Higher Order Active Contours - the `Gas of Circles' Shape Prior

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Short description: The `gas of circles' (GOC) model is a tool to describe a set of circles with an approximately fixed radius. The model is based on the higher-order active contour (HOAC) framework. The method has been succesfully applied to tree crown extraction on aerial images.

Description:  
The ‘gas of circles’ (GOC) model is a tool to describe a set of circles with an approximately fixed radius. The model is based on the recently introduced ‘higher-order active contour’ (HOAC) framework. For certain ranges of the HOAC parameters, the model creates stable circles with an approximately fixed radius instead of networks. The general ‘gas of circles’ model has many potential applications in varied domains, but it suffers from a drawback: the local minima corresponding to circles can trap the gradient descent algorithm, thus producing phantom circles even with no supporting data. We solved the problem of phantom circles by calculating, via a Taylor expansion of the energy, parameter values that make the circles into inflection points rather than minima. We developed an alternative formulation of the ‘gas of circles’, based on the ‘phase field’ framework. We address the tree crown extraction problem by constructing a phase field model of a ‘gas of circles’. The images we used are color-infrared (CIR) and panchromatic images. We introduced two data models. The first describes the use of only one band of the three available bands. The model is based on the image gradient and on Gaussian distributions. Our second data model makes use of all three bands in the CIR images. Experiments show that the models outperform other traditional methods. The models can also be applied to the detection of other circular objects, e.g. in biology, nano-technology, medical imaging, teledetection.

Results

Tree crown extraction on aerial images

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