

# Principles of construction of inductive inference procedures

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**Abstract.** *Due to incompleteness of axiomatic-deductive approach is it shown that inductive mathematics is to be equally developed and applied in modern mathematics. Bayesian approach is the basis of construction of optimal procedure of inductive inference and inductive logic. Markov chains are the source of new important applications.*

## Keywords

Inductive procedures, polynomial estimate,  
non-stationary Markov chains

## Introduction

Gedel's incompleteness theorem proved that axiomatic and deduction couldn't be the only footing in mathematics. The inductive approach complements deductive one. The inductive model helps to study many real-world problems on the basis of a finite number of specific observations. Most important is the fact that the complexity of the inductive procedures proved to be solvable and formally evaluated as the polynomial estimate that depends on the sizes of learning sample and the number of attributes describing the investigated object. As opposed to quantum and DNA computing all calculations are realized on conventional computers. It is shown that the learning procedures based on Bayesian formula optimally process the information contained in the learning sample. This property is carried out on such mathematical structures as Markov chains and independent attributes. Thus, the inductive procedures are essentially polynomial.

The behavior of inductive inference procedures depending on the content of a learning sample is researched. It is shown that if a learning sample contains no information on some class of objects or statistical information on a priori probabilities of classes, any procedure works incalculably badly and its error is strictly positive.

The numerical results for predicting protein secondary structure based on Bayesian recognition procedures on non-stationary Markov chains are discussed. The complementary principles in encoding bases on one DNA chain are presented.

As a matter of fact these results demonstrate that induction and deduction are mutually complementary approaches in mathematics and develop further mathematics as an adequate formal language of the natural science.

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