DOCUMENTATION

Overall Approach

The project aims to automate the counting of sheets in a stack using computer vision techniques. The approach involves several key steps:

1. **Image Preprocessing**: The uploaded image is preprocessed to enhance the visibility of edges, which are crucial for detecting the individual sheets. Techniques like contrast limited adaptive histogram equalization (CLAHE) and Gaussian blur are applied.
2. **Edge Detection**: The Canny edge detection algorithm is used to identify the edges in the image.
3. **Line Detection**: The Hough Line Transform is employed to detect lines in the preprocessed image, which are then filtered based on their orientation to count the number of sheets.
4. **User Interface**: A Streamlit-based web application provides a user-friendly interface for uploading images and displaying the results, including visual feedback with the processed image and additional metrics.

Frameworks/Libraries/Tools

- **Streamlit**: Used for building the interactive web application, allowing users to upload images and view results.
- **OpenCV**: Employed for image processing tasks such as grayscale conversion, edge detection, and line detection.
- **Pillow**: Utilized for image manipulation and handling image file formats.

Challenges and Solutions

- **Challenge: Image Quality Variability**
  Solution: Implemented robust preprocessing techniques including CLAHE and Gaussian blur to standardize image quality and enhance edge detection across varying image conditions.
- **Challenge: Accurate Line Detection**
  Solution: Applied the Hough Line Transform with specific parameter tuning to accurately detect lines corresponding to the sheet edges, and filtered out irrelevant lines based on their orientation.
- **Challenge: Performance Optimization**
  Solution: Utilized Streamlit's caching mechanism to cache computationally expensive operations, such as image preprocessing, to improve the application's response time.

Future Scope

- **Deep Learning Integration**: Incorporate deep learning models, such as Convolutional Neural Networks (CNNs), to improve the accuracy of sheet counting, especially in more complex images.
- **Batch Processing**: Enable the application to handle batch uploads, allowing users to process multiple images simultaneously.
- **Enhanced User Feedback**: Develop additional metrics and visualizations to provide users with more insights into the processing results, such as confidence intervals or error margins.
- **Mobile Compatibility**: Optimize the application for mobile devices to expand accessibility and usability in various operational settings.
- **Customization Options**: Allow users to adjust image processing parameters, such as edge detection thresholds, to cater to specific use cases or image types.