Computational Geometry for Fat Objects and Low-Density Scenes

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In a traditional efficiency analysis in algorithms research, one studies the worst-case running time (or storage usage) of an algorithm as a function of the input size. In many cases such an analysis gives a good indication of the algorithm's efficiency in practice, because the worst-case behavior and the "normal" behavior are fairly similar. For geometric algorithms, however, this is often not the case: the worst-case behavior of a geometric algorithm may have little relation to its efficiency in practice. The main reason is that the worst-case behavior typically arises only for inputs with objects whose shapes or distribution over the space are quite extreme—much more extreme than occurs in practice. The conclusion is that expressing the efficiency of a geometric algorithm as a function of input size only is insufficient. What we need is a *geometry-sensitive analysis*, which also takes the shape and/or distribution of the input objects into account. In other words, we need to express the efficiency as a function of not only the input size, but also of certain parameters that capture the shape or distribution of the input.

This insight not only influences the way in which we should analyze geometric algorithms, it also has an impact on the design of algorithms: we need to design algorithms that become more efficient when the geometry-describing parameters have favorable values. Over the past 15 years or so, many such algorithms have been developed. Most of these either use the *fatness* of the input objects as a parameter, or their *density*. The former parameter says something about the shape of the individual objects, while the latter is concerned with their distribution over the space. In this talk I will give an overview of the results that have been obtained in this area.

This is an extended abstract of a presentation given at EuroCG 2011. It has been made public for the benefit of the community and should be considered a preprint rather than a formally reviewed paper. Thus, this work is expected to appear in a conference with formal proceedings and/or in a journal.