Automating Load-Haul-Dump Cycle Data Capture with Machine Vision and Deep Neural Networks

J Lim[1]

1. Pitram Technical Product Manager, MICROMINE, Perth Western Australia 6007. jlim@micromine.com

ABSTRACT

Accurate tracking of underground loader activities and material movements from the face can be imprecise due to the difficulties inherent in underground mining. These factors can include lack of communications network, difficulty tracking equipment position and the need to manually record data. As a result, loader operators often record or report the incorrect work performed leading to erroneous data in material flow. Another commonly observed scenario is that operators call in material movements in bunches rather than individually which hinders the accurate capture of metrics and makes it difficult to analyze performance and optimize production.

The primary objective is to take the human element out of the data capture process by using machine vision and different sensors to improve the accuracy of cycle data collected from loaders. A secondary objective is to use only generic sensors to allow the solution to be deployed at any mine using equipment from any manufacturer as many mines are run using mixed fleets. With a model trained on different makes and models, the solution will be able to be taken to any mine and with little to no training be able to start recording data. Lastly, by removing the need for the loader operators to switch their focus to reporting in or using a screen to capture data, there could be potential benefits in operating efficiency and safety in the same way road drivers are discouraged or banned from using mobile devices while driving.

Using Convolutional Neural Networks, and a front facing camera mounted in the cabin of loaders analyzed images and feed them to a model to detect changes in a loader cycle and material movements. This was then integrated into the Pitram Mine Control system to automatically collect the data with minimal human interaction.