Long running times for hypergraph bootstrap percolation

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Consider the hypergraph bootstrap percolation process in which, given a fixed r-uniform hypergraph H and starting with a given hypergraph G_0, at each step we add to G_0 all edges that create a new copy of H. We are interested in maximising the number of steps that this process takes before it stabilises. For the case where $H = K_{r+1}^{(r)}$ with $r \geq 3$, we provide a new construction for G_0 that shows that the number of steps of this process can be of order $\Theta(n^r)$. This answers a recent question of Noel and Ranganathan. To demonstrate that different running times can occur, we also prove that, if H is $K_4^{(3)}$ minus an edge, then the maximum possible running time is $2n - \lfloor \log_2(n-2) \rfloor - 6$. However, if H is $K_5^{(3)}$ minus an edge, then the process can run for $\Theta(n^3)$ steps.

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