# Learning-Capable Networks

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## Abstract

The configuration and operation of communication networks typically consists of a set of components and algorithms acting in a relatively small space of states, transitions and optimization steps. While this might seem effective at first sight, it leads to inflexibility with respect to the running environment. Indeed, routers are agnostic to traffic characteristics and to statistics of network failures. This situation occurs because these components and techniques have been developed in the early days of packet communication networks. At that time, computational and memory resources were scarce, and the resulting techniques needed to act sparingly with the available resources.

In the last decades, many techniques have been developed to enable computational processes to mine data-rich environments (data mining) and to model or learn new concepts and processes based on the interaction with their environment (machine learning or other learning paradigms). While many engineering disciplines, such as the automotive or bio-industry, have adopted these techniques to improve the performance of their operational processes, in computer networking, their application has been restricted mainly to passive applications, used as interesting side information in the context of network operation. They help network managers to understand and predict the behavior of their network.

The overall objective of learning-capable networks is to bring the application of data mining and learning techniques one step further: towards the active integration of these techniques into the operational processes of communication networks. Realization of this objective implies to specify a framework for a distributed closed-loop control process which adapts its decisions and tunes its executions from the interaction with its environment using learning techniques. In order to answer the above challenge, the first research goal is to formulate a distributed network architecture comprising modular, learning-capable routers which have only a local view of their environment.

Keywords : future internet, network control, routing, artificial intelligence.

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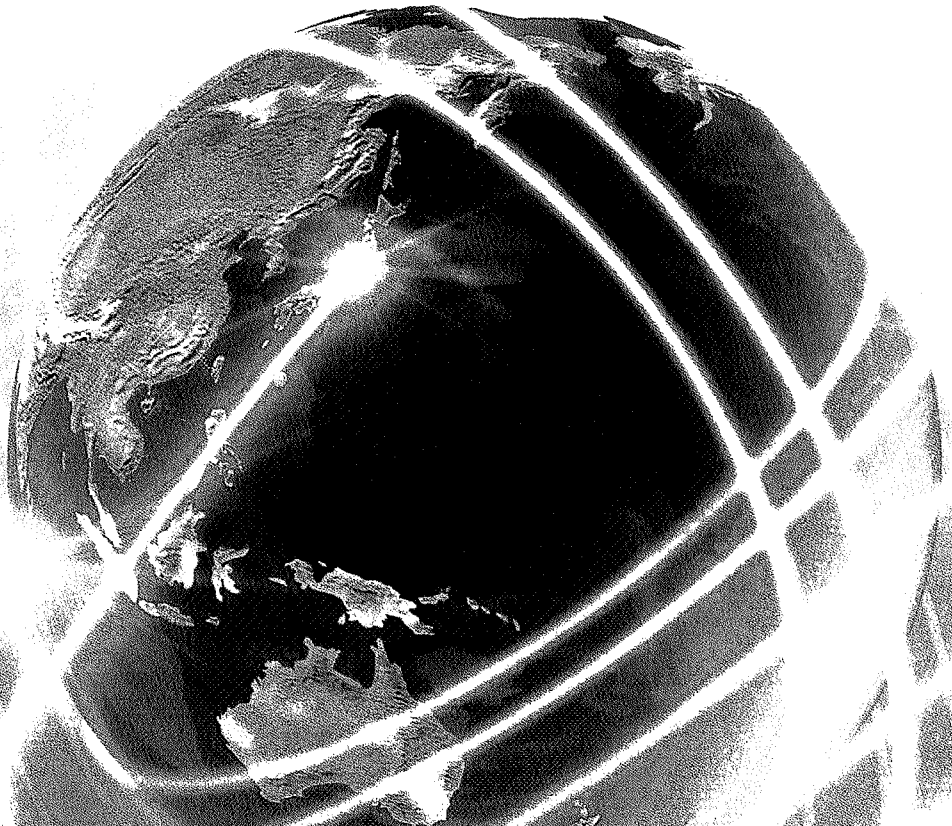

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