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A One Dimensional Approach to Control Grid Interpolation

Image upscaling through pixel interpolation is used in many different fields to create high resolution images from low resolution images that are not riddled with jagged edges or excessive blurriness. Image resolution limits the extent to which zooming enhances clarity, restricts the quality of digital photograph enlargements, and, in the context of medical images, can prevent a correct diagnosis. Interpolation can artificially increase image resolution but is generally limited in terms of enhancing image clarity or revealing higher frequency content. Algorithmic designs must balance qualitative improvements, accuracy, artifacts, and complexity for the desired application. Edge fidelity is one of the most critical components of subjective image quality, and a number of edge-preserving and edge directed interpolation methods have achieved varying degrees of success. However many of the algorithms that achieve good results, are also computationally expensive and time consuming. There is a need for an algorithm that can achieve good clarity, as well as be computationally efficient.

To address these issues, researchers at Arizona State University introduce a new image resizing algorithm based off of the principles of optical flow as utilized for inter-frame (video) interpolation. The optical flow equation insists that for every pixel in a given video frame there exists an isointense pixel in adjacent frames. For video, this amounts to the assertion that subsequent frames are reconfigurations of the same pixels. The inventors apply the optical flow equation to the adjacent rows and columns of single images. The physical basis for optical flow in video (objects are moving) is void in the static image application. However, the use of the optical flow equation in our implementation results in a method superior to the traditional bilinear and bicubic interpolators and competitive with NEDI and iNEDI and at much faster speeds and arbitrary scaling factors.

Potential Applications

- Medical imaging
- Image viewing and processing software
- Photographic printing
- Computer graphics

Benefits and Advantages

- High fidelity of images
- Faster processing with less computational overhead.
- An 8x expansion of an image took 235 times longer using a conventional method than the proposed method
- A 2x expansion of an image took 100 times longer using a conventional method than the proposed method
- Accommodates arbitrary scaling factors