

## “Effective sampling schemes for behavior discrimination in nonlinear ODE systems”



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### **Abstract:**

Behavior discrimination, or parameter synthesis, is the problem of identifying sets of parameters for which the system does (or does not) reach a given set of states. The problem has important applications in various fields of applied sciences; however, current methods for behavior discrimination of ODE systems usually have computational cost increases exponentially with the number of varying parameters, without rigorous bounds on the numerical errors.

In this work, we investigated the problem of choosing effective data sampling schemes for behavior discrimination of ODE models. Using the expected boundary estimator in a probabilistic framework, we suggested two classes of sampling schemes: the low-discrepancy sampling, and the uncertainty-based sequential sampling. In both cases, we successfully derived theoretical results about the convergence of the expected boundary to the discriminating boundary and demonstrate the efficacy of the method in different application contexts. The results indicate that the number of model evaluations needed to produce a fair approximation of the discriminating boundary using our method is more feasible than others. The algorithm is also more robust and can explore a large class of boundary curves, including the case when the boundary has multiple components.

### **Speaker Bio:**

Vu Dinh received his B.S. degree in Mathematics and Computer Science from University of Science (Vietnam) and his M.S. degree in Applied Mathematics from University of Orleans (France). He is currently a PhD student in Mathematics at Purdue University. His research focuses on computational methods in applied mathematics/statistics and their applications in modelling of biological systems.