UNIVERSITY OF JOHANNESBURG

20 YEARS 2005-2025

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INVITATION

The Department of Electrical and Electronic Engineering Science, Faculty of Engineering and the Built Environment, invites you to a student public lecture entitled:

Combined Deep Learning and Blockchain with Extended Kalman Filter for Efficient and Secure Maritime Surveillance Radar Data Analysis and Modelling

by Moloko Sebake (South African National Space Agency, Chief Data Systems)

DATE: 05 May 2025 | **TIME:** 13:30 – 15:30 | **VENUE:** B2 Lab 219, APK Campus

VIRTUAL LINK: https://shorturl.at/U7c89

ABSTRACT: Maritime surveillance radars are widely used for vessel detection and tracking but struggle with accurate ship classification and identification. This thesis addresses these limitations by developing a ship identification system that integrates deep multimodal neural networks, the Extended Kalman Filter (EKF), and blockchain technology. A key challenge arises when different radars or the Automatic Identification System (AIS) assign varying target IDs to the same ship.

The system links radar and AIS trajectories by predicting a ship's future position using initial radar data and matching it with subsequent detections. Gated Recurrent Units (GRU), Long Short-Term Memory (LSTM) networks, and EKF predict trajectories, while another EKF fuses them. The best match is selected using the discrete Fréchet distance, with methods like Dynamic Time Warping (DTW) and Siamese networks also considered. Blockchain ensures data integrity. Evaluation using radar and AIS data, deep neural networks, and deep reinforcement learning, including Deep Q-Networks (DQN), confirms the system's effectiveness. This approach enhances maritime safety, resource efficiency, and situational awareness by providing a robust ship tracking and identification solution.