Prediction of grade and recovery in flotation from physicochemical and operational aspects using machine learning models

By: Gomez-Flores, A (Gomez-Flores, Allan) [1] ; Heyes, GW (Heyes, Graeme W.) [2] ; Ilyas, S (Ilyas, Sadia) [1] ; Kim, H (Kim, Hyunjung) [1]

View Web of Science ResearcherID and ORCID (provided by Clarivate)

MINERALS ENGINEERING

Volume: 183

Article Number: 107627

DOI: 10.1016/j.mineng.2022.107627

Published: JUN 15 2022

Early Access: MAY 2022

Indexed: 2022-06-18

Document Type: Article

Abstract

Machine learning (ML) models for predicting flotation behavior focus on operational variables. Fundamental aspects, e.g., physicochemical variables that describe mineral surfaces for bubble-particle interactions, are largely neglected in these models; however, these physicochemical variables of mineral particles, including bubbles and pulp, influence the flotation behavior. Thus, this study aimed to advance the prediction of flotation behavior by including physicochemical variables. Among four ML models used for the prediction, the random forest model had the best performance and was therefore subsequently used to investigate variable importance. Contact angle, particle diameter, bubble diameter, particle charge, collector concentration, flotation time, and number of mineral species were the most important variables. Limitations (e.g., assumptions and empiricism) and implications of our study were presented. Finally, our expectation was to encourage more attention to physicochemistry in flotation using ML for a more generalized empirical flotation model.

Keywords

Author Keywords: Flotation; Physicochemistry; Modeling; Artificial intelligence; Machine learning

Keywords Plus: BUBBLE-SIZE DISTRIBUTION; NEURAL-NETWORKS; IMAGE-ANALYSIS; PARAMETERS; KINETICS; STATE; FINE

Author Information

Corresponding Address: Kim, Hyunjung (corresponding author)

Hanyang Univ, Dept Earth Resources & Environm Engn, 222 Wangsimni-ro, Seoul 04763, South Korea

Addresses:

1 Hanyang Univ, Dept Earth Resources & Environm Engn, 222 Wangsimni-ro, Seoul 04763, South Korea

2 CSIRO, Mineral Resources Div, Clayton, Vic 3169, Australia

E-mail Addresses: kshjkim@hanyang.ac.kr

Categories/Classification

Research Areas: Engineering; Mineralogy; Mining & Mineral Processing