

Fundamental

Description

The goal of the project is to compute a fundamental matrix from two images. The program first detects and matches keypoints between the two input images using the SIFT algorithm. Using these correspondences, the program estimates the fundamental matrix F with the RANSAC algorithm, based on the 8-point method. After the matrix is computed, the user can click on a point in one of the images, and the corresponding epipolar line is drawn in the other one.

Setup and requirements

The project was developed on Windows 11 using Visual Studio Code with the CMake Tools extension.

To run the program, the Imagine++ library must be installed and accessible.

Compilation

Using the command line

Run the `cmake --build .` command.

Using VS Code

1. Open the project folder in Visual Studio Code.
2. The CMake Tools extension will automatically configure the project.
3. Press the Build button (bottom toolbar) to compile.

Running the Program

Using the command line

Run `.\build\Release\Fundamental.exe` (Windows) or `./build/Fundamental.exe` (Linux/Mac) command.

Using VS Code

Run the built target by pressing the Run button (bottom toolbar).

The program will load the default images - *im1.jpg* and *im2.jpg*. If you want to use your own images:

1. Place them in the same directory as the default images.
2. Change the file paths at the beginning of *main()* in *Fundamental.cpp* (variables *s1* and *s2*).
3. Rebuild and run the program.

Use case scenario

In this section, we show how the program works with example screenshots.

1. When the program is run, two windows open showing the input images.



Figure 1: Two windows at the start of the application

2. In the background, the program automatically computes SIFT feature points in both images and finds potential matches. After a few seconds, matched points are shown in both images as red circles. The total number of detected matches is shown at the top-left corner of the window.



Figure 2: Computed matches using SIFT algorithm

3. By clicking the screen, the program starts computing the Fundamental matrix (F) using RANSAC algorithm, based on the 8-point algorithm. In each iteration, 8 random matches are sampled, F is computed, and inliers are found and counted. The number of iterations of RANSAC is updated dynamically according to the current inlier ratio. Once the inliers reach a sufficient proportion of the matches, the algorithm is done. The last (best) computed F matrix is kept, and the inliers, together with their total count, are shown on screen.



Figure 3: Inliers after RANSAC

4. The user should click the screen once to dismiss the inliers view. After that, the user can click on any image and the program will draw a small circle at the clicked point and the corresponding epipolar line in the other image. The circle and the line are drawn in the same, randomly sampled, color.



Figure 4: Epipolar lines corresponding to the clicked points in the opposite image