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## **A New Algorithm for Calculating Homology Groups of Two-dimensional Digital Images and Its Implementation in a Computer Environment**

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The Digital Topology is a sub branch of mathematics that rapidly developing since late of 1980. Basically Digital Topology perceived as making simulations of concepts in algebraic topology for digital images. In Digital Topology studies, it is aimed to obtain invariant for digital images. Homotopy and Homology groups are seen as fundamental invariant. Computation of Homotopy groups of digital images is very difficult. The calculation of homology groups is relatively easy and efficient. Therefore, homology groups are vital for determine the characteristics of digital images and able to distinguish between them. Digital homology groups were built on digital simplicial complexes. Calculation of homology groups of digital images has an important place in the digital topology. Although, there are many theoretical studies on the homology groups of the digital images in the literature but, yet not available to a robust computer algorithms. This study is targeted primarily to put forward the algorithm for calculating the homology groups of digital images. Then, this algorithm was realized in computer environment. C ++ is preferred as a programming language in transferring the algorithm to the computer environment. The application was done using sample images. Homology groups of previously defined digital simple closed curves and some other basic images were calculated. By calculating homology groups of more complex digital images, the power and effectiveness of the algorithm is observed. Analysis was done using application findings. In addition, two new adjacency relations for two-dimensional digital images are proposed in this study. According to this relation, simple digital closed curves were formed and the homology groups were examined and paralleled with others. It is envisaged that these adjacency relations will contribute to the solution of some problems and to the increase of the efficiency of the homology groups.