Jordan Curves in the Digital Plane with Respect to the Connectednesses given by Certain Adjacency Graphs

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Abstract : Digital images are approximations of real ones and, therefore, to be able to study them, we need the digital plane Z2 to be equipped with a convenient structure that behaves analogously to the Euclidean topology on the real plane. In particular, it is required that such a structure allows for a digital analogue of the Jordan curve theorem. We introduce certain adjacency graphs on the digital plane and prove digital Jordan curves for them thus showing that the graphs provide convenient structures on Z2 for the study and processing of digital images. Further convenient structures including the wellknown Khalimsky and Marcus-Wyse adjacency graphs may be obtained as quotients of the graphs introduced. Since digital Jordan curves represent borders of objects in digital images, the adjacency graphs discussed may be used as background structures on the digital plane for solving the problems of digital image processing that are closely related to borders like border detection, contour filling, pattern recognition, thinning, etc.