Lee, Yeon Ju; Yoon, Jungho

Summary: This paper presents a nonlinear image interpolation algorithm. The suggested method is based on the moving least squares (MLS) projection technique, but introduces a fundamental modification. The algebraic polynomial-based MLS methods provide very satisfactory results. However, the associated approximation space is shift-and-scale invariant so that it cannot be adjusted according to the characteristic of a given data. As a result, when upsampling images, it has a limitation in producing sharp edges such that edges are often blurred in the magnified images. To recover sharper edges, we need to reduce smoothing parameter or adapt a new parameter sharpening the edges. Motivated by this observations, we propose a novel MLS method governed by a set of exponential polynomials with tension parameters such that they can be tuned to the characteristic of given data. Moreover, for a better match to the local structures around the edges, the suggested algorithm uses weights which consider the edge orientation. Numerical results are presented and compared, visually and by using some quantitative fidelity measures (PSNR, EPSNR, SSIM and FSIM), to the bicubic spline interpolation and other recently developed nonlinear methods. The results demonstrate the new algorithm’s ability to magnify an image while preserving edge features.

MSC:
94A08 Image processing (compression, reconstruction, etc.) in information and communication theory
65D05 Numerical interpolation
68U10 Computing methodologies for image processing
41A45 Approximation by arbitrary linear expressions

Keywords:
moving least squares; exponential polynomial; reproducing property; edge-directed interpolation; image upsampling; minimization problem

Software:
FSIM

Full Text: DOI

References:


This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.