**Image Transformations and Filtering**

**Methods and Steps Taken**

1. **Scaling**:
   * **Process**: The images were scaled to 50% of their original size.
   * **Tool Used**: OpenCV cv2.resize() function was utilized to resize each image based on specified scaling factors.
   * **Effect**: Scaling reduced the image size, making it smaller and easier to process. It is useful in applications where storage or computational power is limited.
2. **Rotation**:
   * **Process**: The images were rotated by 45 degrees.
   * **Tool Used**: OpenCV functions cv2.getRotationMatrix2D() and cv2.warpAffine() were used to rotate the images around their center points.
   * **Effect**: The rotation changes the orientation of the image, which is useful in augmenting data for models that need to recognize objects from various angles.
3. **Gaussian Blurring**:
   * **Process**: Gaussian blur was applied to reduce image noise and detail.
   * **Tool Used**: OpenCV cv2.GaussianBlur() function was employed with a specified kernel size to smooth the image.
   * **Effect**: The blurring reduces high-frequency noise, making it easier to process the image for tasks like edge detection and segmentation.
4. **Median Blurring**:
   * **Process**: Median blur was applied to further reduce noise, especially salt-and-pepper noise.
   * **Tool Used**: OpenCV cv2.medianBlur() was used, which is particularly effective in preserving edges while smoothing.
   * **Effect**: Similar to Gaussian blur but more effective in noise removal while maintaining sharper edges.
5. **Edge Detection (Canny Edges)**:
   * **Process**: Canny edge detection was used to identify significant transitions in intensity, highlighting the edges.
   * **Tool Used**: OpenCV cv2.Canny() function with specific thresholds was applied.
   * **Effect**: Edge detection highlights the boundaries within the images, crucial for applications involving shape recognition and object detection.

**Results Achieved**

The processed images demonstrate the impact of each transformation:

* **Scaled Images** show reduced sizes, helping in computational efficiency.
* **Rotated Images** illustrate how orientation changes can affect image analysis, beneficial for training models.
* **Gaussian and Median Blurred Images** highlight noise reduction techniques, improving image quality for further processing.
* **Edge Detection Results** provide clear boundaries within the images, making features more distinguishable.

**Conclusion**

The application of these image processing techniques effectively modified the images, each serving a distinct purpose. Scaling helps manage computational load, rotation aids in data augmentation, blurring reduces noise, and edge detection highlights critical features. These transformations are invaluable in various computer vision tasks, from image classification to object detection.