stereoParameters

Object for storing stereo camera system parameters

Description

The `stereoParameters` object stores the intrinsic and extrinsic parameters of two cameras and their geometric relationship.

Creation

You can create a `stereoParameters` object using the `stereoParameters` function described here. You can also create a `stereoParameters` object by using the `estimateCameraParameters` with an M-by-2-by-$numImages$-by-2 array of input image points, where M is the number of keypoint coordinates in each pattern.

Syntax

```
stereoParams = stereoParameters(cameraParameters1,cameraParameters2,rotationOfCamera2,translationOfCamera2)
stereoParams = stereoParameters(paramStruct)
```

Description

`stereoParams = stereoParameters(cameraParameters1,cameraParameters2,rotationOfCamera2,translationOfCamera2)` creates a `stereoParameters` object that contains the parameters of a stereo camera system, and sets the `CameraParameters1`, `CameraParameters2`, `RotationOfCamera2`, and `TranslationOfCamera2` properties.

example

`stereoParams = stereoParameters(paramStruct)` creates an identical `stereoParameters` object from an existing `stereoParameters` object with parameters stored in `paramStruct`.

Input Arguments

expand all

`paramStruct` — Stereo parameters
struct

Properties

expand all

Intrinsic and extrinsic parameters of the two cameras

`CameraParameters1` — Parameters of camera 1
`cameraParameters` object

`CameraParameters2` — Parameters of camera 2
`cameraParameters` object

Geometric relationship between the two cameras

`RotationOfCamera2` — Rotation of camera 2
3-by-3 matrix

`TranslationOfCamera2` — Translation of camera 2
3-element vector

`FundamentalMatrix` — Fundamental matrix
3-by-3 matrix

`EssentialMatrix` — Essential matrix
3-by-3 matrix

Essential matrix, stored as a 3-by-3 matrix. The essential matrix relates the two stereo cameras, such that the following equation must be true:

$$[P_2 \quad 1] * EssentialMatrix * [P_1 \quad 1]' = 0$$

P_1, the point in image 1, corresponds to P_2, the point in image 2. Both points are expressed in normalized image coordinates, where the origin is at the camera's optical center. The x and y pixel coordinates are normalized by the focal length f_x and f_y.

Accuracy of estimated parameters

`MeanReprojectionError` — Average Euclidean distance
number of pixels

Settings for camera parameter estimation

`NumPatterns` — Number of calibrated patterns
integer

`WorldPoints` — World coordinates
M-by-2 array

`WorldUnits` — World points units
`'mm'` (default) | character vector

Object Functions

`toStruct`	Convert a stereo parameters object into a struct

Examples

collapse all

Stereo Camera Calibration

Specify calibration images.

Open Live Script

```
leftImages = imageDatastore(fullfile(toolboxdir('vision'),'visiondata', ...
    'calibration','stereo','left'));
rightImages = imageDatastore(fullfile(toolboxdir('vision'),'visiondata', ...
    'calibration','stereo','right'));
```

Detect the checkerboards.

```
[imagePoints,boardSize] = ...
  detectCheckerboardPoints(leftImages.Files,rightImages.Files);
```

Specify the world coordinates of the checkerboard keypoints. Square size is in millimeters.

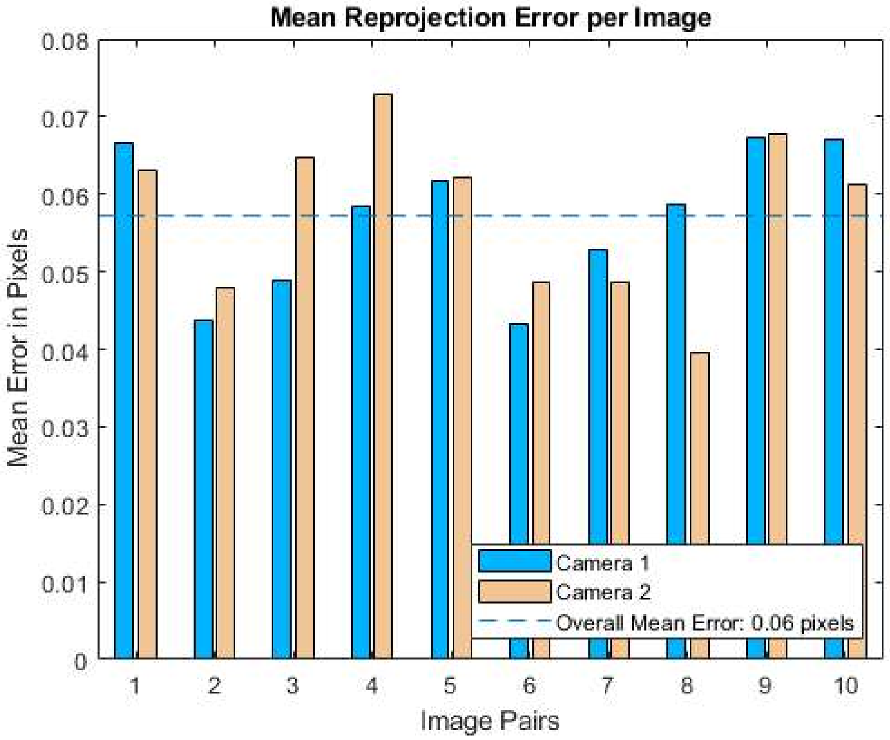
```
squareSize = 108;
worldPoints = generateCheckerboardPoints(boardSize,squareSize);
```

Calibrate the stereo camera system. Both cameras have the same resolution.

```
I = readimage(leftImages,1);
imageSize = [size(I,1),size(I,2)];
params = estimateCameraParameters(imagePoints,worldPoints, ...
                                  'ImageSize',imageSize);
```

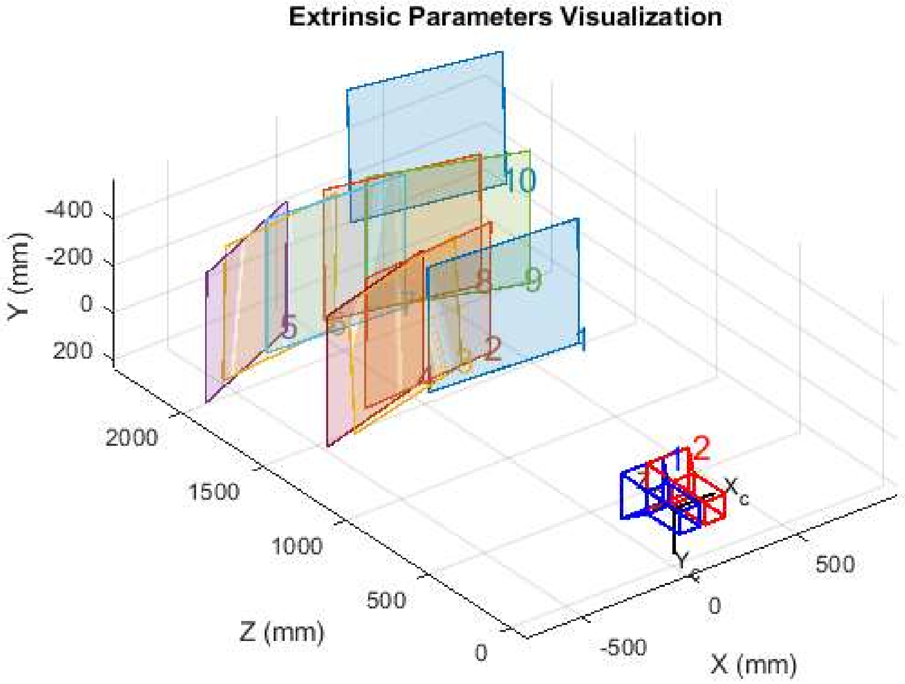
Visualize the calibration accuracy.

```
showReprojectionErrors(params);
```



Visualize camera extrinsics.

```
figure;
showExtrinsics(params);
```



References

[1] Zhang, Z. “A Flexible New Technique for Camera Calibration”. *IEEE Transactions on Pattern Analysis and Machine Intelligence*.Vol. 22, No. 11, 2000, pp. 1330–1334.

[2] Heikkila, J, and O. Silven. “A Four-step Camera Calibration Procedure with Implicit Image Correction.” *IEEE International Conference on Computer Vision and Pattern Recognition*. 1997.

Extended Capabilities

> **C/C++ Code Generation**
Generate C and C++ code using MATLAB® Coder™.

See Also

Apps

Camera Calibrator | Stereo Camera Calibrator

Classes

`cameraParameters` | `extrinsicsEstimationErrors` | `intrinsicsEstimationErrors` | `stereoCalibrationErrors`

Functions

`detectCheckerboardPoints` | `estimateCameraParameters` | `estimateFundamentalMatrix` | `generateCheckerboardPoints` | `reconstructScene` | `rectifyStereoImages` | `showExtrinsics` | `showReprojectionErrors` | `undistortImage` | `undistortPoints`

Topics

Structure From Motion From Two Views

Structure From Motion From Multiple Views

Code Generation for Depth Estimation From Stereo Video

Single Camera Calibrator App

Stereo Camera Calibrator App

Introduced in R2014a