SAIMM
THE SOUTHERN AFRICAN INSTITUTE OF MINING AND METALLURGY

130 Years OF TECHNICAL EXCELLENCE

The Southern African Institute of Mining and Metallurgy in collaboration with the SAIMM Western Cape Branch is hosting the

HYDROMETALLURGY CONFERENCE 2024

Hydrometallurgy for the Future

1 SEPTEMBER 2024
HAZENDAL WINE ESTATE, STELLENBOSCH,
WESTERN CAPE, SOUTH AFRICA

WORKSHOP

ECSA Validated CPD Activity,
Credits = 0.1 points per hour attended.

Data Analytics and Machine Learning Workshop in Hydrometallurgy

OVERVIEW

The day will include lectures and hands-on Python practicals with a focus on regression, classification algorithms, and conditional simulation for process control.

PRESENTER

Professor Glen Nwaila

Glen Nwaila holds a PhD in Geosciences from the University of Würzburg, Germany with Magna cum laude, and an MSc in Chemical Engineering from the University of Cape Town. Glen recently transitioned from being the Director of the Wits Mining Institute to Professor of Economic Geology and Geometallurgy at the School of Geosciences, University of the Witwatersrand where he is also the Deputy Head of School. With over 16 years of experience in academia, the mining industry, and professional advisory consulting services, Glen has worked for several mining companies, advisory firms such as Deloitte, Sibanye Stillwater, Harmony Gold and Gold Fields. His career is marked by a commitment to critical minerals and smart mining research excellence, mathematical modelling, mentorship, and visionary leadership.

FOR FURTHER INFORMATION, CONTACT:
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PROGRAMME

07:00-08:00 **Registration and Early Morning Refreshments**

08:00-08:15 **Introduction, Objectives and Workshop Outcomes**

08:15-09:00 **Lecture 1 - Introduction to Data Analytics and Machine Learning for Engineers**

- Overview of Data Analytics
- Importance in Engineering and Hydrometallurgy
- Key Concepts in Machine Learning
- Fundamentals of forecasting using time series analysis e.g., moving averages, ARIMA/SARIMA.

09:00-10:00 **Python Practicals - Getting Started with Python for Mineral**

- Python Environment Setup - Guide participants through setting up their Python environment (Anaconda, Jupyter Notebooks)
- Basic Python Syntax
- Data Manipulation with Pandas
- Introduction to Data Visualisation with Matplotlib.

10:00-10:15 Tea Break

10:15-11:00 **Lecture 2 - Data Preprocessing and Exploratory Data Analysis (EDA)**

- Importance of Data Management: DAMA-DMBOK and CRISP-DM standards
- Data cleaning: Handling Missing Values (removal, smoothing, replacement, downsampling)
- Data Normalization and Standardization
- EDA Techniques: Descriptive Statistics, Data Visualization
- Tools for EDA in Python.

11:00-12:30 **Hands-On Python Practical - Data Preprocessing and EDA**

- Practical Data Preprocessing: Handling Missing Data, Normalisation - including descriptive statistics
- Conducting EDA: Visualisation with Matplotlib and Seaborn
- Case Study: Preprocessing and EDA on shift-based gold cyanidation plant datasets.

12:30-13:30 Lunch Break

13:30-14:15 **Lecture 3 - Regression and Classification Algorithms**

- Introduction to Regression Algorithms: Linear Regression, Decision Trees and Random Forest
- Introduction to Classification Algorithms: Decision Trees, Random Forests and Support Vector Machines
- Dimensionality reduction e.g., Principal component analysis, Manifold learning and Autoencoders
- Clustering - K-means clustering, and DBSCAN
- Specific Applications Case studies in Hydrometallurgy.

14:15-15:00 **Hands-On Python Practical - Implementing Regression and Classification Algorithms**

- Building Regression Models: Prediction of ore recovery using multi-variate data
- Building Classification Models: Decision Trees, Random Forests for ore blending
- Multidimensional scaling and clustering
- Model Evaluation and Validation and interpretations: Cross-validation, Metrics, Feature importance, partial correlation and SHAP.

15:00-15:15 Coffee Break

15:15-16:15 **Lecture 4 - Conditional Simulation for Process Control**

- Introduction to Conditional Simulation
- Importance in Process Control and Optimisation
- Implementing Conditional Simulation in Python
- Practical Examples.

16:15-16:30 **Q&A and Wrap-Up**

- Summarise the key points covered during the workshop.
- Open the floor for a Q&A session to address any outstanding questions.
- Collect feedback and evaluations from participants.