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# Statistical Identifiability and Convergence Evaluation for Nonlinear Pharmacokinetic Models with Particle Swarm Optimization

The statistical identifiability of nonlinear pharmacokinetic (PK) models with the Michaelis-Menten (MM) kinetic equation is considered using a global optimization approach, particle swarm optimization (PSO). If a model is statistically non-identifiable, the conventional derivative-based estimation approach is often terminated earlier, without converging, due to the singularity. To circumvent this difficulty, we adopt a derivative-free optimization algorithm PSO by combining a derivative-free local optimization algorithm to improve the rate of convergence of PSO. We further propose an efficient approach to not only checking the convergence of estimation but also detecting the identifiability of PK models with MM equation. PK simulation studies demonstrate that the convergence and identifiablity of the PK model can be detected efficiently through the proposed approach. The proposed approach is further applied to clinical PK data along with the two-compartmental model.