Application Research of Image Imaging Based On Differential Equation

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Abstract: In the traditional calculus defect pattern, puts forward the research image of calculus. Through theoretical analysis and experiment, the study is more accurate than the traditional, more clearly.

Keywords: Image Feature,Evolution,Penalty Function,Gradient Modulus

1. Introduction

The image processing technology of partial differential equations is the earliest to have originated in NagaoRudi research on image smoothing and image enhancement based on the development of milepost partial differential equations are attributed to Koenderink and Witkin will be the concept of scale space into partial differential equations, Koenderink and Within pointed out that the multi-scale expression of image filtering is obtained by Gauss in the heat conduction equation of isotropic diffusion, according to this theory, the research based on partial differential equations has opened a new chapter in image processing based on partial differential equations including: image reconstruction, image segmentation, medical image processing, image edge extraction.

In recent years, the image processing technology based on partial differential equation (PDE) is an important branch in the field of image processing, which has attracted the attention of related fields. Since 1992, Rudin and Nagao have begun to study image smoothing and image enhancement[1-3]. At the same time, Koenderink and Witkin have explored the scale space and the image structure in the field of image processing, and have made a breakthrough progress. Later, Hummel found that the parabolic partial differential equation in scale space can be established by thermal diffusion equation, and the evolution equation in order to satisfy the maximum principle can be completed by defining a scale space [4-5]. Other branches of higher mathematics and image processing, such as mathematical morphology, image horizontal line and image shape, provide a useful theoretical basis for the development of the new method. Among them, image filtering and image segmentation in image processing become the direct conditions for the formation of this subject.

2. Partial Differential Equation Theory

The definition of partial differential equations in the field of mathematics is the equation involving partial derivatives of unknown functions. When the equation in the practical application, not only with the field of physics, but also many practical problems with mathematics are closely related to the equation, these practical problems are abstracted, and obtained the mathematical model, according to the different purposes of using different models, we can achieve the desired results. Because the equation solves the problem mainly from physics, it is also called mathematical physics equation. Many branches of physics and mathematics have been used in the theory of partial differential equations due to the increasingly close relationship between various disciplines.

The image processing algorithms of partial differential equations also have some disadvantages, such as large amount of calculation, manual adjustment of parameters and so on. The partial differential equation to the local adaptive, standardization, flexibility and other advantages in the field of image processing including segmentation, enhancement, registration, fusion, denoising method has been widely used in image processing model of partial differential equations can be divided into three categories: (1) based on the anisotropic diffusion equation method, one of the most famous the P equation is a M equation, such processing based on partial differential equation model is mainly based on image processing to determine the diffusion and diffusion direction of partial differential equations. (2) based on the model of energy universal function, the extreme value is obtained by establishing the energy functional, so as to achieve the goal. (3) the geometric description method is mainly used to model the evolution of curves and surfaces in images.

3. Numerical Calculation of Partial Differential

There are many ways to solve partial differential equations, and the most common methods including finite difference method, finite element method, finite volume method, finite difference method, the program is simple, less calculation, but poor applicability, the main idea of this method is by using the differential equation to solve differential equations for the approximation the finite

element method, although strong applicability, but the procedure is complex, large amount of calculation, finite volume method between somewhere in the image field, the general PDE equations were solved by a finite difference method. The commonly used finite difference forms include:

First order forward difference:

$$a(l,j,r)=\frac{el}{er}=\frac{\Delta l}{\Delta r},b(l,j,r)=\frac{dj}{dr}=\frac{\square l}{\Delta r}$$

Two order backward difference:

$$w(l+\Delta l,j+\square j,r+\Delta r)$$

First order central difference:

$$a(l,j,r)=\frac{el}{er}=\frac{\Delta l}{\Delta r},b(l,j,r)=\frac{dj}{dr}=\frac{\square l}{\Delta r}$$

4. Anisotropic Registration Model based on Partial Differential

Image registration and segmentation are two basic tasks in the project, and has been researched separatelyas two separate problems for a long time, Bansal, Yezzi and other researchers noted that the registration process and image segmentation process can utilize each other and promote, and proposed coupled model which combined registration and segmentation.The basic idea is: to take full advantage of the two images on the evolution curve shape similarity to achieve mutual promotion registration and segmentation, which is shown in Figure 1. On one hand, the similarity of target curve shapes on two images promote the changes of displacement field; on the other hand, action on the evolution curve in reference map through displacement field to facilitate the evolution of the curve in the figure.

Figure.1. Registration Divides Heterosexual Registration Model.

Differential optical flow field basic model is constituted by data item and regular item, the improvements of this article include: structure anisotropic regularization term in order to maintain the discontinuity of the image, protect the information on the edge of the image, and use of non-quadratic penalty function to enhance the strength of the model.

Noise problem is an important issue in image processing, although do Gaussian convolution towards data item can eliminate noise, but it will also cause image blur, in order to let the data item be able to protect the edges of the image while de-noising, this paper constraints the data item of two sub-type form, it means data item is defined as non-quadratic penalty function of constant constraint, and requires the penalty function has the ability to accelerate the smooth of continuous area, and the smooth of heterogeneous discontinuous region, therefore, this article a select nonlinear total variation model which has good well-posedness.

$$\ell\left(e^2\right)=\ell e^2+(1-\ell)\wp^2\sqrt{1+e^2/\wp^2},(0\prec\ell\le 1,\wp\succ 0) \quad (1)$$

The above penalty function operate on data item, we can get the following data item of non-second penalty form

$$a(l,j,r)=\psi\left(\left(\Delta wa+w_r\right)^2\right) \quad (2)$$

5. Conclusion

In recent years, the study of calculus has become the current hot. Based on the fuzzy image defects, theory and application of differential equations is studied. Through the data and image forming experiment show that this research has practical value.

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