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Stein's method and stochastic analysis of Rademacher functionals. (English) Zbl 1225.60046

Electron. J. Probab. 15, Paper No. 55, 1703-1742 (2010).

Summary: We compute explicit bounds in the Gaussian approximation of functionals of infinite Rademacher sequences. Our tools involve Stein's method, as well as the use of appropriate discrete Malliavin operators. As the bounds are given in terms of Malliavin operators, no coupling construction is required. When the functional depends only on the first d coordinates of the Rademacher sequence, a simple sufficient condition for convergence to a normal distribution is derived. For finite quadratic forms, we obtain necessary and sufficient conditions. Although our approach does not require the classical use of exchangeable pairs, when the functional depends only on the first d coordinates of the Rademacher sequence, we employ chaos expansion in order to construct an explicit exchangeable pair vector; the elements of the vector relate to the summands in the chaos decomposition and satisfy a linearity condition for the conditional expectation. Among several examples, such as random variables which depend on infinitely many Rademacher variables, we provide three main applications: (i) to CLTs for multilinear forms belonging to a fixed chaos; (ii) to the Gaussian approximation of weighted infinite 2-runs; and (iii) to the computation of explicit bounds in CLTs for multiple integrals over sparse sets. This last application provides an alternate proof (and several refinements) of a recent result by *R. Blei* and *S. Janson* [Ark. Mat. 42, No. 1, 13–29 (2004; Zbl 1049.60007)].

MSC:

60F05 Central limit and other weak theorems
60F99 Limit theorems in probability theory
60G50 Sums of independent random variables; random walks
60H07 Stochastic calculus of variations and the Malliavin calculus

Cited in **3** Reviews
Cited in **17** Documents

Keywords:

Gaussian approximation; Stein's method; Malliavin operators; Rademacher sequence; chaos expansion; CLTs for multilinear forms; CLTs for multiple integrals

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