23 – 24 August 2024 IndabaX Malawi 2024 invites you to:

INDABAX MALAWI

The 5th IndabaX Malawi Symposium "Trends in Machine Learning and Artificial Intelligence"

23 – 24 August 2024 at the Malawi University of Business and Applied Sciences, ODeL Auditorium in Blantyre, Malawi

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AGENDA:

Aug 23, 2024	
Time	**Session + Activities**
8 - 8:30 am	Registration Wellcome (Dr. Amelia Taylor)
9:00 - 9.30 am	Talk: Introduction to Machine Learning and its applications **Dr. Amelia Taylo**r (**MUBAS** and **https://kailab.tech**)
9.30 - 10.20 am **(Health)**	Research presentations - (See list below) **Christina Chiziwa (MSc Student, Impala Project, MUBAS) (15 min)** **Title:** Forecasting For Threshold Alarms Around Critical Illness Events In Patient Monitoring: Auto-Regressive Integrated Moving Average Machine Learning Approach* **Amelia Taylor, Chimwemwe Chamangwana (https://kailab.tech, MUBAS) (15 min)** **Title**: Self-Directed Learning for Community Health Workers in Malawi Through Generative AI **Emmanuel Malunga (Student, Mzuzu University) (10 min)** **Title:** Addressing Diversity and Inclusion in AI-Driven Healthcare Questions **(10 min)**
10.20 - 10.40 am	Health Break
10.40 - 11:20 pm **(Applications of ML in Agriculture)**	Research presentations - 2 sessions of 15 minutes each (See list below) **Chimwemwe C. Mvula (Mzuzu University, Undergraduate Student)** Maize Seed Quality Detection Using Machine Learning

	Emmanuel Ngalande (UNIMA, PhD Student) Comparative analysis of CNN for fall armyworm detection and segmentation using UAV imagery in smallholder farms in Malawi Questions **(10 min)**
11:20 - 12:00 **(Remote Sensing/ GIS)**	Research presentations - 2 sessions of 15 minutes each (See list below) **Lewis Msasa, Evelyn Chapuma, Grey Mengezi, Amelia Taylor (https://kailab.tech, MUBAS)** **Title:** mwBD: A Dataset of Satellite Imagery for Assessing Building Damage caused by Cyclone Freddy in Blantyre, Malawi **Patrick Ken Kalonde (PhD Student, MLW)** **Title:** Geospatial Methods for Public Health Surveillance in Urban Environment Questions **(10 min)**
12.00 - 1.00 pm	**Lunch Break**
1.00 - 1.55 pm **(Education and Society)**	Research presentations - 3 sessions of 15 minutes each (See list below) **Dickson Thegha (Mzuzu)** **Title:** Primary Science Augmented Reality (AR) System (PSARS) **Peter Oseghale Ohue, Olusanya Elisa Olubusoye, Olaoluwa Simon Yaya (University of Ibadan Nigeria) - Online** **Title:** Voter Apathy in Nigeria: Leveraging Bayesian Networks and Deep Learning Models for Evidence-Based Solutions **Amos Roberts, Amelia Taylor, Tamanda Phiri (https://kailab.tech, MUBAS)** **Title:** Can ML be utilised to detect SMS Fraud in Malawi? Questions **(10 min)**
2:00 - 2:30 pm	**Talk: Colleen Farrelly: Introduction to graph neural network** Colleen M. Farrelly (Post Urban Ventures) is a lead data scientist and researcher with a broad industry background in machine learning algorithms and domains of application. While her focus has been industry, she also publishes academically in geometry, network science, and natural language processing.
2.30 - 3.00 pm	**Workshop 1: Security & Privacy Considerations for AI & ML (Facilitated by Susie Haydon)** After over 20 years in Unix & Linux systems engineering in Australia, Susie Haydon has moved into Cyber Security. She is looking forward to learning more about the intersection of Cyber Security and Artificial Intelligence at 2024 IndabaX Malawi.
3.00 - 4.00 pm	**Panel DIscussion: Security & Privacy Considerations for AI & ML** **Members of the panel:** **Dr. Anthony Ziba, Anthony Ziba, Head of ICT at MUBAS** Dr. Anthony Sinya Kampingo (ASK) ZIBA is the Head of Information and Communication Technologies (ICT) at the Malawi University of Business

	and Applied Sciences (MUBAS) and has over 18 years cumulative experience in the ICT industry spanning both public and private sectors across the world. He obtained his Bachelor of Science degree in Computer Science from the University of Malawi, Chancellor College, in 2001. In 2004 he obtained the Master of Science degree in Information Technology and later in 2009 he obtained a PhD in Information Systems, both from the Edinburgh Napier University in Scotland, UK. He is EC Council Certified Ethical Hacker and Certified Computer Hacking Forensic Investigator. In addition to that, he is ISACA Certified Information Systems Auditor and PECB Certified ISO 27001 Lead Implementer. He is a registered candidate for the Offensive Security's PEN 200 Certification Program. **Exile Njoka(MBA,B.Sc,CISSP,DPO)** Exile Njoka is an information security specialist with over a decade of experience. He has a versatile background in information security across various sectors, including finance, telecommunications, and non-governmental organizations. His areas of specialization include business security development,Business Continuity, Data privacy, Cyber surveillance ethics, digital fraud investigations, cloud security, cybersecurity awareness, and incident response. Exile is currently the Group ICT Manager for Continental Holdings Limited. He also serves as a Director at Turtletech Limited, a cybersecurity company in Malawi, and is the founder of Cyber Flames, a non-profit organization specializing in information security capacity building. He holds an MBA, B.Sc., CISSP, PECB Data Privacy Officer, and several other information security certifications. **Eva Mfutso-Bengo** Eva Mfutso Bengo is the Acting Head of Department of Economics and Law at MUBAS. She has been teaching Corporate Law, Environmental Law and Public Health Law. She is pursuing a dr. jur. in the area of financial crimes. She has a strong interest in the interlinkage of legal information systems, legal text and AI.
4 pm	**Closing Remarks / Networking**
Aug 24, 2024	
8:00 - 8:10 am	**Welcome to day 2**
8:10 - 9.20 am	Research presentations - 4 sessions of 15 minutes each (See list below) **Richard Chilipa (Lecturer MUST)** Evolving Fuzzy Systems for Real Time Applications **Alinafe Emmanuel Kaliwo (Lecturer MUBAS)** The State of Responsible AI in Malawi: Ensuring Ethical and Inclusive Development Questions (10 minutes)
9:20 - 9:50 am	Workshop 2: Machine Learning tutorial

9.50 - 10.10 am	Health break
10.10 - 11.00 am	**ML Competition launch** (Zindi.Africa)
11.00 - 10.00apm	**Closing Remarks and Networking Lunch**

Research Papers List

No.	Author	Title	Description
1	Peter Oseghale Ohue, Olusanya Elisa Olubusoye, Olaoluwa Simon Yaya University of Ibadan Nigeria.	Voter Apathy in Nigeria: Leveraging Bayesian Networks and Deep Learning Models for Evidence-Based Solutions **(Society)(Online)**	The scourge of voter apathy in Nigeria poses a significant threat to the country's democratic fabric, necessitating innovative approaches rooted in advanced data analytics. This paper proposes a holistic methodology that combines Bayesian networks, probabilistic graphical models (PGMs), and deep learning techniques to unravel the intricate dynamics of voter disengagement. By leveraging Bayesian inference and deep learning algorithms, our study aims to pinpoint the multifaceted determinants of voter apathy, encompassing socio-political, economic, and demographic factors. Through rigorous data collection, preprocessing, and model development, we elucidate the underlying causes of low voter turnout and predict future voting behaviours with high accuracy. Our analytical framework integrates key concepts such as causal modeling, exact inference, and parameter learning, enabling a comprehensive understanding of Nigeria's electoral landscape. Additionally, we incorporate deep learning models to enhance predictive performance and uncover latent patterns in voter behaviour. The use of metrics such as accuracy, precision, and recall ensures robust model evaluation, while scenario analysis enables policymakers to assess the potential impact of intervention strategies. By bridging the gap between theory and practice, this research offers actionable insights for stakeholders across the political spectrum. With a focus on sustainability, inclusivity, and democratic resilience, our study seeks to empower citizens and strengthen the foundations of Nigeria's democracy.
2	Christina Chiziwa (MUBAS)	Forecasting For Threshold Alarms Around Critical Illness Events In Patient Monitoring: Auto-Regressive Integrated Moving Average Machine Learning Approach **(Health)**	Background: It is essential to monitor vital signs in critical care settings continuously to ensure patient safety and provide timely intervention. While traditional patient Monitor threshold alarm systems have been instrumental in saving lives, they often produce numerous non-actionable alarms, overwhelming caregivers and hindering effective patient monitoring. This study aimed to forecast threshold alarms around critical illness events using the ARIMA (AutoRegressive Integrated Moving Average) machine learning approach, enabling preemptive medical interventions and improving patient care outcomes. Method: Secondary data from 772 patients was extracted from the IMPALA Project conducted in the High Dependency Unit (HDU) at Queen Elizabeth and Zomba

			Central Hospitals in Malawi. The dataset comprised time-series vital signs data from patient monitors of hospitalized patients. The patient's vital signs data included ECG heart rate, ECG respiratory rate, and SPO2. Data pre-processing steps involved cleaning and structuring the time-series data, resampling and interpolation of the data, and the Augmented Dickey-Fuller (ADT) test was used to test the seasonality and stationarity of the data. The ARIMA (AutoRegressive Integrated Moving Average) machine learning approach was used to forecast threshold alarms around critical illness events. The model was trained as a classification task, on threshold alarm patterns around critical illness events and mean square error was used to determine the accuracy of the model.
3	Alinafe Emmanuel Kaliwo	The State of Responsible AI in Malawi: Ensuring Ethical and Inclusive Development **(Responsible AI /Ethics)**	This presentation explores the current landscape of Artificial Intelligence (AI) in Malawi, focusing on the principles of responsible AI. Drawing from comprehensive research and analysis, the presentation will highlight key findings on the existing frameworks, government actions, and the role of non-state actors in promoting ethical AI practices. It will address the challenges and opportunities for AI in Malawi, emphasizing the importance of inclusive development and the need for a robust policy environment that aligns with global best practices. The session aims to provide actionable insights for stakeholders to drive ethical and inclusive AI adoption in Malawi, ensuring that the benefits of AI are broadly shared while mitigating potential risks.
4	Chimwemwe C. Mvula (Mzuzu University, Undergraduate Student)	Maize Seed Quality Detection Using Machine Learning **(Agriculture)**	Maize, a vital staple crop in Malawi, underpins food security and livelihoods. High-quality seeds are essential for maximizing yields and minimizing food shortages. However, manual seed inspection, which is the current practice, suffers from slowness, human error, and fatigue-induced mistakes. This project proposes a computer vision-based model for real-time, automatic assessment of maize seed quality in Malawi, which will use a diverse image dataset of healthy and defective "Njovu", "Mkango", "Dkc-8033", and "Dk777" seeds to be acquired through collaboration with agricultural research institutions and seed companies. This solution will ensure the selection of only high-quality seeds, ultimately promoting improved yields, and consequently ensuring food security. By using the Deep Learning model deployed on an automated simple seed selecting machine, the system categorizes an input image as good and bad quality seed. The good clusters of seeds can go through the final processing steps, and the bad clusters can be rejected. Malawi relies heavily on agriculture, with maize being the primary crop cultivated by a large proportion (over 60%) of smallholder farmers. However, post-harvest losses due to inadequate seed quality assessment processes contribute to food insecurity and economic losses. Traditional methods of assessing corn quality, such as

			manual inspection are inefficient and prone to inaccuracies. Several studies have utilized machine vision technology for seed quality assessment. By analyzing seed images, features like color, texture, size, and shape are extracted, enabling the identification of seed defects using various computer vision classifiers. This automated process offers a more efficient alternative to manual seed sorting, significantly enhancing productivity.
5	Richard Chilipa MUST Lecturer	**Evolving Fuzzy Systems for Real Time Applications**	Evolving Fuzzy Systems (EFS) have emerged as a powerful tool for handling streaming data and enabling lifelong learning, with particular relevance for Internet of Things (IoT) applications. EFS integrate artificial neural networks and fuzzy logic to create self-learning, data-driven models suitable for online (real-time) applications. In the context of IoT and other streaming data applications, EFS offer several key advantages; they can effectively model and learn from data that arrives continuously from distributed sensor networks, edge devices, and other IoT data sources, without the need to store or revisit past observations. EFS can autonomously grow their model complexity as required to capture the evolving data patterns, adding new fuzzy rules and modifying existing ones. This allows them to maintain high performance even as the data distribution shifts or new concepts emerge in the dynamic IoT environment. The online continual learning capabilities of EFS are particularly valuable for IoT applications that require real-time, adaptive intelligence. EFS can quickly adapt their knowledge representation and decision-making logic to changes, without catastrophic forgetting of previous learned data. This makes them well-suited for deployment in autonomous IoT systems, healthcare, fraud detection, smart cities, industrial automation, and other applications that need adaptable, life-long learning to handle the complexity and volatility of streaming IoT data. This presentation outlines the key characteristics of EFS and highlights their suitability for IoT and other streaming data applications that demand online continual learning. The presentation will delve deeper into the core algorithms, system architectures, and real-world IoT use cases that demonstrate the practical benefits of evolving fuzzy systems.
6	Emmanuel Ngalande (UNIMA, PhD Student)	Optimal Application Of Deep Learning Models For Maize Fall Armyworm Detection And Segmentation In Smallholder Farms In	Maize is a staple food crop grown and consumed in most Eastern and Southern African (ESA) countries, including Malawi. It is the main seasonal crop in most of ESA, providing an income to many small-scale farmers. However, pests and diseases largely affect maize yield quality and quantity. It is crucial to conduct disease diagnosis and identification for timely intervention and treatment of maize pests and diseases, ultimately enhancing its production quality and economic efficiency. Traditionally, farmers in

		Malawi (**Agriculture**)	Malawi use visual detection of pests and disease infestation in the fields, which is time-consuming and error-prone due to the subjective nature of human evaluation. Several automatic disease detection techniques that improve detection time and accuracy compared to visual methods exist, yet they are not universal for all available environmental contexts. In this study, we utilized three convolution neural networks (CNNs) based on U-Net architecture, namely, EfficientNetB0, VGG19 and ResNet50v2, for fall armyworm detection and segmentation. High-resolution images were captured using unmanned aerial vehicle (UAV) remote sensing technology. All three models achieved an accuracy of over 99% on our dataset. However, ResNet50v2 performed superior on our segmentation task with an Intersection over Union (IoU) of 80.77%. EfficientNetB0 achieved a lower IoU of 49.53% but utilized fewer parameters compared to ResNet50v2 and VGG19. The models can be fine-tuned further and with enough labelled data to improve the performance for fall armyworm detection and segmentation.
7	Amos Roberts, Amelia Taylor, Tamanda Phiri kailab.tech (MUBAS)	Can ML be utilised to detect SMS Fraud in Malawi? **(Online safety/Cybersecurity**)	SMS Fraud refers to the activities that use short message service to defraud people. In Malawi, SMS fraud has grown significantly in the last few years. This growing trend has been noted across the world as the use of digital money increases. In Malawi, some SMSs are written in Chichewa but also English and mixed language are used. We report on our experiments of using machine learning models to classify Chichewa SMSs as fraud or non-fraud. To that aim, we also develop a small dataset of SMSs in Chichewa. Our experiments show that machine learning algorithms can effectively classify Chichewa SMS messages as fraudulent or non-fraudulent, and hence can be integrated into tools that give alerts or block fraudulent SMSs on users' devices.
8	Dickson Thegha (Mzimba)	Primary Science Augmented Reality (AR) System (PSARS) **(Education)**	Game-based learning is a technique used to improve the quality of education on a particular subject matter. With numerous advantages over conventional face-to-face learning, game-based learning can be used to improve the effectiveness and efficiency of learning science subjects. A preliminary study indicated that most students do not gain adequate information from the face-to-face learning. The proposed solution is to use a game-based learning app called Primary Science Augmented Reality System (PSARS) to conduct virtual experiment. The app is developed to make learning resources accessible to students in an easy and fast way. The app is there to enable students experience the real world scenarios, which is difficult and dangerous to be observed in real life. The app also enhance the effectiveness and efficiency science concepts delivery. The ultimate goal of any Game-based learning application like the primary science AR system is to improve both the process and results of learning particular subject matter. The

			technical design of these applications needs to exploit the concepts of spaced learning and depth of processing through visualizations while making the whole end over fun and interactive. Additionally, Game-based applications need to be designed to put the learner in an active, rather than passive, position during the learning process. The app is a native cross-platform application that runs on mobile phones and tablets and do not require an active internet connection. The application is developed to be used in all primary schools in Malawi. The users are both the teachers and the learners from these primary schools.
9	Amelia Taylor, Chimwemwe Chamangwana kailab.tech (MUBAS)	Self-Directed Learning for Community Health Workers in Malawi Through Generative AI **(Health)**	In many lower and middle-income countries, a lack of resources affects the availability and quality of education and training. In the healthcare domain, access to knowledge can make the difference between life and death. Timely access to technical and clinical guidelines to support decisions is crucial. Healthcare workers need access to up-to-date guidelines on case definitions for surveillance, treatment protocols, and relevant clinical and medical knowledge. However, guidelines documents tend to be bulky and complex and may change over time in response to health priorities, research, or public health emergencies. Generative AI has proven to be a disruptive technology in healthcare, but its limitations and applicability are subject to experimentation. We present evidence that Large Language Models (LLMs) can be leveraged to facilitate needs-driven and self-directed learning regarding guidelines for healthcare professionals in Malawi. We developed an application called IntelSurv that uses GPT-4 to achieve a 'chat'-like functionality where users ask questions about priority diseases, seek clarification on the use of case identification forms, and have access to technical guidelines published by the Ministry of Health. IntelSurv is both a web app and a mobile app and can run either online or offline. Healthcare professionals engaged in disease surveillance and community health in two major cities in Malawi tested the tool and gave positive feedback on its impact. We report on the development of the tool, and its use of GPT-4. We discuss choices of features and functionalities in response to testing and feedback from users.
10	Emmanuel Malunga (Mzuzu University)	Addressing Diversity and Inclusion in AI-Driven Healthcare **(Health)**	Artificial intelligence (AI) in healthcare lacks diversity and representation in training data, leading to biased and inaccurate results. This study aimed to develop a framework to address diversity and inclusion in AI-driven healthcare. We conducted a comprehensive review of AI applications in healthcare, identifying gaps in data representation and algorithmic bias. Our framework demonstrated improved diagnostic accuracy and reduced bias in treatment recommendations for underrepresented populations. This study highlights the importance of addressing diversity and inclusion in AI-driven healthcare, providing a

			framework to improve AI systems and reduce health disparities.
11	Lewis Msasa, Evelyn Chapuma, Grey Mengezi, Amelia Taylor kailab.tech (MUBAS)	mwBD: A Dataset of Satellite Imagery for Assessing Building Damage caused by Cyclone Freddy in Blantyre, Malawi **(Remote Sensing/ GIS)**	Recently, satellite and drone imagery have been used for detecting damage to buildings caused by environmental disasters such as flush floods or cyclones. In 2023, cyclone Freddy caused severe damage to several areas in Blantyre. We did not find a ready to be used dataset of satellite images of affected areas and buildings. Our contribution is to develop a methodology for preparing a dataset of satellite images from three areas in Blantyre (Chilobwe, Chirimba, and Ndirande) to be used for training classification models for the extent of damage to buildings. We report on our experiments in training a model on our dataset for classifying damaged buildings.
12	Patrick Ken Kalonde (MLW)	Geospatial Methods for Public Health Surveillance in Urban Environments **(Remote Sensing/ GIS)**	Background: Concerns about the impact of plastics on human health are increasing. This study aims to describe spatial-temporal patterns in urban waste to explore potential associations with human exposure to pathogens. While such evidence is crucial for guiding practical action, methods for mapping urban waste are still evolving. Here, we present our work on mapping urban waste in Ndirande, Malawi, including the practicalities of image acquisition, data processing, and the generation of valuable information that can inform policy and practice. Methods: We are running a drone-based environmental study that will continue until February 2025. We have been using a DJI Mavic 3M to collect aerial images of the Ndirande neighborhood, gathering approximately 6,000 images, which we process using open-source software—OpenDroneMap—installed on an in-house HPC system. The imagery has been annotated, and we have been training automatic classifiers, including a U-Net and some based on the Geographical Object-Based Image Classification framework. In parallel, we have used geostatistics to model the risk of exposure to pathogens known to be found in the environment (plastics) and are exploring potential associations with waste piles. This will help us understand and quantify the contribution of living in close proximity to waste on exposure to pathogens. Current results and next steps: Urban waste has been observed to exhibit unique patterns that can be mapped, and training automatic classifiers has shown varied performance, with model building still ongoing. While capturing drone images and processing them is practical for small areas, scaling up to larger areas, such as an entire community, presents

			challenges due to increased storage and computational resource demands. The use of HPC systems and parallel computing appears to offer a promising solution. Additionally, we have begun exploring potential associations between urban waste and human exposure to pathogens found on the surface of plastics.
13	Matthews Jere (UNIMA)	RGB Image Segmentation for UAV Imagery Using Fully Convolutional Neural Networks **(Remote Sensing/ GIS)**	Semantic segmentation of remote sensing imagery is a critical task in computer vision, enabling detailed scene understanding for applications such as agriculture, environmental monitoring, and urban planning. This paper presents a comparative study of advanced RGB image segmentation approaches using Fully Convolutional Neural Network (FCN) architectures, including Attention U-Net, Deeplabv3+, ResNetv2-based U-Net, MobileNetv2-based U-Net, VGG19-based U-Net, and EfficientNet-based U-Net. The ResNetv2-based U-Net model achieved the highest Intersection over Union (IoU) score of 0.91 on UAV-captured images from the Mpokwe Extension Planning Area in Zomba, Malawi. This model effectively segments maize, water, trees, bare land, built-up areas, and other vegetation types, enabling applications in agricultural yield estimation, land use analysis, and environmental monitoring. The MobileNetv2-based U-Net offered a balanced performance, making it suitable for real-time tasks due to its efficiency. This is an effort to leverage cost-effective RGB sensors to achieve competitive performance in image segmentation.
14	Gladson Phiri (MUST)	Leveraging Machine Learning Models to Assess Current Carbon Stock in Malawi **(Environment)**	In recent years, the issue of the carbon cycle has become an important topic in biodiversity management and conservation. Carbon Quantification is crucial for addressing the effects of climate change on biodiversity, health and Agriculture. This study used machine learning to assess the present carbon stock in Malawi. The study utilized datasets from the Global Aboveground and Belowground Biomass Carbon Density Maps for the Year 2010 and 2017, current land use/land cover maps, and soil organic carbon data to quantify current carbon stock in Malawi. Methodology: the Random Forest algorithm was applied using the R programming environment, specifically utilizing the 'randomForest', raster', package. Additional data processing and visualization were conducted using packages such as 'dplyr', 'ggplot2', 'sf', and 'terra' packages. The remote sensing data included satellite imagery and biomass carbon density maps, providing detailed information on vegetation structure and biomass. The model's training process involved feature selection and hyperparameter tuning to

			optimize performance. Vegetation indices, topographic variables, and climatic variables were incorporated as features. Cross-validation was employed to prevent overfitting, and the model's performance was evaluated using metrics such as R^2 and Root Mean Square Error. The results indicate that the RF model effectively estimated carbon stock with an R^2 value of 0.85 and an RMSE of 2.1 Mg C/ha. The spatial distribution of carbon stock revealed significant variations across different land cover types, with the highest carbon densities found in forested regions and lower densities in agricultural and urban areas. These findings provide a comprehensive understanding of carbon stock distribution in Malawi, which is crucial for formulating sustainable land management and conservation strategies. This study demonstrates the potential of machine learning, particularly the Random Forest model, to accurately estimate carbon stock. By integrating data on biomass carbon density, land use/cover, and soil organic carbon, the approach offers a scalable and efficient means to assess carbon stocks, which can provide valuable insights for climate change mitigation and environmental conservation initiatives in Malawi.
15	Chimango Chisuwo (Independent Scientist)	Mapping water bodies using sentinel c-band synthetic aperture radar and machine learning **(Environment)**	The aim of this study is to map the extent of open water in lakes from 2016 to 2024 and observe seasonal variations in their spatial extent. To achieve this, the study will utilize Sentinel-1 C-band Synthetic Aperture Radar (SAR) in Interferometric Wide (IW) mode with dual polarization capabilities. The research will focus on analyzing how the area of open water changes throughout the year and over the eight-year period. The dual-polarization SAR data will be instrumental in accurately capturing and monitoring these variations in lake water extent.
16	Mudaniso Hara (LUANAR)	Breaking Barriers in Mental Health Analysis in Malawi: Leveraging Synthetic Data-Powered AI Models **(Health/ Education)**	In the context of university level Open and Distance Learning (ODL) programs in Malawi, the mental well being of students is a matter of paramount importance. However, the absence of comprehensive counseling datasets presents a significant challenge in addressing mental health issues effectively. This study seeks to address this gap by employing Artificial Intelligence (AI) techniques to analyze the mental health of ODL students, making use of synthetic data due to the scarcity of counseling datasets in Mal awi's university ODL programs. Again, e-counseling can be a valuable solution for addressing the shortage of mental health counselors supporting ODL students by providing accessible, timely, and scalable support services. Through the generation of synthetic data that simulates counseling interactions, emotional expressions, and mental health scenarios,

			this research harnesses the potential of AI models. These models are deployed to uncover hidden patterns and trends within the synthetic mental health data. The study explores sentiment analysis, emotion recognition, and natural language processing to gain insights into the emotional states and well being of university ODL students. Additionally, this research investigates the influence of demographic variables and academic backgrounds on mental health outcomes, offering a comprehensive understanding of the unique challenges faced by ODL students. By leveraging synthetic data, this study provides an innovative avenue for developing and evaluating strategies to enhance mental health support services in the absence of actual counseling datasets in Malawi. The findings contribute to the broader discourse on the application of AI in the domain of remote education, particularly in the context of university level ODL, with a focus on promoting students' mental health and overall academic success.
17	Mudaniso Hara (LUANAR)	Application of Deep Learning in Assessment of Drought using Google Earth Engine (GEE) in Drought Prone Areas in Malawi (**Environment**)	While various methods have been implemented for drought prediction, few studies in Africa have utilized Artificial Intelligence (AI). AI models have demonstrated the ability to simulate and analyse large datasets, as well as model extensive areas in a near-continuous manner. However, in Malawi, the adoption of AI for drought monitoring has been minimal. This study aims to contribute to the understanding of AI use in drought monitoring by specifically modeling soil moisture during the growing season with Deep Learning and mapping drought patterns. The study will employ remote sensing techniques and use geospatial data from Google Earth Engine (GEE), with analysis conducted via the GEE Application Programming Interface (API). The research findings are anticipated to offer valuable insights into drought dynamics in Malawi and inform strategies for drought mitigation and adaptation.

OPTIONAL

2	Aleka Melese Ayalew	An Internet of Things Based Machine Learning Framework for Real Time Tuberculosis Monitoring and Detection **(Health)(Online)**	Tuberculosis (TB) is a highly infectious illness that affects millions of people throughout the world. Early identification is critical for reducing the spread of the disease and improving patient outcomes. The study proposes a real-time TB monitoring and detection system using an Internet of Things (IoT) framework. This system collects real-time user symptom data to monitor treatment response, identify suspected symptoms early, and determine the nature of TB through data analysis. The IoT has altered the way communication takes place in conjunction with data collecting sources supported by smart sensors. It has also implemented in machine learning (ML) approaches to improve decision making through efficient data gathering, storage, retrieval, and management. The framework comprises four key components: wearable sensor-based symptom data collection, cloud infrastructure, machine learning models for data analysis, and doctors. This study employs five machine learning algorithms, namely Decision Tree, K-Nearest Neighbor (K-NN), Nave Bayes, Support Vector Machine (SVM), and Artificial Neural Network (ANN), to rapidly predict potential tuberculosis patients from real-time symptom data. After testing all algorithms, the ANN algorithms achieved 100% training accuracy, 99% test accuracy, and a 100% AUC score. In this study, ANN approaches were better than other machine learning algorithms. Based on these results, we believe that real-time symptom data will allow our machine learning algorithms to provide precise and effective diagnoses of potential TB cases, and the framework will assist in monitoring each patient's response to treatment.

3	Nigus Asnake	X-ray image-based pneumonia detection and classification using deep learning **(Health)(Online)**	Pneumonia is a dangerous lung disease that has affected millions of people worldwide. Several people have died as a result of incorrect pneumonia diagnosis and treatment. This has necessitated the urgent need for quick detection and classification methods of pneumonia detection for efficient treatment and quick recovery of affected persons. However, the causes of pneumonia are not accurately diagnosed using outmoded methods which use chest X-rays. This paper therefore presents a method for identifying and classifying chest X-ray images of normal and pneumonia-infected persons. The designed deep learning model first preprocesses the X-ray images to extract useful features, then segments them using a threshold segmentation technique, detects normal and pneumonia infected persons from X-ray images using the YOLOv3 detector, and classifies them as normal and with pneumonia using Support vector machine (SVM) and softmax. The suggested model was trained and evaluated using a dataset of chest X-ray images. The results show that the overall accuracy, precision, recall, and F1-score are all 99%. The findings show that deep features produced accurate and consistent characteristics for pneumonia detection. Using the presented approach, radiologists can assess pneumonia patients and deliver a rapid diagnosis.
10	Glory Phiri (Mzuzu University)	Diabetes Risk Prediction System using Machine Learning Algorithms **(Health)**	Diabetes is one of the chronic diseases that causes blood sugar levels to rise. Diabetes is one of the leading causes of blindness, kidney failure, amputations, heart complications, hypertension, and damage to various organs. Diabetes can be caused by various factors such as age, obesity, lack of physical exercise, hereditary diabetes, lifestyle, bad diet, and high blood pressure. Early detection and management are crucial in preventing complications and improving patient's quality of life. Traditional methods rely on symptoms, healthcare professionals use physical and chemical tests for diagnosing diabetes. These tests often focus on specific symptoms associated with diabetes which means they may not detect early signs of diabetes or consider other contributing factors. This project aims to develop a system that can perform early prediction of diabetes using machine learning techniques. The proposed system will analyze various health parameters such as blood glucose level, body mass index, age, family history, and lifestyle factors to predict the risk of developing diabetes for individuals. The system will employ a diverse set of Machine Learning algorithms including K-Nearest Neighbor, Logistic Regression, Decision Tree, Support Vector Machine, Naïve Bayes, Gradient Boosting, Random Forest, and Adaptive Boosting to effectively learn from the dataset and provide accurate results.
4	Mtendere Elizabeth Mderu	AI Umoyo : a future doctor's perspective on Malawi's	This presentation explores the transformative potential of artificial intelligence (AI) in the healthcare sector, as seen from a future doctor's perspective. The aim is to present a

		health technology **(Health)(Online)**	multifaceted view of AI in healthcare, including opportunities for AI-assisted diagnosis, treatment, and management of health conditions, as well as personalized healthcare, improved efficiency, and cost-effectiveness, and addressing health disparities. However, as with any new technology, ethical considerations must be taken into account, and this presentation will explore strategies for promoting responsible use of AI in healthcare.