VLZ 10 prof. James Damon

3. "Using Scale for the Problems of Discreteness and Noise in Images"

In computer imaging, our idealized view of images as formed from objects with differentiable boundaries differs from actual images which are defined by color or grayscale functions which in reality are discrete and contain noise. As such they are realistically modelled by nondifferentiable even noncontinuous functions (or even measures). Nonetheless we still wish to obtain geometric features from such images. The introduction of scale in computer imaging has developed over the past twenty years to deal with these issues, extracting geometric properties of discrete objects in the presence of noise. Scale is introduced by classical PDE methods or by convolution with various kernels. We explain how scale allows for the applications of methods of singularity theory and geometry for smooth functions, but applied to objects defined discretely, by working in scale space and determining the resulting geometric properties that such objects then have. This involves an application of an extension of the Thom transversality theorem and other basic theorems of singularity theory to various subspaces of mappings. How exactly I will distribute the lecture time among the three topics I still have to work out. Depending on participants interests, I could replace one of these topics by an alternative talk 4) on recent results on the topology of matrix singularities.

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