

## Characterizing Ore Body with Process Performance Indicators using Pattern Recognition

Shamez Kotadia<sup>1</sup>, Dean Wallace<sup>2</sup>, and Leonard Slipp<sup>3</sup>

<sup>1</sup>Production Intelligence, Pattern Discovery Technologies Inc., Waterloo, ON, Canada.

<sup>2</sup>Dean Wallace Consulting Inc., Beaumont, AB, Canada.

<sup>3</sup>Product Development, Pattern Discovery Technologies Inc., Calgary, AB, Canada.

Oil sands block models are typically populated with geological properties such as facies designation and physical properties such as bitumen concentration, average particle size (D50) and fines concentration. In an effort to deliver consistent feed to the extraction circuit, mining operations attempt to blend ores based on these physical properties. However, these properties alone are not necessarily the strongest influences on extraction circuit performance. It is generally accepted that many other characteristics of the ore such as the chemical analysis (pH, Ca, K, Mg, etc.) and the mineralogy (MBI, etc.) combine with the other known factors to influence the overall performance. Better understanding of the interaction of these factors can help refine the control strategy needed to reduce future plant upsets and heighten recovery and froth quality.

This paper proposes a novel approach for associating ore properties with plant performance indicators using pattern recognition techniques:

- 1) First, unobvious relationships between circuit ore properties and performance indicators such as froth quality are automatically discovered and quantified, using a “rule based” association algorithm;
- 2) Once the underlying characteristics of the system are learned, the method then transforms the patterns that are discovered into easily interpretable production rules which can then be used to predict the performance of different ore types.

With a predictive rule model learned from batch extraction tests, we can now classify all geological or mining blocks of the mine according to their potential processing performance. For example, a tag of primary recovery can be assigned to each block in the mine. This information can greatly help optimize mine planning and provide the extraction circuit with consistent ore feed in terms of processing behaviour. Because of the transparent nature, this proposed system not only assigns a performance value to a block, but also reveals the reasons behind the assignment. Understanding the underlying cause for poor performance can lead to the development of the most effective mitigation strategies - altering chemistry characteristics in the control room or changing physical characteristics by blending the ores.