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Visualization and machine learning application for the sorting of diamondiferous rock from mined kimberlite

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Traditional diamond mining methods require the use of vast amounts of water and energy to process mostly barren rock to recover diamonds. The crushing of rock can lead to diamond breakage reducing the profitability of a mine. PET sensor technology negates these undesirable effects by enabling the early detection of relatively unprocessed diamond bearing rocks which can be isolated and processed in an environmentally friendly manner that preserves diamond integrity.

Key to automated diamond detection is the creation of PET images from raw sensor data and the identification of diamond features using AI methods. Raw gamma ray detector hits are used to construct lines-of-response which define 2D projections. These are then used to reconstruct 3D images using the Maximum Likelihood Expectation Maximization (MLEM) algorithm. Bright spots in the images are identified along with their features. These are then used as inputs to various machine learning algorithms to train them for diamond identification.

Presented are MLEM reconstructed images for simulated 10cm kimberlite rocks containing diamonds of various sizes. The training of various machine learning algorithms is also discussed. The results show the first ever application of automated diamond detection using machine classifiers.

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