Doctoral School of Information and Biomedical Technologies Polish Academy of Sciences

Subject
Strong law of large numbers for intuitionistic fuzzy random variables

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Project Description

The Kolmogorov version of the strong law of large numbers (SLLN) is one of the most fundamental and widely applied theorems in probability theory (see [1]). In particular, it is used in statistical inference for estimating a population mean from a simple random sample. It was also generalized to the cases where the considered random variables are not identically distributed, they are dependent or their first moments do not exist.

In many practical applications, one assumes that there are two main sources of uncertainty: randomness and imprecision. Imprecision is often modeled by fuzzy sets and their generalizations, including intuitionistic fuzzy sets (IFS), introduced by Atanassov in 1980s (see [2,3]). IFS are defined by two functions, which describe the degrees of membership and nonmembership of elements to a given set.

Fuzzy random variables are applied for description of an uncertain phenomena, which are simultaneously random and imprecise. For various concepts of fuzzy random variables and their generalizations, corresponding probability theories have been developed. Within these theories, appropriate versions of SLLN were formulated and proved. In [4], intuitionistic fuzzy random variables (IFRV), which can be treated as generalizations of fuzzy random variables for IFS, were defined and applied to statistical learning theory. In particular, the law of large numbers for IFRV was used to a key theorem of learning theory, based on intuitionistic fuzzy random samples. Another concept of IFRV was proposed and applied in [5] to an insurance problem. In [6], generalized versions of the central limit theorem for observables were proved within other non-standard probability theories for IFS, not involving the notion of fuzzy random variable.

The proposed research work concerns further development of the probability theory for IFRV, including formulation and proof of generalised versions of SLLN, as well as application of this theory together with computational and statistical methods (not restricted to the areas discussed in [4,5]).

Bibliography

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