Catalytic computation

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How much space (memory) does one need to solve a system of linear equations, reachability on a directed graph or satisfiability of a Boolean formula? We do not know a good answer to this question but our best algorithms for all of these problems require working memory of size at least linear – that is proportional to the number of variables of the system or the number of vertices in the graphs. Can we do better?

In this talk I will show that under some circumstances you can do much better. We introduce the concept of catalytic computation where we allow the algorithm to use memory that is occupied by data of someone else under the promise that our algorithm does not destroy the data. We show that such catalytic memory can be useful. This is somewhat counter-intuitive as the foreign data might be entirely incompressible and one cannot erase them. Currently, we know just few algorithmic techniques that can take advantage of the catalytic memory. It is an intriguing open problem to devise more such techniques and establish exact bounds on the extra power provided by the catalytic memory.