算法研究

一种新的基于CV模型的图像分割算法

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摘要：

CV模型是一种重要的图像分割模型，本文针对其收敛速度慢、效率低的缺点提出一种求解CV模型的新方法。首先将CV模型的能量泛函改写成与原来有相同稳定解的总变分公式形式，然后使用对偶公式法求总变分公式的极小值，再在其中引入一速度项以加快模型的收敛速度。新方法一方面克服了梯度下降法要求时间步长小、迭代次数多的缺点，经过较少次的迭代就能收敛，减少了迭代计算的次数；另一方面，引入的速度项能够减少每次迭代的时间，从而缩短求解模型的时间。速度项的引入同时减少了对梯度的依赖，增强了抗噪性。另外，可以通过调节速度项得到不同数目的同质区域，以适应相同图像不同分割任务的需求。实验结果表明本文方法是有效的。

关键词： CV模型；水平集；总变分；对偶公式

A New Algorithm for Image Segmentation Base On CV Model

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Abstract:

The active contour model without edges (CV model) is one of the most successful variational models in image segmentation. The paper proposes a new method to improve the efficiency of CV model. Firstly, the energy function of CV model is substituted by the form of total variation which has the same stable solution with the original model. Secondly, the dual method is used to solve the minimal value of the total variation formulation. At the same time, a speed term is introduced to improve the convergence speed. The speed term can reduce the reliance on gradient and improve the robust. The new method can get different segmentation results from same image by changing speed term. The first experiment solves the partial differential equations by the gradient descent method and the new method respectively, it shows that the proposed method is not only faster than gradient descent method , but also robust to noise with more integrated segmentation result and more smooth edges. The second experiment solve the partial differential equations by the new method but the speed term is different, it shows that the convergence speed is lower and the segmentation result has more homogeneity regions when the speed term is small. The experiments show that the propose method is effective and potent.

Keywords: CV model; level sets; total variation dual formulation

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