Project 2022-2023 Image Analysis and Computer Vision

Visual motion analysis

of a player's fingers

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Results

The process for the Calibration is the following:

A. Rectification of the Horizontal Façade hor_rectification()

includes functions:

- 1. vanishing_points()
- 2. affine()
- 3. metric()
- 4. ratio()

First, I select a frame from the video and for this frame I run rectification(frame).

I find the vanishing points, vertical and orthogonal, and line at the infinity. Then I run the functions to build the rectification matrices and rectify image. Following the rectification, I run the last function ratio() to determine the ratio of the horizontal façade. The results are the following

vol = 1.0e+03 * 1.5291 -0.2399 0.0010 Affine matrix: 1.0000 0 -0.0002 0 1.0000 0.0026 0 0 1.0000 -2361 -616 Euclidean matrix: -0.0734 1.1210 0 1.1210 -0.3672 0 Vertical Vanishing point: 0 0 1.0000 1.0e+03 * Rectification Matrix: 0.2986 0.9116 0.0002 0.9116 0.0597 -0.0026 0.0010 0 0 1.0000 Line at the infinity: Horizontal Facade ratio: 0.8521	Horizontal Vanishing points:			
1.5291 -0.2399 0.0010 Affine matrix: 1.0000	vo1 =			
-0.2399 0.0010 Affine matrix: 1.0000	1.0e+03 *			
0.0010 Affine matrix: 1.0000				
vo2 =				
vo2 = 0 1.0000 0.0026 -2361 Euclidean matrix: 1 -0.0734 1.1210 0 1.1210 -0.3672 0 Vertical Vanishing point: 0 0 1.0000 1.0e+03 * Rectification Matrix: 0.6603 0.2986 0.9116 0.0002 0.0010 0 0.9116 0.0597 -0.0026 0 0 1.0000 Horizontal Facade ratio:	0.0010	Affine mat	rix:	
Vo2 = -2361 -616 1		1.0000	0	-0.0002
0 0 1.0000 -2361 -616 1 -0.0734 1.1210 0 1.1210 -0.3672 0 Vertical Vanishing point: 0.6603 4.6040 0.0010 Line at the infinity: -0.0002 0.0026 1.0000 Horizontal Facade ratio:	vo2 =	0	1.0000	0.0026
-616	V02 =	0	0	1.0000
1	-2361			
1	-616	Euclidean matrix:		
Vertical Vanishing point: 1.0e+03 * 0.6603 4.6040 0.0010 Altrix: 0.9986 0.9116 0.0597 0.0026 0.0010 Altrix: 0.40000 Altrix: 0.40000 Rectification Matrix: 0.40000 0.40000 Rectification Matrix: 0.40000 0.40000 Altrix: 0.40000 0.40000 Horizontal Facade ratio:		-0.0734	1.1210	0
1.0e+03 * 0.6603 4.6040 0.0010 Line at the infinity: -0.0002 0.002 Rectification Matrix: 0.2986 0.9116 0.0597 0.0026 0.010 0 0 1.0000 Horizontal Facade ratio:		1.1210	-0.3672	0
Rectification Matrix: 0.6603 4.6040 0.0010 Line at the infinity: -0.0002 0.0020 0.0020 0.0020 0.0020 0.0020 0.0020 Horizontal Facade ratio:	Vertical Vanishing point:	0	0	1.0000
0.6603 4.6040 0.0010 0.2986 0.9116 0.0002 0.9116 0.0597 0.0026 0 1.0000 0 1.0000 Horizontal Facade ratio:	1.0e+03 *			
4.6040 0.9116 0.0597 -0.0026 0.0010 0 0 1.0000 Line at the infinity: -0.0002 0.0026 1.0000 Horizontal Facade ratio:		Rectification Matrix:		
0.0010 0.00397 =0.0026 0.0010 0 1.0000 Line at the infinity: -0.0002 0.0026 1.0000 Horizontal Facade ratio:	0.6603	0.2986	0.9116	0.0002
Line at the infinity: -0.0002 0.0026 1.0000 Horizontal Facade ratio:	4.6040	0.9116	0.0597	-0.0026
-0.0002 0.0026 1.0000 Horizontal Facade ratio:	0.0010	0	0	1.0000
-0.0002 0.0026 1.0000 Horizontal Facade ratio:				
-0.0002 0.0026 1.0000 0.8521	_	Horizontal Facade ratio:		
	-0.0002 0.0026 1.0000	0.8521		

```
Points after affine and metric rectification:
AA =
184.1672 263.6828
BB =
234.1082 253.1212
CC =
276.6419 262.2095
DD =
 226.7011 272.7712
  B. Camera Calibration
     Calibration() includes IACfunct()
     I continue with the calibration process. The results are the following
     IAC =
        1.0e+06 *
         0.0000 0 -0.0010
           0 0.0000 0.0001
        -0.0010 0.0001 2.0672
     aa =
        0.9066
     fx =
        1.0175e+03
      fy =
       922.5426
     K =
        1.0e+03 *
         1.0175 0 1.2124
            0 0.9225 -0.0891
```

0 0.0010

C. Rectification of the Vertical Façade Ver_rectification()

The result which is useful for the continuation of the exercise is the following:

D. Localization Localization()

```
cameraPosition =

699.0089
42.8109
-781.9455
```

cameraRotation =

```
0.9976 -0.0691 -0.0014
0.0691 0.9976 -0.0029
0.0016 0.0028 1.0000
```