A GA-Based Method For Function Approximation Using Adaptive Interpolation

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Abstract

We are developing GA-based tools for use in constructing high quality approximations to continuous functions. In this paper we report on a GA-based method for adaptively selecting effective interpolation points. We evaluate our approach on a variety of test functions, and we compare are results to more traditional approaches. The results are quite promising and suggest directions for further improvements.

1 Introduction

Developing effective techniques for approximating functions is an important and well-studied area. One of the difficult issues in function approximation is how to deal with the fact that some portions of functions have large functional variation while other portions are relatively smooth and easy to approximate [Cont,1980; Jeffery,1996]. One approach is to attempt to construct a polynomial with a sufficient number of higher order terms to approximate the target function within a given error tolerance. While there are proofs that such polynomials exist for a wide range of target functions, constructing the polynomials is difficult in general and invariably involves expensive computational search procedures. An alternative approach is to approximate a target function via a sequence of piece-wise interpolations involving simple, low order polynomials. The key here is developing an efficient procedure for choosing the interpolation points (mesh points) and the interpolation polynomial to be used in each interval. In this case the simplest approach is to use uniformly spaced mesh points. This approach requires the fixed interval between mesh points to be sufficiently small to deal with the worst case functional variation, resulting in general in many unnecessary mesh points. Adaptive interpolation attempts to deal with this by varying the distance between mesh points depending on the functional variation.

2 Results

In our study we used the Lagrange polynomials for approximations, and the fitness function defined as $Error = |f(x) - p_n(x)|$ and we tested our ideas on several cases, and it clear in Figure 1. For more detail check(www.galaxy.gmu.edu/˜ rmoustaf/publications).

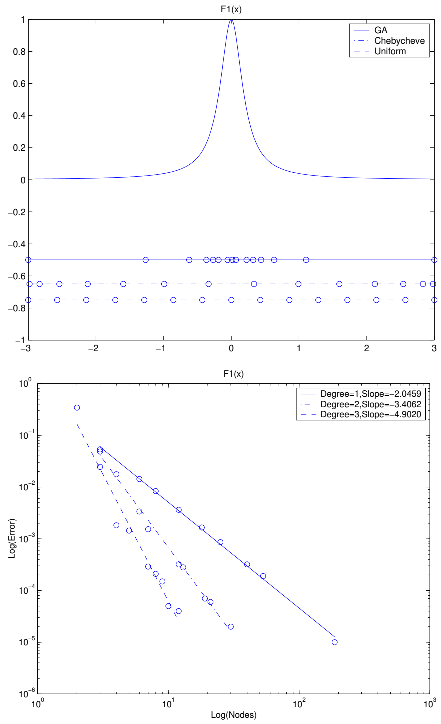

Figure 1: Node distributions and the accuracy, generated by uniform, Chebychev and GA methods on Rung Function