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| Title: | Shape Backprojection In 3D Scenes |
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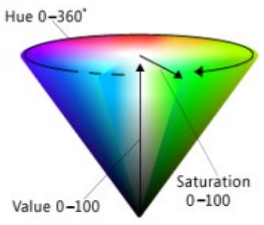
| Keyword(s): | Depth<br>backprojection<br>random forest, robotics |
| Subject(s): | Computer Vision<br>Robotics |


Abstract: For segmentation of 3D surfaces, there are a variety of methods but they take very high computation time for a large number of points in a 3D scene. Till date there are no robust solutions for edge detection in 3D scenes having unorganized data structure. Taking inspiration from color backprojection, we present an algorithm which solves multiple kinds of problem in single computation and takes very less computation time compared to previous algorithms. The algorithm takes 3D point cloud as input and computes histograms of local 3D shape of the point cloud. It captures the local 3D surface variations. This histogram is back projected in a test scene cloud and the probability is used to take decisions for various problems. If surface segmentation is required, the histogram of planar surface is backprojected. If edges are to be detected, histogram is backprojected but for smaller radii. It can also be used in 3D feature based object recognition. A fuzzy color shade adaptive histogram is introduced to capture the color information of the object in photopic(color histogram) and scotopic(gray scale shades) histograms. The algorithm automatically decides, which histogram to be used for binning and backprojection. It can be used alongwith shape backprojection to im- prove surface segmentation. Based on the informations in shape and fuzzy color shade adpative histogram, a feature of dimension 37x1 is also part of the thesis, which is used to classify point clouds. For classi fication random forest is used.


(a) Conical HSV model

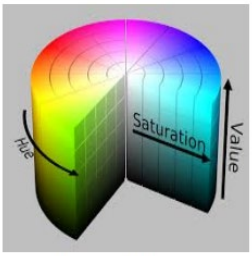
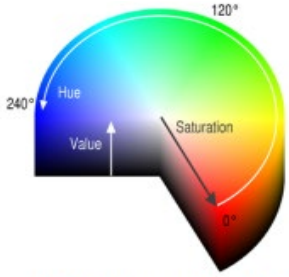



Figure 3.2: HSV model




(b) Cylindrical HSV model

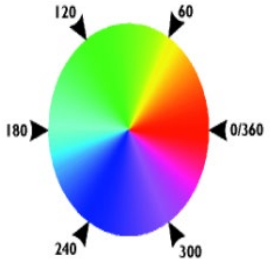



Figure 3.4: Hue component in HSV space visualization

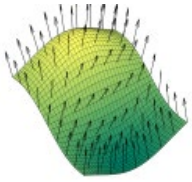
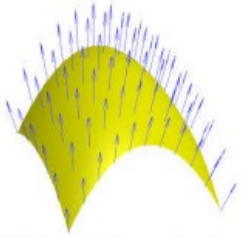
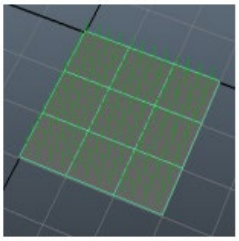


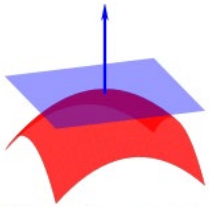
Figure 2.1: Surface normals



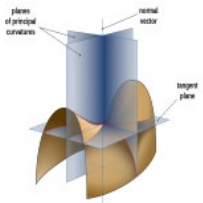
(a) Normals of a curved surface



(b) Normals of a planar surface



(a) Tangent plane a point on surface



(b) Principle Curvature planes of a surface


Figure 1.3: SIFT object detection

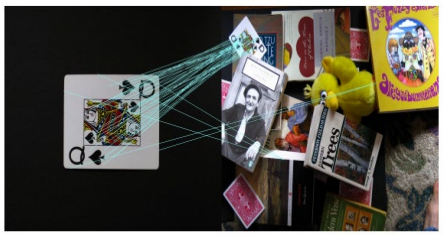


Figure 1.2: SIFT object detection


Figure 1.1: SIFT object detection