Modeling A Grinding Circuit Using Genetic Programming

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Abstract

Accurate and efficient computer models of mineral processing systems are becoming increasingly important as the mineral industry strives to improve the efficiency of beneficiation systems. This paper considers the approach of using genetic programming for developing a data-driven model of grinding, one of the most prominent unit operations in the processing of minerals.

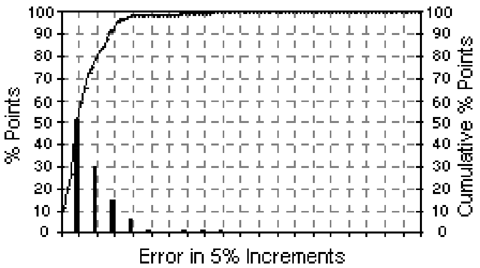
1 INTRODUCTION

Traditional first-principle models are difficult to develop for systems in the minerals industry because these systems are often characterized by complex chemical reactions and complicated physical phenomena such as three-phase flows. However, there is little doubt that the minerals industry can benefit from the application of computer models in the areas of equipment design and process control, just to name two.

In this paper genetic programming is used to develop a computer model of a grinding circuit - both fineness of the product and energy consumption required were modeled. Results are presented that indicate genetic programming is a viable approach to developing a data-driven computer model of grinding.

2 RESULTS

The results of this effort are summarized the figures below. These figures are % error histograms; they represent the number of points in a training set that were within a specified percent error. Figure 1 is for the fineness model while Figure 2 is for energy consumption.



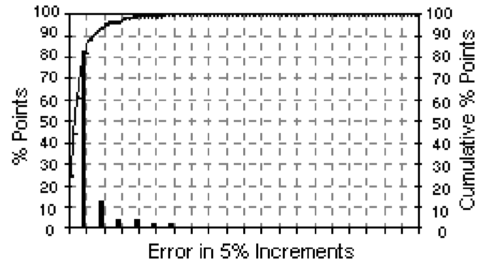


Figure 1: The first histogram above shows that the fineness model predicts 79.5% of the test points to within 10% err. The second histogram shows that 82.2% of the predicted values of energy consumption were within 5% error, while 94.2% of the predicted values were within 10% error.

The results presented here are quite promising. System modeling is an important yet difficult problem applicable in a wide range of industries. If genetic programming can effectively improve or simplify the process of developing modeling equations, then the economic impact on the minerals industry can be substantial.