ABSTRACT

Topology is one of the most important fields in Mathematics which studies the properties of spaces that are invariant under continuous deformation. The topological notions like open, closed, frontier, connectedness, boundary etc. are closely related to the field of Image Analysis. To apply all these topological notions in the field of Image Analysis, Rosenfeld introduced the notion of 'Digital Topology' and he represented a digital image as a neighborhood graph whose nodes are pixels and whose edges are linking adjacent pixels to each other. Though this representation is very much useful for the study of images, it contains two paradoxes namely connectivity and boundary paradoxes. To overcome these difficulties, Kovalevsky initiated a new concept namely 'Abstract Cellular Complex' and established that every Abstract Cellular Complex is isomorphic to Finite Topological Spaces with T_0-Separation Axiom. This motivates us to study various topological notions on Abstract Cellular Complex. Levine introduced the concepts of semi-open set and semi-continuity in Topological spaces and studied some of their properties. Mashhour et al. introduced the notion of pre-open sets and pre-continuous functions in Topological spaces.

This thesis is mainly focuses on the concept of semi-open subcomplexes in Abstract cellular complex and investigates some of their basic properties through semi-frontier, semi-interior and semi-closure. Further, the concept of semi-neighborhoods, local semi-neighborhood, semi-continuous and semi-homeomorphism are introduced. Kovalevsky's Chain code algorithm to trace the boundary of an object in an image is compared with Moore's Neighborhood algorithm. Moreover, the boundary tracing algorithm using semi-subcomplex is proposed and the proposed algorithm is compared with Kovalevsky's chain code algorithm. Further, spatial filters using the notions of abstract cellular complex are introduced for denoising the

images. Finally, the concept of pre-open subcomplex in Abstract cellular complex is introduced and their basic properties are discussed.

In Chapter 2, the concept of semi-open subcomplex in Abstract Cellular Complex is introduced and some of its basic properties are discussed. The concepts of semi-frontier, semi-interior and semi-closure are introduced and some of their fundamental properties are discussed. Further, the notion of semi-open subcomplex is extended to higher dimensions and the relationship between semi-open subcomplexes and homogeneously n-dimensional subcomplexes are established. Finally, the concepts of quasi- solid and semi-region subcomplexes are introduced.

In Chapter 3, the concept of semi-neighborhoods and local semi-neighborhoods in abstract cellular complex are introduced and some of their basic properties are studied.Further, the notion of semi-homeomorphism and strictly semi-homeomorphism in abstract cellular complex are introduced and some of their basic properties are investigated. The semi-separation axiom in abstract cellular complex is initiated and is characterized using semi-open subcomplexes.

In Chapter 4,the procedure for representing the digital image as a two dimensional abstract cellular complex is presented. The Kovalevsky's chain code algorithm to trace the boundary of an object in an image is discussed and is compared with Moore's neighborhood algorithm. Further,the boundary tracing algorithm using semi-subcomplexes is proposed and the proposed algorithm is compared with Kovalevsky's chain code algorithm.

In Chapter 5, the procedure of designing window of different sizes used in the filtering techniques using notions of abstract cellular complex is discussed. The Mean filter and Median filters in ACC for denoising the images are developed. Further, the proposed filters are implemented through

MATLAB and are compared with standard Mean and Median filters by denoising various noise images.

In Chapter 6, the notion of pre-open subcomplex in abstract cellular complex is introduced and some of its basic properties are studied by using the notions of pre-frontier, pre-interior and pre-closure. Further, the notion of pre-open subcomplex is extended to higher dimensions and the notions of pre-neighborhoods and pre-continuous map in ACC are introduced. Finally, the pre-open subcomplex is compared with other subcomplexes and the relationship between them are studied through various notions.