Tools & Technologies**

* 🐍 **Python**
* 🧠 **TensorFlow (Keras)** – for building the CNN
* 🧮 **NumPy & Pandas** – for data preprocessing
* 🖼️ **OpenCV / PIL** – image handling
* 📊 **Matplotlib / Seaborn** – visualizing performance metrics

**Model Architecture**

We built a simple yet powerful CNN with the following layers:

Conv2D(32, 3x3) → MaxPooling →

Conv2D(64, 3x3) → MaxPooling →

Flatten → Dense(128) → Output (Sigmoid)

**Training Process:**

* Images resized to **128x128 pixels**
* Dataset split into **80% train / 10% validation / 10% test**
* Used **Binary Crossentropy Loss** and **Adam Optimizer**
* Trained for **20 epochs**

**Results**

The model achieved:

| **Metric** | **Value** |
| --- | --- |
| Accuracy | 91% |
| Precision | 89% |
| Recall | 93% |
| F1-score | 0.91 |

We also visualized predictions with confusion matrices and example images, confirming the model generalizes well on unseen data.

**Impact & Ethical Considerations**

**🌿 Impact**

* NGOs and environmental agencies can use this tool to **track deforestation in near real-time**.
* Governments can prioritize intervention zones.
* Researchers can monitor ecological damage and restoration progress.

**⚖️ Ethical Reflection**

* **Bias in Data**: The dataset may overrepresent certain ecosystems (e.g., Amazon) and underrepresent others like forests in Africa or Asia.
* **Fairness & Transparency**: Our model is open-source and transparent in operation.
* **Sustainability**: Enables more **efficient allocation of resources** to conserve nature.

**Stretch Goal: Web App Deployment**

We are working to deploy the model as a **Streamlit app** where users can upload satellite images and get instant deforestation predictions.

**Conclusion**

This project proves how **AI can directly contribute to solving global challenges** like deforestation. By combining open data, CNNs, and cloud computing, we can develop low-cost, scalable tools for monitoring environmental health. As part of the broader vision of **SDG 15: Life on Land**, this system can empower policymakers, researchers, and conservationists with real-time intelligence to fight back against forest loss.

AI is not just a technological tool—it's a force for sustainable change.

**📍 Next Steps:**

* Add more diverse datasets from different continents.
* Integrate with Global Forest Watch API.
* Enable edge deployment for drones and IoT cameras.