**CS 7390 – Fall 2020**

**HW(BR): Exploring Multiview Camera Concepts in OpenCV**

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**1) findHomography**

**What is input?**

InputArray srcPoints, InputArray dstPoints, int method, double ransacReprojThreshold, const int maxIters, const double confidence

**What is output?**

The output of findHomography returns the perspective transformation H between the source and the destination planes.

**How many points are required?**

2: srcPoints and dstPoints

**What is returned?**

A Mat object. The function returns the perspective transformation H between the source and the destination planes.

**How would be use it?**

The function is used to find initial intrinsic and extrinsic matrices.

**2) findEssentialMat**

**What does this do?**

Calculates an essential matrix from the corresponding points in two images.

**What is input?**

InputArray points1, InputArray points2, InputArray cameraMatrix, int method, double prob, double threshold

**What is size output matrix?**

Output array of N elements, every element of which is set to 0 for outliers and to 1 for the other points.

**How would you apply the output?**

The result of this function may be passed further to decomposeEssentialMat or recoverPose to recover the relative pose between cameras.

**That is, what problem does it solve regarding relating multiple views?**

The function will compute the essential matrix that encodes the transformation between the scenes.

**3) findFundamentalMat**

**What does this do?**

Calculates a fundamental matrix from the corresponding points in two images.

**What is input?**

InputArray points1, InputArray points2, int method, double ransacReprojThreshold, double confidence, int maxIters

**What is size output matrix?**

3x3 (or 9x3 in case of the 7-point algorithm)

**How would you apply the output?**

The calculated fundamental matrix may be passed further to computeCorrespondEpilines that finds the epipolar lines corresponding to the specified points. It can also be passed to stereoRectifyUncalibrated to compute the rectification transformation.

**That is, what problem does it solve regarding relating multiple views?**

The matrix helps map points and epipolar lines across views.

**4) What is the difference between the EssentialMatrix and the Fundamental Matrix?**

Both matrices relate corresponding points in two images. The difference is that in the case of the Fundamental matrix, the points are in pixel coordinates, while in the case of the Essential matrix, the points are in "normalized image coordinates". Normalized image coordinates have the origin at the optical center of the image, and the x and y coordinates are normalized by Fx and Fy respectively, so that they are dimensionless.

**5) What is RANSAC?**

Random sample consensus (RANSAC) is an iterative method to estimate parameters of a mathematical model from a set of observed data that contains outliers, when outliers are to be accorded no influence on the values of the estimates.

**What does it stand for?**

The RANdom SAmple Consensus (RANSAC) algorithm.

**To what kinds of problems is it applied?**

The RANdom SAmple Consensus (RANSAC) algorithm is a predictive modeling tool widely used in the image processing field for cleaning datasets from noise.

**What is the advantage of using RANSAC when given matching points that are somewhat noisy?**

RANSAC can be sensitive to the choice of the correct noise threshold that defines which data points fit a model instantiated with a certain set of parameters.

**6) computeCorrespondEpilines**

**What are epilines?**

When two cameras view a 3D scene from two distinct positions, there are a number of geometric relations between the 3D points and their projections onto the 2D images that lead to constraints between the image points.

**What inputs are required for this?**

InputArray points, int whichImage, InputArray F

**We have seen that an epipolar line is a mapping of a point in one image to a line in a second image of a second image.  What matrix is used to define this relation?**

findFundamentalMat to get the foundamenal matrix.