Evaluation of Distortion Error with Fuzzy Logic

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- Distortions in the design and manufacturing processes of camera lenses inherently cause distortion in the image captured by the sensors or by film of the camera (Goldberg, 1992).The six major types of errors are spherical aberration, come astigmatism, field curvature, lens radial distortion and chromatic distortion (Choi et al., 2006). There can be found three types of distortions, radial distortion, tangential distortion, mustache distortion (moustache distortion).

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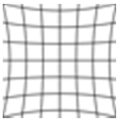
Barrel distortion



pincushion distortion

mustache distortion

$$\Delta r = r - r' \qquad \Delta r = r - c * \tan\tau$$

$$\Delta r = K_1 r^3 + K_2 r^5 + K_3 r^7$$

$$r^2 = (x - x_0)^2 + (y - y_0)^2$$

(x, y) are the fiducial coordinates of the image point.

(x_0, y_0) are the fiducial coordinates of the point of symmetry

K_1, K_2 and K_3 are coefficients whose values depend upon the camera focal setting

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- The fuzzy subset theory was introduced by Zadeh in 1965 as an extension of the set theory by the replacement of the characteristic function of a set by a membership function whose values range from 0 to 1 (Dincer et al.,2008, Yalcin and Tasdemir,200).
- There are two types of structure fuzzy logic. The first one is Mamdani. The second one is Sugeno. A model in Mamdani structure of fuzzy logic was built with FIS (Fuzzy Inference System) editor of Fuzzy toolbox in MATLAB R2006a program

CONCLUSIONS

Interpolation	Fuzzy	% Success
67,79	66,8	98
33,44	32,6	97
-73,39	-71,3	97
306,78	304,9	99
58,85	59,6	98
29	28,6	98
172,22	171,9	99
24,47	22,4	91
49,93	48,6	97
13,84	12,7	91
51,58	53,6	96
5,20	5,8	88