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TOPIC OF THESIS: Multi-output hybrid genetic programming model for efficient prediction of time series data

FINDING

Time series modeling aims to study and develop a model that takes into account the various features of a series and whose goal is to predict the future values of the series. This discipline is useful for various practical fields such as finance, economics, engineering, and medical sciences. A successful time series forecast comes down to the fitting of a model. Over the years, various models have been developed, ranging from conventional statistical models to computational intelligence and evolutionary computing-based methods. However, the quest for a better, scalable, faster, and more accurate model remained a challenge. In the field of computational intelligence, most of the models are single-input and single-output (SISO) models, except a few. Artificial Neural Networks (ANNs) dominates their applications in various fields of study as multi-input and multi-output (MIMO) model. There is a need to look for an alternative method that should work as MIMO. This thesis contributes to the field of Cartesian Genetic Programming (CGP), a variant of Genetic Programming (GP), for time series prediction that can be deployed as a MIMO model.

GP is a form of evolutionary computation where programs are evolved stochastically into better programs. It is tree-based, where the internal nodes represent the functions and the leaf nodes represent the variables and terminals. CGP is a variant of the GP, which has several advantages over GP such as it is MIMO in nature. Further, CGP has bloat-free execution, natural drift, and reusability of the nodes. Standard CGP uses only the mutation operator and (1+4) evolution strategy. However, later researchers used (μ+λ) strategy where μ was chosen as 2 and λ as 48. Several researchers have seen the effect of varying these parameters on the functioning of the CGP. Also, there are several variants of CGP, such as Modular CGP, Self-modifying CGP, Mixed Type CGP, Recurrent CGP, Differential CGP which were later developed by various researchers. All of these variants have their respective operators in addition to the mutation operator. It was seen that the classical crossover of the Genetic Algorithm (GA), when used in CGP, gave disruptive results. In addition to the mutation operator several other operators were developed later that may be utilized for standard CGP, which include Clegg's Crossover, Forking, and Sub-Graph Crossover.