cases	doc_1		doc_2		decision	id
	authors	• Benninghoff, Heike • Garcke, Harald	**authors**	• Benninghoff, Heike • Garcke, Harald	NOT DUPLICATES	1125
	title	Segmentation and Restoration of Images on Surfaces by Parametric Active Contours with Topology Changes	**title**	Segmentation of Three-dimensional Images with Parametric Active Surfaces and Topology Changes		
	publication_date	2015-05-01 00:00:00	**publication_date**	2015-01-01 00:00:00		
	source	SupportedSources.CORE	**source**	SupportedSources.CORE		
	journal	None	**journal**			
	volume		**volume**			
	doi	10.1007/s10851-015-0616-6	**doi**	None		
	urls	• http://arxiv.org/abs/1505.00193	**urls**	• https://core.ac.uk/download/33181648.pdf		
	id	id-6086060461736686044	**id**	id1250016016811203770		
	abstract	In this article, a new method for segmentation and restoration of images on two-dimensional surfaces is given. Active contour models for image segmentation are extended to images on surfaces. The evolving curves on the surfaces are mathematically described using a parametric approach. For image restoration, a diffusion equation with Neumann boundary conditions is solved in a postprocessing step in the individual regions. Numerical schemes are presented which allow to efficiently compute segmentations and denoised versions of images on surfaces. Also topology changes of the evolving curves are detected and performed using a fast sub-routine. Finally, several experiments are presented where the developed methods are applied on different artificial and real images defined on different surfaces	**abstract**	In this paper, we introduce a novel parametric method for segmentation of three-dimensional images. We consider a piecewise constant version of the Mumford-Shah and the Chan-Vese functionals and perform a region-based segmentation of 3D image data. An evolution law is derived from energy minimization problems which push the surfaces to the boundaries of 3D objects in the image. We propose a parametric scheme which describes the evolution of parametric surfaces. An efficient finite element scheme is proposed for a numerical approximation of the evolution equations. Since standard parametric methods cannot handle topology changes automatically, an efficient method is presented to detect, identify and perform changes in the topology of the surfaces. One main focus of this paper are the algorithmic details to handle topology changes like splitting and merging of surfaces and change of the genus of a surface. Different artificial images are studied to demonstrate the ability to detect the different types of topology changes. Finally, the parametric method is applied to segmentation of medical 3D images		
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