

Morphogenesis as an Amorphous Computation

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Abstract:

In this paper, we present a programming language viewpoint for morphogenesis, the process of shape formation during embryological development. Specifically, we model morphogenesis as a self-organizing, self-repairing amorphous computation and describe a framework through which we can program such large-scale shape formation by giving local instructions to cell-like objects. Then, using this programmatic perspective, we specify some example developmental processes and discuss the characteristics that make them suitable candidates for evolutionary variation and selection. Consistent with the theory of facilitated variation from evolutionary biology, we find that variation in developmental processes can be introduced and conserved due to the hierarchical organization of growth specification.