Duan, Yuping; Tai, Xue-Cheng: Domain decomposition methods with graph cuts algorithms for total variation minimization

Abstract: Recently, graph cuts algorithms have been used to solve variational image restoration problems, especially for noise removal and segmentation. Compared to time-marching PDE methods, graph cuts based methods are more efficient and able to obtain the global minimizer. However, for high resolution and large-scale images, the cost of both memory and computational time increases dramatically. In this paper, we combine the domain decomposition method and the graph cuts algorithm for solving the total variation minimizations with $L(1)$ and $L(2)$ fidelity term. Numerous numerical experiments on large-scale data demonstrate the proposed algorithm yield good results in terms of computational time and memory usage. ADVANCES IN COMPUTATIONAL MATHEMATICS, 36 (2), 175-199, FEB 2012

Shi, Yuying; Wang, Li-Lian; Tai, Xue-Cheng: Geometry of total variation regularized L-p-model

Abstract: In this paper, the geometry and scale selection properties of the total variation (TV) regularized LP-model are rigorously analyzed. Some intrinsic features different from the TV-L-1 model are derived and demonstrated. Numerical algorithms based on recent developed augmented Lagrangian methods are implemented and numerical results consistent with the theoretical results are provided. JOURNAL OF COMPUTATIONAL AND APPLIED MATHEMATICS, 236 (8), 2223-2234, FEB 2012.

Franz, Trenton E; Caylor, Kelly K.; King, Elizabeth G.; Nordbotten, Jan M.; Celia, Michael A.; Rodriguez-Iturbe, Ignacio: An ecohydrological approach to predicting hillslope-scale vegetation patterns in dryland ecosystems

Abstract: Drylands are an important ecosystem, as they cover over 40% of the Earth’s land surface and are believed to be sensitive to climate change. Where dryland vegetation supports pastoralist livestock production, catastrophic ecological shifts present a grave concern because of the direct coupling between the quality of available forage and human livelihoods. In this research we investigate the organization of vegetation on hillslopes by
developing a relatively simple spatially explicit daily stochastic ecohydrological model. Using a 2 year observational study in central Kenya, we present an empirical patch water balance of three representative patch types, bare soil, grass, and tree. Given the recent expansion of bare areas, the system is dominated by Hortonian runoff and overland flow. By incorporating concepts of simple local interactions from complex systems we are able to simulate a range of surface flowpath convergence states across the hillslope during a rain event. The model also allows the root to canopy radius of the tree patches to vary affecting the length scale of water competition. By changing the length scales of facilitation and competition, the model demonstrates a range of most efficient hillslope water-use patterns from random to highly organized static vegetation patterns. The findings of this work support the mechanism of symmetry-breaking instabilities for pattern formation in drylands. WATER RESOURCES RESEARCH (48), Article Number: W01515, JAN 18 2012.