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Week-04-Task-03: Satellite Image Analysis for Deforestation Monitoring

a. Dataset Preprocessing Steps:

- **Loaded Satellite Images:**
  - Used satellite images representing before and after deforestation.
- **Resizing:**
  - Resized both before and after images to **128x128 pixels** to ensure uniformity.
- **Grayscale Conversion:**
  - Converted both images to **grayscale** to focus on pixel intensity changes and simplify image comparison.
- **Thresholding:**
  - Applied **thresholding** to the absolute difference of the before and after images to highlight significant changes (deforestation).

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b. Model Selection and Rationale:

- **Model Selection:**
  - Did not use a pre-trained deep learning model.
  - **Image Processing Techniques** were used instead of CNNs for detecting deforestation, as comparing two images over time doesn't require training a model.
- **Rationale:**
  - **Grayscale Conversion**: Simplifies the images and makes it easier to detect changes based on pixel intensity.
  - **Thresholding:** Highlights significant changes (deforestation) by setting a pixel intensity threshold.

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c. Challenges Faced and Solutions:

- **Challenge 1:** Image Size Mismatch
  - **Solution**: Resized both the before and after images to **128x128 pixels** for consistency.
- **Challenge 2:** Image Not Loading Correctly
  - **Solution**: Verified and corrected the **file paths** to ensure images are loaded correctly.
- **Challenge 3:** Undefined Variables in Code
  - **Solution**: Imported **NumPy** to perform pixel-wise operations like counting deforested areas.

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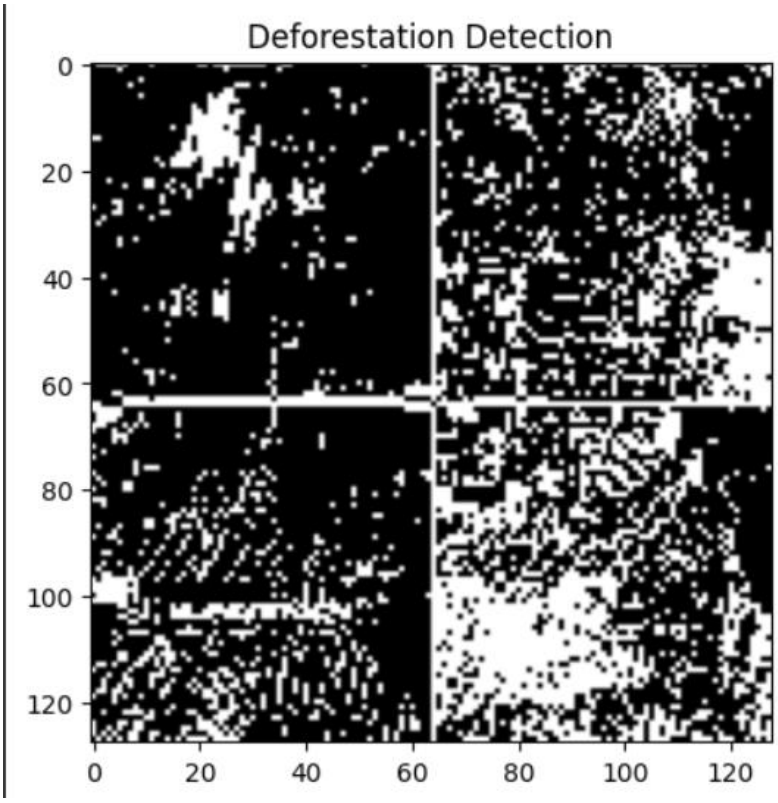
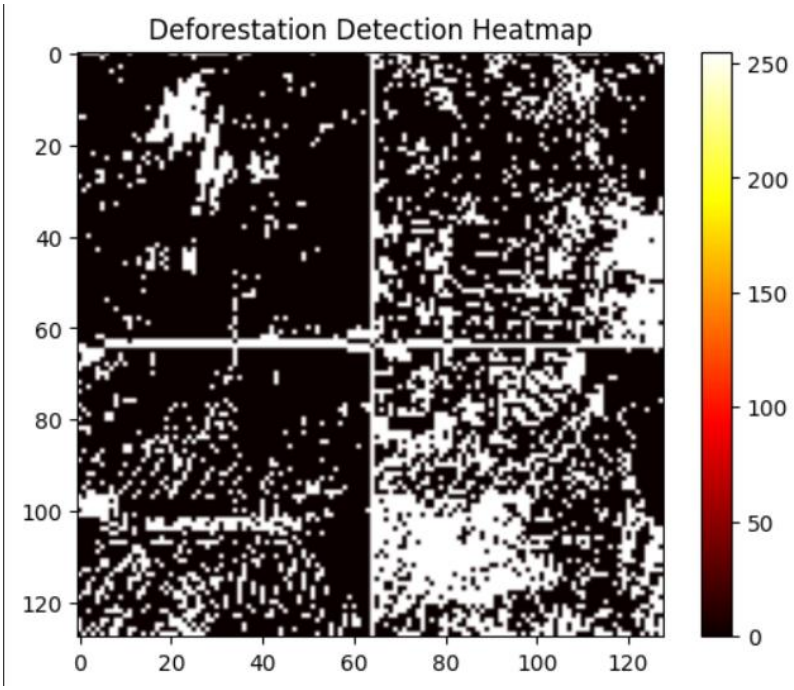
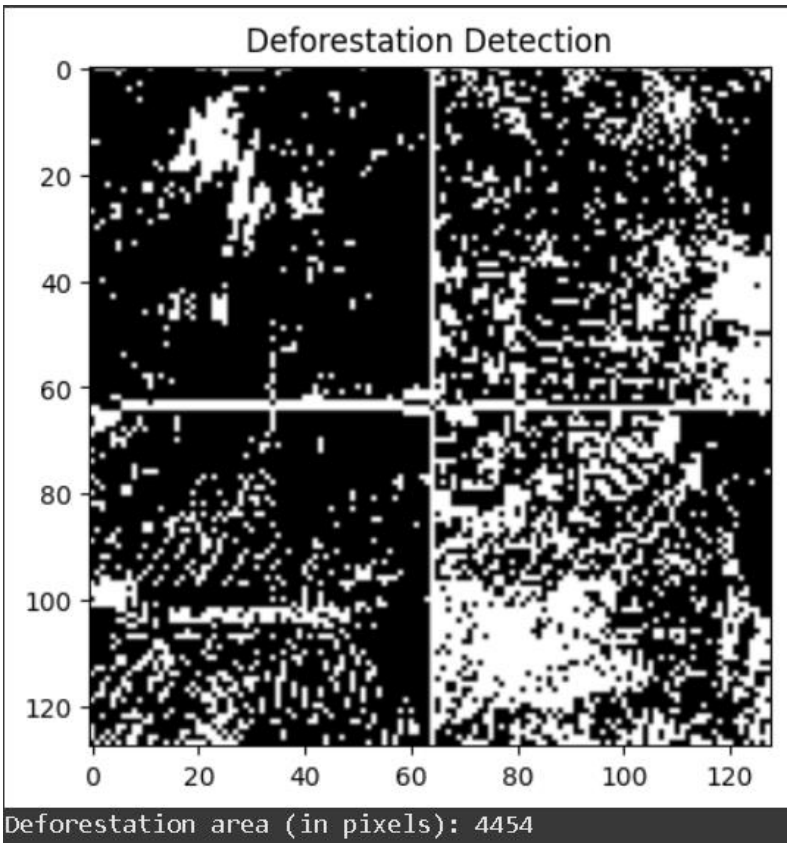
d. Results with Visualizations and Interpretations:

- **Results:**
  - **Deforestation Area**: Calculated by counting the **white pixels** (value = 255) in the thresholded image.
  - **Deforestation Detection**: The change detection was visualized using **grayscale** and **heatmap** visualizations.
- **Interpretations:**
  - **Deforestation Area**: The number of pixels (white pixels) in the thresholded image indicates the extent of deforestation.
  - **Micro-F1 & Hamming Loss**: These metrics were not calculated for this task as it focuses on change detection rather than classification. However, we focused on **visual analysis** and pixel counting.
- **Visualization:**
  - **Heatmap of Deforestation**:
    A heatmap was used to visualize the areas affected by deforestation.
  - **Deforestation Area (in pixels)**: The number of affected pixels (calculated as white pixels in the thresholded image) gives us the **extent of deforestation**.

Example Output Visualization






Deforestation Detection
0
20
40
60
80
100
120
0
20
40
60
80
100
120
Deforestation area (in pixels): 4454