SHEET COUNTING APPLICATION

1. Overall approach:
    a. I have used streamlit to create a simple web interface where users can upload an image file.
    b. Then, the program reads and converts the uploaded image to grayscale.
    c. Next, it applies Gaussian Blur to reduce noise.
    d. Next, it uses the Canny edge detection algorithm to detect edges.
    e. Next, it applies Hough Line Transform to detect lines in the image.
    f. Then, it filters out horizontal lines based on their slope.
    g. Further, it counts the number of significant horizontal lines (i.e., those not too close to each other).

2. Frameworks/Libraries/Tools Used:
    a. Streamlit: To create the web interface and handle user interactions (file upload and displaying results).
    b. OpenCV (cv2): For image processing tasks including reading images, converting to grayscale, applying Gaussian Blur, detecting edges, and detecting lines.
    c. NumPy: For numerical operations and handling arrays.
    d. Pillow (PIL): To handle image files and convert them to a format compatible with OpenCV.
    e. Math: For mathematical operations such as calculating the slope of lines.

3. Challenges and Solutions:
    a. I encountered a lot of problems with accurate detection of the edges due to the noise. I fixed this by revising the code and applied Gaussian Blur multiple times to reduce noise before edge detection.
    b. The Hough Line Transform detects all lines, not just horizontal ones. In the image with the scale attached to the stack, it was also being counted as lines, resulting in an inaccurate count of sheets. I fixed this by filtering lines based on their slope to identify and keep only horizontal lines.

4. Future Scope:
    a. Improved line detection accuracy.
    b. Allow users to upload and process multiple images at once.
    c. Implement parallel processing or GPU acceleration to handle large images and multiple uploads more efficiently.

d. Add features for users to control parameters for the detection of lines, allowing them to manually adjust or confirm the results.
e. Develop the capability to process images in real-time, potentially integrating with camera feeds for live analysis.