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OMNI-REUNIS Super-Spreader Seminar Series

These seminar series is intended to provide faculty members, OMNI-RÉUNIS affiliates and HQPs a platform to present their research, share experiences and foster collaboration among OMNI-RÉUNIS, the Emerging Infectious Disease Modelling (EIDM) networks, and the scientific community.

THE MATHEMATICS OF DEEP NEURAL NETWORKS WITH APPLICATION IN PREDICTING THE SPREAD OF INFECTIOUS DISEASES THROUGH DISEASE-INFORMED NEURAL NETWORKS (DINNS)

Hybrid Seminar (Zoom) Petri Sci. & Engr Building, Room 018, 140 Campus Walk

Thursday, Oct 31, 2024

10:30 am-11:30 am EDT

REGISTER HERE

NICKSON GOLOOBA

MEET THE PRESENTER

The speaker is an MA student at York University, under the supervision of Professor Woldegebriel Assefa Woldegerima. He is currently pursuing a Double MSc Degree in Mathematics for Real World Applications, awarded by the InterMaths Consortium, through an International Double MSc Degree program involving the University of L'Aquila, Italy, and York University, Canada. His research has been focused on integrating deep learning with mathematical modeling to enhance the accuracy of epidemic predictions. Specifically, his thesis explores the use of Disease Informed Neural Networks (DINNs) to model the spread of infectious diseases. His research interests include epidemic modeling, dynamical systems, numerical methods, and the application of AI in solving complex public health challenges. Nickson received his BSc in Education, majoring in Mathematics and minoring in Chemistry, from Makerere University, Uganda. Following this, he pursued an MSc in Mathematical Engineering at the University of L'Aquila, Italy, and currently, he is furthering his studies in Applied Mathematics at York University, where he is applying these principles to real-world challenges through his thesis research.

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SEMINAR TITLE AND ABSTRACT

THE MATHEMATICS OF DEEP NEURAL NETWORKS WITH APPLICATION IN PREDICTING THE SPREAD OF INFECTIOUS DISEASES THROUGH DISEASE-INFORMED NEURAL NETWORKS (DINNS)

Deep learning has emerged in many fields in recent times where neural networks are used to learn and understand data. This thesis combines deep learning frameworks with epidemiological models and is aimed specifically at the creation and testing of DINNs with a view to modeling the infection dynamics of epidemics. This research thus trains the DINN on synthetic data derived from an SI-SIR model designed for Avian influenza and shows the models accuracy in predicting extinction and persistence conditions. In the method, a twelve hidden layer model was constructed with sixty-four neurons per layer and ReLU activation function was used. The network is trained to predict the time evolution of five state variables for birds and humans over 50,000 epochs. The overall loss minimized to 0.000006, was characterized of the loss of data and physics, which made the DINN follow the differential equations that fundamentally described the disease progression.

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