Towards improving the knowledge of underlying mechanisms of Rainfall-Runoff process using Genetic Programming

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Genetic Programming (GP) is a valuable tool for modelling nonlinear dynamic systems. GP implements the trial and error process to successfully discover the governing model structure that best fits the data, via, testing many random permutations of model components and structures, retaining the best parts of the structures and recombining them to form complete mathematical models. The potential of GP has not been exploited to the fullest extent in the field of hydrology to understand the complex dynamics involved. The state of the art applications of GP in hydrological modelling involve the use of GP as a short-term prediction and forecast tool rather than as a framework for the development of a better model. In today's scenario with the increasing monitoring programmes and computational power, the techniques like GP can be employed for the development and evaluation of hydrological models, balancing prior information, model complexity, parameter and output uncertainty.

In this contribution, as a preliminary step to the overall motive stated above, the GP is trained to capture the dynamics of the rainfall- runoff process using tank system, where each tank is a storage unit in a watershed that corresponds to varying depths below the surface. The tank model considers rainfall minus losses as the input and generates flows at different levels as the output thereby capturing the phenomenon of storage, infiltration and percolation. The meteorological data employed in this study belongs to the Kent Ridge catchment of National University Singapore, a small urban catchment (8.5 hectares) that receives a mean annual rainfall of 2500mm and consists of all the major landuses of Singapore. The algorithm so designed can capture the response of the model employed for simulation, returning the exact number of tanks and appropriate parameters present in the model structure, thereby providing useful physical insight of the catchment.