

论文与报告

基于四元数分数阶方向微分的图像增强

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摘要

根据已有的四元数和分数阶微分的知识, 以及它们在现代信号处理中的应用, 推导出一种新知识: 四元数分数阶方向微分, 并将其应用于图像增强. 该方法首先将一幅彩色图像用一个四元数函数表示, 给出四元数函数的分数阶方向微分的定义和计算方法, 继而推导出沿八个方向的四元数分数阶方向导数的数值计算模板, 并根据八个方向的分数阶导数求出图像平面中各点的四元数分数阶方向微分的矩的最大值, 以该最大值代替该点的像素值, 从而得到增强后的图像. 实验结果表明, 该方法应用于图像增强能使图像边缘明显突出、纹理更加清晰和图像平滑区域信息得以非线性保留, 其视觉效果明显优于传统的微分锐化方法.

关键词 [四元数](#) [分数阶微分](#) [四元数分数阶方向微分](#) [分数阶驻点](#) [灰度投影](#)

分类号

Image Enhancement Based on Quaternion Fractional Directional Differentiation

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Abstract

In this paper, according to the developed fractional differentiation and its applications in modern signal processing, we extend it to the quaternion body and put forward a novel concept: quaternion fractional directional differentiation, for image enhancement. We first use a quaternion function to color image and give the definition and calculation method of the quaternion fractional directional derivative. Then, we deduce their numerical calculation templates along eight directions. According to the fractional directional differentiation along the eight directions, the maximum of the norm of quaternion fractional directional differentiation for every point in the image plane is found, then this maximum as the pixel value of this point is viewed, and the enhanced image is obtained. Experimental results show that our method can greatly increase high frequency, reinforce medium frequency, and non-linearly preserve low frequency of signals, hence it is superior to those based on the traditional methods of differentiation in visual effects.

Key words [Quaternion](#) [fractional differentiation](#) [quaternion fractional directional differentiation](#) [fractional stationary point](#) [gray projection](#)

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