The path opening is a filter that preserves bright regions in the image in which a path of a certain length L fits. A path is a (not necessarily straight) line defined by a specific adjacency relation. The most efficient implementation known scales as O(min(L, d, Q)N) with the length of the path, L, the maximum possible path length, d, the number of graylevels, Q, and the image size, N. An approximation exists (parsimonious path opening) that has an execution time independent of path length. This is achieved by preselecting paths, and applying 1D openings along these paths. However, the preselected paths can miss important structures, as described by its authors. Here, we propose a different approximation, in which we preselect paths using a grayvalue skeleton. The skeleton follows all ridges in the image, meaning that no important line structures will be missed. An H-minima transform simplifies the image to reduce the number of branches in the skeleton. A graph-based version of the traditional path opening operates only on the pixels in the skeleton, yielding speedups up to one order of magnitude, depending on image size and filter parameters. The edges of the graph are weighted in order to minimize bias. Experiments show that the proposed algorithm scales linearly with image size, and that it is often slightly faster for longer paths than for shorter paths. The algorithm also yields the most accurate results- as compared with a number of path opening variants-when measuring length distributions.