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Ortho-radial Drawing in Near-linear Time

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Abstract: An orthogonal drawing is an embedding of a plane graph into a grid. In a seminal work of Tamassia (SIAM Journal on Computing, 1987), a simple combinatorial characterization of angle assignments that can be realized as bend-free orthogonal drawings was established, thereby allowing an orthogonal drawing to be combinatorially by listing the angles of all corners. The characterization reduces the need to consider certain geometric aspects, such as edge lengths and vertex coordinates, and simplifies the task of graph drawing algorithm design.

Barth, Niedermann, Rutter, and Wolf (SoCG, 2017) established an analogous combinatorial characterization for ortho-radial drawings, which are a generalization of orthogonal drawings to cylindrical grids. The proof of the characterization is existential and does not result in an efficient algorithm. Niedermann, Rutter, and Wolf (SoCG, 2019) later addressed this issue by developing quadratic-time algorithms for both testing the realizability of a given angle assignment as an ortho-radial drawing without bends and constructing such a drawing.

In this paper, we take it a step further by improving the time complexity of these tasks to near-linear time. We prove a new characterization for ortho-radial drawings based on the concept of a good sequence, which enables us to construct an ortho-radial drawing through a simple greedy algorithm.

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