Catherine Lichten

Title of Poster Presentation: An Application of the Geometric Heat Equation for Rapid Edge Detection

Abstract:
In recent years, the application of differential equations to image processing has undergone significant growth, leading to a number of results related to image analysis, processing and comparison, and computer vision. Our goal is to develop an edge detection approach capable of providing large capture range and dealing with images of different sizes. We begin with a convex, smooth, closed curve, C(t,p) = C[x(t,p), y(t,p)], where t parameterizes the family of curves and p parameterizes each particular curve. We base our model on the geometric heat equation, dC/dt= KN, where N denotes the normal vector and K is curvature. If N is the inward normal, the curve shrinks and if it is the outward normal, the curve enlarges in the direction of the normal vector. A penalty function is used in our model to detect the presence of objects, control the curve,s evolvement, and segment the image if more than one object is encountered. On the basis of the model, we developed an algorithm applying finite differences. Using Mathematica, we created a tool capable of detecting the edges of multiple objects located in an image. Our algorithm is advantageous in that it has low run-time, large capture range, and requires no prior knowledge of the image. Also, it can detect one or multiple objects, with varying size and position in the image (although there are certain object relations that the model cannot yet resolve). So far, the method has been applied to black and white images but could be adapted to gray level images as well. Research is underway to analyze the algorithm's stability and to improve the model so that the tool fully detects all boundary concavities, object holes, and object relations.