Strong graphical LLN for random outer semicontinuous mappings and its applications

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Abstract

In the report we give sufficient conditions providing strong graphical law of large numbers (LLN) for random outer semi-continuous mappings, where convergence of set valued mappings is understood as convergence of their graphs and generally it is not uniform. These results extend LLN known for random sets to the case of random set valued mappings.

In case of integrably bounded random mappings we show that graphical convergence is equivalent to uniform convergence of some blurred mappings. In case of unbounded mappings we give a number of sufficient conditions for the fulfillment of the LLN. In particular, they cover the case of a sum of bounded and cone random outer semi-continuous mappings.

The study is motivated by applications of the set convergence and the graphical LLN in stochastic variational analysis, including approximation and solution of stochastic generalized equations, stochastic variational inequalities and stochastic optimization problems. The nature of these applications consists in sample average approximation of the problem mappings, application of the graphical LLN and obtaining from here a graphical approximation of the set of solutions.