Forecasting and Deductive Systems

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Abstract

Let S(t) be the state of some time-dependent system S at time t. Furthermore, let S(t') be the possible state of the system S at time t', where t' > t. Such states are often characterized by some time-dependent numeric variable x(t) or vector $\langle x_1(t),x_2(t),\ldots,x_n(t)\rangle$. The task of prognosis can then be described as follows: when observing the time-dependent numerical variable x(t) or vector $\langle x_1(t),x_2(t),\ldots,x_n(t)\rangle$ we try to find the probability *p* that at time t' > t the variable has a specific value (see Murphy A.H. 1998, Gneiting T. 2009). It is also possible to characterize the described states with a list of conditions C(t) and C(t'), that are met by system S at time t and may meet at time t' > t. According to the principle of developments and deduction (see Lorents 2006) *it is probable that the system S moves from state S(t) to state S(t'), if the description C(t') of the possible state S(t') follows (logically) from the description C(t).* In such cases we can base the prognosis of states on the logical derivability of the descriptions of corresponding states

For example, if we are interested the decision that a certain individual or group will follow at some time, then we can search for the answer by collecting the available texts (discussion transcripts, interviews, written arguments etc.) that represent the reasoning of the individual or group (for example, by using E. Matsak's dialogue system DST, see Matsak 2005, 2009b) and

- find the basic arguments and principles (so called holy truths, situation assessments etc.),
- find the steps (inference rules) that are used to infer new arguments from existing arguments,
- find if the description of the possible state of interest can be inferred from the basic arguments.

Similar approaches are supported by the theory of deductive systems (see Maslov 1987). For example, one can predict how biological species (as an aggregation of living beings that represent a certain genetic code) evolve in the future:

Theorem (Maslov 1975). In evolution, every species will disappear with a probability of 1.

Maslov was able to use the deductive systems theory to describe the correlation between dominant reasoning mechanisms in the society and art – especially in architectural styles (for

example, an analysis of data from Russia since 1700 resulted in a correlation of 0.82, according to Kendall. See Maslov 1983, 1987).

Using methods that are suitable for describing discrete structures, Lukov and Sergejev (1983) were able to model the reasoning mechanism of Otto von Bismarck. The model was used on Bismarck's memoirs and the results were compared with the descriptions of historical events (for example, Bismarck's reasoning and decisions related to the proposal for weakening Bavaria in 1866 by the Duke of Baden).

As for the realization of deduction utilities, there have been interesting comparative studies on neural networks (see Vipan Kakkar 2009), specifically on software, as well as analog and digital circuits (for example efficiency, operating speed). Matsak (2009a), for example, has researched the realization of logic inference steps as digital circuits.

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