Towards Automation of "Normal Science" through Empirical Machines

Henrik Jacobsson & Tom Ziemke
School of Humanities and Informatics, University of Sk¨ovde,
{henrik.jacobsson,tom.ziemke}@his.se

Abstract
Several researchers have suggested that we should strive for creation of artificial scientists. It is well known that the development of scientific theories and models is strongly e_ected by the perceptual and conceptual limitation of human scientists. While some of these, e.g. perceptual limitations, can be overcome through the use of tools, e.g. microscopes, others might be better overcome by the complete automation of the scientific process. The scientific knowledge is also a convenient form of knowledge to study and may be more suitable starting point when developing artificial intelligence than "common sense knowledge". However, the ideas of "artificial scientists" are very seldomly accompanied with a concrete plan for how to do this in practice. As a first step we suggest to focus on simpler, computational domains, and on the purely empirical process of model building and observation. For these computational domains, it is much easier to create large numbers of new computational models and observations than to actually understand any of them, which suggests that there is a need for automating the analysis process. As an example, this is already beginning to be realised within the field of recurrent neural networks from which finite state automata are being extracted. This is perhaps also a good field to start with since these networks can be quite complex, and are a subclass of a wide set of input-driven dynamic systems. We propose that certain aspects of Kuhn's "Normal Science" could be automated with what could be called Empirical Machines which automatically build models of phenomena they are selected to analyse. These machines should be guided through sound scientific methodology, e.g. according to Popper's principle of falsifiability, and through the queries of (human) researchers. To start with computational modeling can be a feasible path towards artificial scientists.