Digital Image Processing

Homework Assignment #1

Due: 14:20, 10/17, 2024

Exercise 1

1. Write a program for non-integer scaling of an image with two interpolation methods:

   -- Bilinear interpolation

   -- Bicubic interpolation

2. Take a selfie of yourself, with a size of at least 512 by 512 pixels, and apply the above image scaling program to your selfie:

(1) First shrink your selfie with a scaling factor of 0.12,

(2) Then zoom the above shrinked selfie with a scaling factor of 7.

3. Compare the quality of the images obtained with bilinear interpolation and with bicubic interpolation.

4. Explain the method of bicubic interpolation, and compare its computational complexity with that of bilinear interpolation.

Exercise 2

1. Lens distortion is a special kind of image warping. Explain the difference between barrel and pincushion distortion, regarding Brown's Conrady Model.

2. Write a program of image warping to simulate lens distortion for different radial lens distortion coefficients.

3. With the above warping program, warp your selfie used in Exercise 1 to generate a distorted image having obvious barrel distortion.

4. With the above warping program, warp your selfie used in Exercise 1 to generate a distorted image having obvious pincushion distortion.

Language for Implementation

- C++ or Python (If you want to use other languages, please contact TAs. We need to make sure we can run your program!)
- OpenCV is a useful open library for image processing, and you can use the function in OpenCV directly.

Report for this assignmnet

- In this report, you need to show
  - which function you use or implement
  - how does your program work
  - how to use your program
  - Resulted images for comparison
  - Explanation

Submission

- Please submit a .zip/.rar file to NTU COOL, containing
  - Project (source code and execution file)
  - Report (.pdf file)
- Late submission:
  - within 24 hours after its due will incur 20% penalty,
  - after 24 hours and within seven days of its due will incur 50% penalty, and
  - after seven days of its due will not be graded.

  Note: One minute late is the same as 23 hours late.

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