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Adaptive interpolation of images using a new nonlinear cell-average scheme

S. Amat [a,1], J. Ruiz [b,*,1], J.C. Trillo [a,1]

[a] *Departamento de Matemática Aplicada y Estadística, Universidad Politécnica de Cartagena, Spain*
[b] *Departamento de Matemáticas, Universidad de Alcalá de Henares, Spain*

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Abstract

We present a new method for image interpolation which combines a cell average version of the nonlinear interpolatory technique called PPH (Piecewise Polynomial Harmonic) and subcell resolution techniques. It is designed to perform more accurately at discontinuities, avoiding the evaluation of any extrapolation technique. Numerical experiments are shown validating the theoretical aspects of the algorithm.

MSC: 41A05; 41A10; 65D05; 65D17

Keywords: Zoom; Subcell resolution; Image interpolation; Cell-average multiresolution; Nonlinear subdivision scheme

1. Introduction

Image interpolation is an area of image processing with interesting applications and it has received much attention in the last decade. It is crucial to have algorithms which define well the edges of the zoomed images. It is at this point where nonlinear methods emerge as good candidates.

The fields of application of wavelets have been really expanded in the last years. Several techniques initially thought to improve the classical linear multiresolutions of wavelet type have led to nonlinear multiresolutions [6–9,13–15].

In [3], in the context of image compression, a new nonlinear point-value multiresolution, called PPH (for Piecewise Polynomial Harmonic) has been presented. This nonlinear interpolatory technique leads to a reconstruction operator with several desirable features. First, each polynomial piece is constructed with a fixed centered stencil of 4 points. Second, the reconstruction is as accurate as its linear equivalent on smooth regions. Third, the accuracy is reduced close to singularities, but it is not completely lost as in its linear counterpart. In particular, the classical Gibbs phenomena of linear approximation is reduced. The details can be found in [3].

In this paper we are interested in a setting more adapted to image applications as it is the cell-average framework. Our aim is to apply this framework to the interpolation of images. The goal is to reduce the numerical artifacts introduced

* Corresponding author.
E-mail addresses: sergio.amat@upct.es (S. Amat), juan.ruiza@uah.es (J. Ruiz), jctrillo@upct.es (J.C. Trillo).
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