Image processing with the SPH method

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Abstract: One of the most significant research fields in computer graphics is the digital image processing. Scaling, rotating and repairing are the fundamental components in image processing which are all based on interpolation. There are many grid-based interpolation algorithms for image processing such as the nearest neighbor interpolation, bilinear interpolation, polynomial interpolation, B-spline interpolation and cubic convolution interpolation [1, 2]. Although these algorithms have achieved great success, their dependence on the grids might introduce difficulties and disadvantages for advanced image processing. On the other hand, the meshless methods only use the image information in the support domain to compensate the missing parts without the limit of grids. In this paper, the meshless smoothed particle hydrodynamics (SPH) method and the corrective smoothed particle method (CSPM) are used to deal with scaling, rotating and repairing of three typical images including Lenna, Pepper and Stanford Dragon as shown in Fig. 1. The numerical results indicate that the meshless methods can obtain better results according to the Peak Signal to Noise Ratio (PSNR) as shown in Table 1. Moreover, dissipation of moving images has also been successfully achieved by modelling it with a convection-diffusion process.

(a) (b) (c)

Figure 1: Typical images for processing

Table 1: PSNRs in scaling for different image interpolation methods

Case name	Interpolation methods			
	Nearest neighbor	Bilinear	SPH	CSPM
Lenna	28.1987	28.1984	29.7391	31.1865
Pepper	27.1608	28.3115	30.7758	28.9502
Standford Dragon	28.5788	30.5884	31.7239	31.8727

References

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