

Asymptotic expansion under degeneracy

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Concerning the ergodic diffusion process, the distributional asymptotic expansions of estimators have already been established; the second order expansions of MLE and M-estimators were obtained by Yoshida(1997) and Sakamoto-Yoshida(1998), respectively, and the third order expansions of M-estimators by Sakamoto-Yoshida(1998, 1999). Bhattacharya-Ghosh's transform method used there requires non-degeneracy of random variables which comprise the stochastic expansions of estimators in question. For almost all ergodic diffusion processes, the non-degeneracy holds true, and asymptotic expansions of their estimators were obtained from the results above. Only the third order expansion of MLE for the Ornstein-Uhlenbeck(O-U) process has degeneracy because of the full linearity, while the second order one does not have any problem, and was in fact obtained by Yoshida(1997) and Sakamoto-Yoshida(1998). We here consider functionals whose stochastic expansions up to some order consist of asymptotically linearly dependent random variables. For such functionals, we obtained distributional asymptotic expansions by using the global approach for the martingale expansion in Yoshida(1997). Applying this result, it was found that the formal expansion of MLE for the O-U process, derived from the results of Sakamoto-Yoshida(1998, 1999), was valid.

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