ABSTRACT

It has been observed from the past work that the hierarchical representation schemes (such as quadtree in 2D and octree in 3D) are used extensively for representing binary objects in different applications. They are compact and suitable for boolean operations. It is observed that little work has been done on MCR and MSR representations. The reason for apathy of the earlier researchers may be noted:

1. MCR/MSR (without proper encoding) are not as compact (storage efficient) as hierarchical coding schemes such as quadtree/octree for representing binary images.
2. In MCR/MSR, the primitives, circles/spheres overlap while covering the entire image. Hence, they are not directly usable in set operations such as union and intersection of two objects as well as in the computation of area, perimeter, volume etc,.

But, the above deficiencies notwithstanding, MCR/MSR can be used with positive benefit in other types of computations such as geometric transformation, computation of cross-section (in 3D) and computation of normals at boundary points (in 2D) and shading of 3D objects. This is possible because MCR/MSR representation is the union of medial circles/spheres with an underlying well defined geometry. Further, the geometry of those medial circles/spheres can also be controlled (suited to particular application) by using different kinds of metric (such as digital octagonal metric). As the binary object is represented in discrete (digital) space, use of digital metric enhances the computation speed as well as the quality of the result.

In this work, MCR/MSR has been studied for different aspects and their use in different kinds of computations like linear transformation, cross-sectioning in 3D images and normal computations at the boundary points in 2D images. Firstly, digital distances and digital spheres are studied for their use in MCR/MSR. Next the compactness (storage efficiency) of the representation has also been explored to get the maximum benefit out of it. Finally, the advantage of using MCR/MSR over different representation schemes in computation of geometric transformation, cross-section of 3D objects, normals at boundary points and discrete shading have also been highlighted in this thesis.