Optimization by Controlling Self-Optimizing Measurements

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The optimization approach presented in this paper is inspired from the idea of feedback control, where a controller manipulates one input in such a way that another variable is kept at its pre-specified setpoint in spite of disturbances.

In an optimization context, this means that we want to find variables, which give optimal operation when kept constant. Thus, instead of focusing on finding the right input variables to a process, we present how to find the right output variables, which guarantee optimal or near-optimal operation.

As an example consider a marathon runner. The objective is to run the marathon in minimum time. A simple strategy would be to run with a constant speed, however this will hardly be optimal. A different strategy would be to use some model to find the optimal speed at each instant of the run. If a good model is available, this will be close to optimal, but relative complicated and little robust in practice. A better strategy which is in the spirit of this work is to run with a constant heart rate. When there are changes in the conditions, such as changing slope or winds, the runner will adjust optimally to the new situation. This strategy is easy to implement, while it is robust with respect to disturbances and will be close to the true optimum.

Thus, one may formulate the goal of our research as to find the "heart rate" of the process. We present some examples from chemical engineering e.g. heat exchanger networks, where this concept is applied successfully to optimize operation.