Geometric Rectification

Wednesday, 7 August 2024

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**Lab Task 1: Geometric Rectification of Satellite Imagery**

**Objective**: Correct the geometric distortions in satellite images using bilinear interpolation. **Materials**: A distorted satellite image, ground control points (GCPs), and image processing software (such as Python with OpenCV). **Steps**:

1. Import the distorted satellite image into the image processing software.
2. Identify and mark ground control points (GCPs) on the distorted image.
3. Define the corresponding coordinates for the GCPs in the rectified image.
4. Apply a transformation matrix to map the distorted image to the corrected coordinates.
5. Use bilinear interpolation to resample the pixel values in the rectified image.
6. Compare the rectified image with the original image to evaluate the effectiveness of the rectification process.
7. Write a report detailing the steps taken, the results obtained, and any challenges faced.

**Lab Task 2: Medical Image Rectification**

**Objective**: Rectify distortions in MRI images using bilinear interpolation. **Materials**: Distorted MRI images, reference anatomical model, and image processing software. **Steps**:

1. Import the distorted MRI image into the image processing software.
2. Identify and mark key points on the distorted MRI image.
3. Obtain the corresponding coordinates from the reference anatomical model.
4. Apply a transformation matrix to align the MRI image with the reference model.
5. Use bilinear interpolation to resample the pixel values in the rectified image.
6. Compare the rectified MRI image with the reference model to assess accuracy.
7. Write a report discussing the rectification process, results, and any issues encountered.

**Lab Task 3: Drone Image Rectification**

**Objective**: Correct the geometric distortions in drone-captured images of an agricultural field using bilinear interpolation. **Materials**: Distorted drone images, control points from known field locations, and image processing software. **Steps**:

1. Import the distorted drone image into the image processing software.
2. Identify and mark control points on the distorted image.
3. Define the corresponding coordinates for the control points in the rectified image.
4. Apply a transformation matrix to map the distorted image to the corrected coordinates.
5. Use bilinear interpolation to resample the pixel values in the rectified image.
6. Generate an orthophoto of the field and compare it with the original image.
7. Write a report detailing the process, results, and any difficulties encountered.

**Lab Task 4: Historical Photo Restoration**

**Objective**: Rectify and restore old, distorted photographs using bilinear interpolation. **Materials**: Scanned old photographs, reference images, and image processing software. **Steps**:

1. Import the scanned old photograph into the image processing software.
2. Identify and mark key points on the distorted photograph.
3. Obtain the corresponding coordinates from a reference image or known dimensions.
4. Apply a transformation matrix to align the distorted photograph with the reference coordinates.
5. Use bilinear interpolation to resample the pixel values in the rectified image.
6. Compare the rectified photograph with the original scanned image and the reference image.
7. Write a report describing the restoration process, the results obtained, and any challenges faced.

**Lab Task 5: Architectural Image Rectification**

**Objective**: Rectify perspective distortions in architectural images using bilinear interpolation. **Materials**: Distorted architectural images, known dimensions of the building, and image processing software. **Steps**:

1. Import the distorted architectural image into the image processing software.
2. Identify and mark key points on the distorted image corresponding to known dimensions of the building.
3. Define the corresponding coordinates for these points in the rectified image.
4. Apply a transformation matrix to align the distorted image with the known dimensions.
5. Use bilinear interpolation to resample the pixel values in the rectified image.
6. Compare the rectified image with the original distorted image to evaluate the correction.
7. Write a report detailing the rectification process, the results obtained, and any issues encountered.