



ARTIFICIAL
INTELLIGENCE
FOR
DEVELOPMENT
AFRICA



Research and Application of Artificial Intelligence and Machine Learning in Africa

A Compendium of Research Projects



Research and Application of Artificial Intelligence and Machine Learning in Africa

A Compendium of Research Projects

Table of Contents

| | | |
|-----|---|----|
| I. | ABOUT AI4D AFRICA SCHOLARSHIP PROJECT | V |
| II. | RESEARCH PROJECTS | |
| | A framework for an early warning system for the management of the spread of Locust invasion based on Artificial Intelligence Technologies | 1 |
| | Secure and efficient anonymous certificate-less encryption for key distribution scheme for smart grid | 2 |
| | Optimization of machine learning techniques for agricultural yield prediction | 3 |
| | Application of deep learning model on stress detection of tomato in Benin | 4 |
| | Prediction model and decision support system for Chronic Obstructive Pulmonary Disease (CORD) patients based on wearable pulse oximeter | 5 |
| | An agent-based model for surveillance of Dengue and Chikungunya in Sub-Saharan Africa..... | 6 |
| | RSSI-assisted propagation loss learning algorithms for mobile user tracking through 802.11 WLAN indoor fingerprinting..... | 7 |
| | Ensemble convolutional neural network for multiclass, multilabel retinal disease detection | 8 |
| | Internet of Things (IoT) security for e-health in developing countries | 9 |
| | Speech improvement framework using long short-term memory neural network and dynamic time warping to improve Kenyatta National Hospital health records retrieval | 10 |
| | Modelling spectrum sensing using machine learning and deep learning for wireless networks in South Africa | 11 |
| | Leveraging geospatial technology for smallholder farmer credit scoring | 12 |
| | Developing methods to monitor and analyze eutrophication of Lake Tana from remote sensing imagery using machine learning– Upper Blue Nile, Ethiopia | 13 |
| | The hybrid approach in verbal autopsy cause of death determination..... | 14 |
| | Examining East Africa’s precipitation and temperature response to nitrogen dioxide, sulphur dioxide and carbon monoxide..... | 15 |
| | School curriculum and learning contents matching using machine learning algorithms..... | 16 |

| | |
|---|-----------|
| Development of numerical and statistical weather prediction methods for intelligent management of electrical networks with a high rate of renewable energy | 17 |
| Practical use of random forest regression for predicting disease vector abundance: application to the abundance of Rhipicephalus appendiculatus in permanent livestock pastures..... | 18 |
| Development of an intelligent system for the management of agricultural crop diseases for sustainable development in Niger | 19 |
| Automatic generation of biomedical image captions (biomedical images captioning) | 20 |
| The use of artificial intelligence in mitigating crop losses in Cape Verde..... | 21 |
| Using machine learning algorithms for efficient complex system analysis on multi-core architectures | 22 |
| An AI enhanced detection and treatment of tomato plant diseases in Africa..... | 23 |
| Statistical and physically based hyperspectral and multispectral reflectance modelling for agricultural monitoring: A case study in Vilankulo, Mozambique | 24 |
| Leveraging multi-agent models for learning recommendations and improvement of farmer-to-farmer interactions in small scale dairy | 25 |
| Crop conditions monitoring and yield prediction using IoT systems and machine learning techniques for precision agriculture (Case study of maize in Rwanda) | 26 |
| Application of AI/ML approaches in targeting aid beneficiaries..... | 27 |
| Deep learning techniques for early detection of crop diseases..... | 28 |
| An integrated AI, IoT and mobile App based tool for early-prediction and control of mycotoxin in grains case-study: maize and peanuts crops in Tanzania..... | 29 |
| Machine Translation (MT) and Automatic Speech Recognition (ASR) for Dioula..... | 30 |
| III. AI4D AFRICA SCHOLARSHIP PROJECT EVENTS..... | 33 |
| IV. RESEARCH PUBLICATIONS..... | 34 |

About AI4D Africa Scholarship Project

The African Centre for Technology Studies (ACTS) is implementing the Artificial Intelligence for Development in Africa (AI4D) Scholarship Project to foster and nurture talent in responsible Artificial Intelligence (AI) and Machine Learning (ML) in African public universities.

The 3-year project, funded by the International Development Research Centre (IDRC) and the Swedish International Development Cooperation Agency (SIDA), aims to meet the growing demand for research and development in responsible Artificial Intelligence (AI) and Machine Learning (ML) in the continent.

Specifically, the project is supporting selected scholars to undertake and successfully complete PhD research in AI and ML in African universities; and early career academics (ECA) to strengthen their research and development capacities in the two areas. Special consideration is given to research projects on responsible AI innovation for sustainable development, gender equity, equitable regional distribution in low-income countries.

ACTS is implementing the AI4D Africa scholarship project in partnership with Kwame Nkrumah University of Science & Technology in Ghana; University of Linköping, Sweden and Université Cheikh Anta Diop de Dakar, Senegal. Other partners include the Regents of the University of California, United States; Human Sciences Research Council and Institute for Humanities in Africa based in South Africa; and the University of Eduardo Mondlane, Mozambique.

This initiative is built on the premise that whereas majority of doctoral graduates expect to secure jobs in academic and research, a postdoctoral period is desirable to develop fully-fledged, independent, and competent researchers. Also, there are very few universities in Africa that currently offer MSc and PhD programs in AI and ML. The bulk of the departments, however, do offer MSc and PhD in ICT related courses with some potential to supervise PhD in AI and ML.

Apart from supporting research capacities of selected scholars, the programme will enhance the capacities of existing ICT departments to offer MSc and PhD in AI and ML by supporting them with research tools and related infrastructure for AI and ML. This will not only facilitate research activities of Early Career Academics (ECA) but will also be made available to other postgraduate and final year undergraduate students within the departments.

The program design has also lined up a series of complementary activities that will help enhance research capacities of the scholars which include short-courses, PhD Academy, quarterly seminars, annual workshops, mentorship, regional conferences and online training.

After three years, it is expected that there will be a critical mass of scholars to enhance research and development in AI and ML related fields while public universities in sub-Saharan Africa will have developed their capacities to provide postgraduate training in AI and Machine Learning. In addition, there will be adequate access to knowledge by researchers and practitioners and enhanced networking opportunities of the AI and ML scholars

The programme is also expected to generate substantial evidence for policy making on AI and ML related issues enhanced in Sub-Saharan Africa.

This initiative is built on the premise that whereas majority of doctoral graduates expect to secure jobs in academic and research, a postdoctoral period is desirable to develop fully-fledged, independent, and competent researchers. Also, there are very few universities in Africa that currently offer MSc and PhD programs in AI and ML. The bulk of the departments, however, do offer MSc and PhD in ICT related courses with some potential to supervise PhD in AI and ML.



22 African Universities



**20 PhD Scholars
10 Male. 10 Female**



**10 ECAs
5 Male 5 Female**



**23 students under ECAs
19 MSc and 4 PhDs**

LIST OF ACRONYMS

| | |
|-------|--|
| ACTS | African Centre for Technology Studies. |
| AI | Artificial Intelligence. |
| AI4D | Artificial Intelligence for Development in Africa. |
| AML | African Migratory Locust. |
| ANN | Artificial Neural Networks. |
| CDSS | Clinical Decision Support System. |
| CNN | Convolution Neural Network. |
| CO | Carbon Monoxide. |
| COPD | Chronic Obstructive Pulmonary Disease. |
| DL | Deep Learning. |
| ECAs | Early Career Academics. |
| EnR | Renewable Energies. |
| FAO | Food and Agriculture Organization. |
| FAW | Fall Army Worm. |
| GAN | Generative Adversarial Network. |
| GDP | Gross Domestic Product. |
| ICT | Information Communication Technology. |
| IDRC | International Development Research Centre. |
| IoMT | Internet of Medical Things. |
| IoT | Internet of Things. |
| KNN | K Nearest Neighbours. |
| LMICs | Low and Low Middle Income Countries. |
| LR | Logistic Regression. |
| ML | Machine Learning. |
| MSc | Masters of Sciences. |
| MT | Million Tonnes. |
| NB | Naïve classification Bayesian. |
| NO2 | Nitrogen Dioxide |
| NWP | Numeric Weather Prediction. |
| PhD | Doctorate of Philosophy. |
| PNT | Positioning, Navigation and Timing. |
| RF | Random Forest |
| RSSI | Received Signal Strength Indicator. |
| SDG | Sustainable Development Goals. |
| SO2 | Sulphur Dioxide. |
| SSA | Sub Saharan Africa. |
| SSPs | Small Scale Producers. |
| SVM | Support Vector Machines. |
| UAVs | Unmanned Aerial Vehicle. |
| VA | Verbal Autopsy. |
| WLAN | Wide Local Area Network. |
| WRF | Weather Research and Forecasting. |
| WSNs | Wireless Sensor Network. |

AI4D Project Team



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Team Leader



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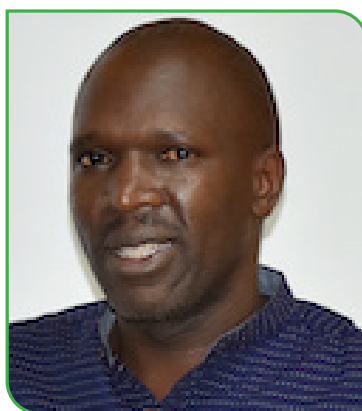
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Selected AI4D Africa Scholarship Research Projects



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Supervisor: Prof. Jackson Phiri
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A framework for an early warning system for the management of the spread of locust invasion based on artificial intelligence technologies

Research Overview



Locust swarms can consume vast amounts of vegetation, including crops, pastures, and trees. This leads to severe damage to agricultural lands, resulting in crop failure, reduced food production, and loss of livestock grazing areas. The destruction of crops can have devastating consequences for local communities, especially in regions where agriculture is a primary source of livelihood. Many small-scale farmers and pastoralists heavily rely on their agricultural activities and livestock for income and livelihoods. When locusts destroy their crops or deplete pasturelands, these communities suffer from income losses, reduced employment opportunities, and overall economic instability. Artificial intelligence (AI) can play a crucial role in managing the spread of locust invasions by providing real-time monitoring, early detection, and decision support. The existing management strategies for locusts are ineffective, unsustainable, and expensive. Thus, AI-based early warning systems for locust invasions in Africa can play a vital role in detecting and managing these infestations. Thus, it costs money to apply pesticides later than necessary because of the late discovery of a locust infestation. An AI-based early warning system for locust invasion in Africa can provide timely and accurate information, assisting in proactive measures, reducing the impact of locust infestations on agriculture, and enabling more efficient locust management strategies. This research study aims to explore how IoT, Geospatial, cloud computing and machine learning technologies can be used to detect African Migratory Locust (AML) invasion.

Research Objectives



- To identify challenges faced by farmers and government in controlling AML invasion using existing early warning models;
- To explore how IoT, Geospatial, cloud computing and machine learning technologies can be used to detect AML invasion;
- To design and implement an early warning system framework for AML Invasion.

Key Outputs



- An early warning system framework for AML Invasion
- PhD Thesis
- Research Publications
- Blogs
- Policy Recommendations

Expected Outcomes



- Improved accuracy in forecasting the potential areas of locust infestation;
- Enhanced knowledge and skills in the application of AI technologies for locust management;
- Increased agricultural productivity in affected areas.



Name: Jennifer Batamuliza
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Supervisor: Dr. Damien Hanyurwimfura
 University of Rwanda

Secure and efficient anonymous certificate-less encryption for key distribution scheme for smart grid

Research Overview



Smart Grid uses modern metering electricity and related devices to collect energy data in real time and generate client's electricity consumption reports to service providers, which is used by the latter for billing purposes. Through this smart grid, the daily energy consumption and devices used by the client can be predicted by the service provider depending on how much electricity is consumed. This poses a security risk where hackers can easily capture client's data while in transit to the service provider. The hacker can modify the transmitted data and the service provider will receive the wrong data. It would be critical to develop a key distribution system that is more efficient and secure to address key escrow related issues in existing devices. This research study, therefore, aims to develop a certificate-less signcryption for key distribution scheme which is more efficient and secure than the existing schemes. It allows for both decryption and verification by authorized users, provide Key Generation Center and provide low computation and communication cost compared to existing works. A Secure and Efficient Anonymous Certificate-less Encryption for Key Distribution Scheme for Smart Grid is designed to provide secure and efficient communication in a smart grid environment without the need for digital certificates.

Research Objectives



1. To design a Semantically-Aware Query based protocol that meets k-l diverse conditions and a semantically-Aware Query cloaking Algorithm that put into account the heterogeneity of these queries both for privacy preserving and later analyze the security of the proposed algorithm and carry out experiment to verify this;
2. To develop a three-Factor Authentication and privacy preserving Protocol Revisited in Distributed Systems.

Key Outputs



- A semantically-Aware Query based protocol
- PhD Thesis
- Research Publications
- Blogs
- Policy Recommendations

Expected Outcomes



- Reduced the risk of certificate-related attacks such as certificate forgery or theft;
- Enhanced efficiency and streamlined key distribution process.



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Supervisor: Prof. Romain Glele
University of Abomey-Calavi

Optimization of machine learning techniques for agricultural yield prediction

Research Overview



Climate change has significant effects on agricultural production in Benin, impacting the country's food security, rural livelihoods, and overall economy. Agricultural production conditions are becoming more difficult due to climatic variabilities, complex of the African continent and its interaction with socio-political challenges. Climate change has led to alterations in rainfall patterns, including shifts in the timing, duration, and intensity of rainfall. This variability affects the growing seasons, crop water requirements, and overall water availability for agricultural activities. Changes in temperature and rainfall patterns can have direct impacts on crop yields and productivity. Heat stress, water scarcity, and altered pest and disease dynamics can result in reduced crop yields and lower-quality produce. However, few studies have been done to show that the metamorphosis of the ozone layer and the variabilities of the season can naturally induce a remarkable variation in yield. Early prediction of maize yield allows for early identification of potential production shortfalls or surpluses. This information is vital for policymakers and stakeholders to take proactive measures to ensure food security, such as implementing appropriate agricultural policies, managing imports and exports, and initiating interventions to address any anticipated food shortages. This research study focuses on maize's plants (*Zea mays*) as a basis for bidirectional analysis. It focuses on the weather and fertilization pattern using growth and yield parameters and also yield prediction from weather and fertilization scenarios.

Research Objectives



1. Determine from pattern mining algorithms associated with pre-generated weather characteristics using maize yield data cultivated in real environments;
2. Assess the effect of pre-generated weather characteristics and fertilization levels on the growth parameters and the yield of maize;
3. Assess the performances of Ensemble Learning techniques compared with other Machine learning methods for the yield maize prediction;
4. Assess the effect of variation of hyper-parameters on the performance metrics of the main machine learning methods and compute the final optimization technique of maize.

Key Outputs



- A model for early prediction of maize yields
- User-friendly software applications
- PhD Thesis
- Research Publications and blogs
- Policy Recommendations

Expected Outcomes



- Enhanced food security and agricultural policies;
- Improved accuracy and reliability of yield predictions;
- Improved understanding and skills in the application of optimized machine learning techniques for yield prediction.



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Application of deep Learning model on stress detection of tomato in Benin

Research Overview



Tomato, one of the most important vegetable globally, is often exposed to diseases and pests. Tomato bacterial wilt, the most important phytosanitary constraint for its production is caused by three pathogens: *Sclerotium rolfsii*, *Fusarium oxysporum f. sp. lycopersici* and *F. solani*; the first being the most devastating (Sikirou et al., 2015). Southern blight is also a challenge for tomato production, but it is not as dangerous as the first disease. Tomato diseases can have significant impacts on yields in Benin, affecting both the quantity and quality of tomato production. These challenges in addition to the constraints due to abiotic stress cause enormous damage to producers. This lack of control leads to a considerable reduction of tomato yields. Adoption of advanced and efficient technologies like computer vision, deep learning, big data analytics is therefore critical to improve tomato yields in Benin. The application of deep learning models for stress detection in tomato plants in Benin can provide valuable insights into plant health and enable timely intervention. By applying deep learning models for stress detection in tomato plants in Benin, farmers and agricultural stakeholders can benefit from early identification of stress conditions, allowing for timely interventions such as irrigation adjustments, nutrient supplementation, disease management, or pest control. This approach can help optimize tomato plant health, improve yields, and enhance overall agricultural productivity.

Research Objectives



1. Determine the sources of stress on fruits and vegetables especially tomato plants using deep machine learning;
2. Empirically compare the performance of the main Deep Learning techniques used to detect plants stresses;
3. Build a scalable Deep Learning model with potential to detect climate-based stresses on tomato plants;
4. Develop a scalable Deep Learning model with potential I to detect disease based-stresses on tomato plants.

Key Outputs



- Tomato disease detection model
- PhD Thesis
- Research Publications and blogs
- Policy Recommendations

Expected Outcomes



- Improved accuracy in identifying various stress factors affecting tomato plants;
- Increased tomato yields and improved farmer incomes;
- Enhanced decision-making capabilities, enabling farmers to optimize resource allocation and apply targeted treatments.



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 University of Rwanda

Prediction model and decision support system for chronic obstructive pulmonary disease (CORD) patients based on wearable pulse oximeter

Research Overview



Chronic Obstructive Pulmonary Disease (COPD) is characterized by airflow limitation that is not fully reversible. The disease process causes a number of very distinct, physiologic and structural lung changes that are responsible for the varying degree of COPD symptoms. The standard way of COPD diagnosis is GOLD staging that is based on FEV1 for classifying the severity of airflow limitation. With this, the characteristics of patients in different GOLD stages are known, such as their risk of exacerbation, hospitalization and death. However, at an individual level FEV1 is unreliable marker of the severity of breathlessness, exercise limitation and health status impairment. Therefore, the myriad of patient physiologic profiles within individual Gold stages confounds efforts to create effective nested rules systems. Currently, app-based solutions that simply mimic paper based home action flowcharts, use routine questionnaires by providing an overall daily symptoms assessment score. The latter could not determine the severity of every single respiratory symptom at individual level. This work presents models that remotely monitors the health status of patients and they detect the onset of COPD related worrisome events. A personalization of patient-specific data that include likely symptom-cut points to cope with symptoms uncertainty and COPD factors interdependence complexity, will be trained in these predictive models This research aims at promoting tele healthcare system based on (by the integration of) Prediction Model for a personalized easy classification and subsequent triage of COPD patients and Decision Support System for COPD worrisome efficient management based on wearable pulse oximeter. This will be able to reduce hospital admission for COPD patients, length of stay and mortality by improving COPD patient’s healthcare and management.

Research Objectives



1. Provide a cloud computing hybrid AI-CDSS application to facilitate physicians to make decision on processed patients cases more intelligently;
2. Design an interpretable prediction model for COPD continuous monitoring to detect in real time exacerbation, subsequent exacerbations and COPD associated worrisome.

Key Outputs



- An interpretable prediction model for COPD
- PhD Thesis
- Research Publications and blogs
- Policy Recommendations

Expected Outcomes



- Reduce hospital admission for COPD patients, length of stay and mortality;
- Cost savings associated with the adoption of the system in healthcare settings;
- Improved patient outcomes in COPD management.



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An agent-based model for surveillance of Dengue and Chikungunya in Sub-Saharan Africa

Research Overview



Despite the known factors that lead to infectious diseases, there are still unknown factors that lead to the emergent of infectious diseases, as a result of not being to detect diseases on time and therefore delayed emergency response. Thus, producing timely, well-informed and reliable forecasts for an ongoing epidemic of an emerging infectious disease is a huge challenge (Venkatramanan, et al., 2018). Most of the solutions to address availability of health data on disease outbreaks, surveillance and containment have not focused on the climatic and environmental components that govern these diseases. But in today's world, the technology requires to analyse and model the interactions in the dynamic systems in order to understand how the disease agents may change their participation as conditions, policies and rules change. Agent-based modelling and simulation provides a suitable solution for infectious diseases because it introduces a computing paradigm where intelligent agents can be used to perform tasks such as sensing, planning, scheduling, reasoning and decision-making (Jun Wu, 2020; Pereda, Santos, & Galán, 2015).

Research Objectives



1. To conceptualize the Agent-Based Model study domain on Dengue and Chikungunya diseases;
2. To develop Agent-Based Model and Simulation for surveillance of Dengue and Chikungunya in Tanzania;
3. To develop decision support tools to support differential diagnostics and surveillance for Dengue and Chikungunya in Tanzania.

Key Outputs



- Agent-Based Model for Surveillance of Dengue
- PhD Thesis
- Research Publications
- Blogs
- Policy Recommendations

Expected Outcomes



- Improved detection and response to dengue fever outbreaks;
- Reduced mortality and morbidity due to dengue fever.



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RSSI-assisted propagation loss learning algorithms for mobile user tracking through 802.11 WLAN indoor fingerprinting

Research Overview



Current indoor WiFi positioning systems and their utilization in applications are hampered by the lack of understanding of the requirements present in the real-world deployments. The complex indoor areas surrounded by equipment (i.e., furniture) and human beings are the causes of the multipath effect in radio propagation. Multipath and signal blockage are some of the main challenges to overcome for more accuracy in tracking locations of mobile devices. Directional communications at 60GHz are vulnerable to obstacles in mmWave networks. The project aims to improve the accuracy and efficiency of mobile user tracking in indoor environments using received signal strength indicator (RSSI) data and fingerprinting techniques based on 802.11 WLAN signals

Research Objectives



The overall objective of this research is to develop a conceptual framework for a robust autonomous mobile user tracking for caching-enabled access points for delivery services such as file sharing, information multicasting in buildings (huge malls, campus, etc.) to dedicated customers. For example, in universities students can be provided with information about the various campus facilities, files available in the different cache access points, events on campus etc. Several techniques are designed to track location of mobile users. The learning algorithm updates the propagation model as the mobile user moves in different indoor environments.

Key Outputs



- A conceptual framework for a robust autonomous mobile user tracking
- A PhD Thesis
- Research Publications
- Blogs
- Policy Recommendations

Expected Outcomes



- A more resilient tracking system that can adapt to changing signal conditions;
- Enhanced accuracy of mobile user tracking.



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Supervisor: Prof. Serestina Viriri
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Ensemble convolutional neural network for multiclass, multilabel retinal disease detection

Research Overview



There has been a significant increase in cases of sight threatening retinal diseases across the world, with developing countries the worst affected owing to compromised budgets to effectively detect and arrest progression. Deep Learning methods show promise in a bid to provide automated detection models but more needs to be done to provide methods that could match or surpass human level detection accuracies and gain trust and acceptance from the Food and Drug Associations across the world. While Ensemble methods have proved to be successful in obtaining better performances in other machine learning applications, not much research has been done to explore the potential of ensemble methods for multiple retinal disease diagnosis.

Research Objectives



1. Review literature to understand state of the art methods for detection of multiple retinal diseases
2. Acquire datasets for model development;
3. Pre-process the datasets to ready them for model development;
4. Train ensemble Convolutional Neural Networks on the datasets;
5. Evaluate the performance of the ensemble models;
6. Publish research outcomes.

Key Outputs



- A model for early detection of retinal diseases.
- PhD Thesis
- Research Publications
- A prototype of a convolutional neural network for retinal diseases
- Policy Recommendations

Expected Outcomes



- Improved accuracy and reliability of disease detection, leading to early and accurate diagnosis for patients;
- Improved patient outcomes through early detection of retinal diseases and improved access to health care;
- A solution that is affordable, easy to use, and can be deployed in resource-constrained healthcare environments.



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Internet of Things (IoT) security for e-health in developing countries

Research Overview



With a large number of IoT applications comes risks of security and privacy. Without a reliable and interoperable IoT ecosystem, emerging IoT applications cannot achieve high demand and thus not operate at their full potential. In addition the Internet, cellular networks, and WSNs, IoT has unique security challenges such as privacy issues related to authentication, management, information storage, etc. Device security is about protecting IoT devices from attacks, while data security is related to protecting the integrity and confidentiality of data generated by IoT sensors and other monitoring instruments. This also applies to user privacy. The first step towards securing IoT devices is risk identification and categorization, in which the impact of different IoT devices is considered. Next, the feasibility principle analyzes implementation complexity, cost, and verifiable details to address the verifiability of the implementation. Medical IoT systems have become the core of the e-healthcare field, where smart sensors and medical devices are installed to improve the life span and health status of patients. However, this field has suffered various attacks targeting medical systems. Analysis of previous security and privacy systems of IoT have been discussed but not actually related to IoMT. Various intrusion detection methods and authentication/authorization have been discussed to ensure a secure IoT environment with little regard to their application to IoT. This research aims to develop and optimize security mechanisms to ensure the privacy and confidentiality of sensitive health data transmitted and stored within IoT devices and systems

Research Objectives



1. A comprehensive bibliographic study of the state of IoT security in the medical field and medical data.
2. Study of new security approaches, their integration in the IoT (limited resource) and the securing of medical data using intelligent and light cryptographic techniques
3. Study the effects of blockchain for the security of IoMT and medical data.
4. Develop customized blockchain systems of record with enhanced privacy features and limited accessibility.

Key Outputs



- A customized blockchain systems of record with enhanced privacy features
- PhD Thesis
- Research Publications
- Security Frameworks, tools and Guidelines
- Policy Recommendations

Expected Outcomes



- Improved safety of patient medical information;
- A more secure and resilient IoT infrastructure for e-health services.



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Supervisor: Dr. Lawrence Nderu
 Jomo Kenyatta University of Agriculture and Technology (JKUAT)

Speech improvement framework using long short-term memory neural network and dynamic time warping to improve Kenyatta National Hospital health records retrieval

Research Overview



Speech recognition is the capability of a machine program to identify spoken word and convert it to a readable format. It helps to recognize vocalized words to finish a task that has been assigned or decipher the spoken word into text. In the sector of health care, the providers regularly use speech recognition to generate medical documentation. This has in a great way enhanced and transformed the way healthcare providers execute their day-to-day tasks thanks to the several improvements that have been developed in the recent years. Currently in the area of speech signal processing there is still a challenge on speech improvement. Reviewed literature on speech recognition present numerous speech improvement algorithms which can be categorized into filtering, spectral restoration and speech model techniques (Liu et al., 2019). These methods are widely used, however they are not very competitive in late lncy reduction, increased accuracy and give poor output in a noisy environment. With ongoing development of neural networks in deep learning, this study will develop a framework based on long short-term memory neural network and dynamic time warping algorithm which will be tested and validated using data obtained from health records.

Research Objectives



1. To investigate and review existing literature on Long Short-term Memory Neural Network and Dynamic Time Warping for speech recognition;
2. To develop speech improvement framework based on Long Short-Term memory Neural Network and Dynamic Time Warping;
3. To implement the long short-term memory and dynamic time warping framework and evaluate the accuracy level and latency;
4. To test and validate the developed framework for speech recognition using Kenyatta National Hospital health records data.

Key Outputs



- Speech Improvement Framework/system
- PhD Thesis
- Research Publications
- Evaluation metrics and benchmarking methodologies
- Policy Recommendations

Expected Outcomes



- Improved Speech Recognition Accuracy;
- Improving speech quality and fluency.



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Gender: Male



Supervisor: Prof. K. Sibanda
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Modelling spectrum sensing using machine learning and deep learning for wireless networks in South Africa

Research Overview



Wireless networks rely on limited radio frequency spectrum resources to provide communication services. With the ever-increasing demand for wireless connectivity, efficient spectrum utilization is crucial. ML and DL can help optimize spectrum allocation and improve spectral efficiency by accurately sensing and detecting available spectrum bands, thereby mitigating spectrum scarcity issues. In South Africa, as in many other countries, spectrum bands are allocated to different services and license holders. However, these bands are not always fully utilized, leading to inefficiencies. ML and DL algorithms can enable dynamic spectrum access, allowing secondary users to opportunistically access underutilized spectrum bands without causing interference to primary users. This approach can effectively address spectrum scarcity concerns and increase spectrum utilization efficiency. Modelling spectrum sensing using ML and DL techniques is crucial for wireless networks in South Africa. By leveraging these advanced algorithms, South Africa can address spectrum scarcity, optimize spectrum utilization, mitigate interference, enable dynamic spectrum access, enhance spectrum management, and improve overall network performance. Spectrum scarcity has accelerated the need to design efficient methods for spectrum optimization. Several algorithms have been currently put forward for spectrum sensing. However, these methods tend to fall short in low signal-to-noise ratio environments. Some algorithms are computationally complex as they require knowledge of the noise signal before sensing the spectrum. Hence this research aims to employ several Machine learning / deep learning algorithms for the optimization of spectrum sensing in a sample of wireless networks in South Africa.

Research Objectives



1. To analyze existing spectrum sensing techniques in cognitive radio networks;
2. To analyze machine learning optimization algorithms that can be applied for spectrum sensing;
3. To develop and evaluate a spectrum sensing model for cognitive radio networks.

Key Outputs



- Spectrum Sensing Models and Simulation Tools
- Datasets
- PhD Thesis
- Research publications
- Policy Recommendations

Expected Outcomes



- Increased network capacity, improved quality of service, and efficient spectrum utilization;
- Improved spectrum utilization and optimization of wireless network performance.



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Gender: Female



Supervisor: Prof. Galcano Mulaku
University of Nairobi

Leveraging geospatial technology for smallholder farmer credit scoring

Research Overview



Financial exclusion has a major impact on small holder farmers in Kenya. Credit history is often required by financial institutions to evaluate the risk of a potential borrower before making lending decisions. Most farmers face hindrances when they want to access credit facilities to fund their farming activities. This is mainly because they lack financial history data which is required by financial institutions to create credit scores for credit risk evaluation. In retrospect, financial institutions are faced with a challenge of collecting data from farmers in far flung areas that are hard to reach or access is physically limited due to poor road networks. To overcome these challenges and reduce financial exclusion, there is need to investigate how non-financial data which is not related to a person's financial activities can be used in credit scoring. There is no known study in Kenya that has sought to investigate and demonstrate how geospatial technologies can leverage farm credit scoring. Hence to break this cycle, this research seeks to fill the above gaps and at the same time answer the following: how can geospatial technologies, be used to leverage credit scoring for farmers?

Research Objectives



To demonstrate how geospatial technology can be used to leverage farm credit scoring for the benefit of small holder farmers. Specific objectives:

1. To identify the small holder farms in the study areas;
2. To determine the extent of small holder farmer financial exclusion;
3. To develop a new farmer credit scoring approach that includes remotely sensed crop data.

Key Outputs



- Credit Scoring Model/System/Approach
- PhD Thesis
- Research publications
- Blogs
- Policy Recommendations

Expected Outcomes



- Enhanced Credit Access for small holder farmers;
- Improved risk assessment for smallholder farmers;
- Increased financial inclusion among smallholder farmers in Kenya.



Name: Elias Legesse
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Country: Ethiopia
Gender: Male



Supervisor: Dr. Adimassau Seifu
 Bahir Dar University

Developing methods to monitor and analyze eutrophication of Lake Tana from remote sensing imagery using machine learning– Upper Blue Nile, Ethiopia

Research Overview



In Lake Tana basin shortage of data have hindered studies related to nutrient load prediction and watershed management scenarios to reduce water quality effluents from point and Non-point sources. Due to this, only very few researches (Goraw et al 2017& Teddy et al., 2016) have tried in the lake basin to identify the pollutant sources and transportation mechanisms. Others studies were conducted to show the status of the Lake's specific water quality parameters in a specific or whole area of the Lake for specific period (Dagnew et al., 2014, Mamaru A. Moges, et al. 2017, and Minychel G., et al. 2019). Modelling helps to predict nutrient loading and investigate different alternative watershed management that reduces water impairments. Such studies are only applicable in areas where long term water quality parameters are available. Because of the discontinuity of the insitu water quality measurement, variation of water quality parameters and variation of sampling locations between different studies it has been very difficult to do researches related to comparisons and/or trend analysis, modeling sources of pollutants and transport mechanism, and identifying effective management scenarios to reduce water quality effluents in to the lake from the results of previous studies.

Research Objectives



The main objective of this project is to develop intelligent multi-agent models for learning recommendation and improvement of farmer-to farmer learning for increase in milk yield. The proposed research will accomplish the following specific objectives:

1. To collect data on management choices, constraints and milk yield and defining requirements for the mobile application for peer-to-peer learning tool;
2. To develop a complete dataset by cleaning, sorting and labelling on-farm management and milk data based on 6 dairy production clusters;
3. To develop data-driven agent-based models and simulate peer to-peer farmer learning and networking for increase in milk yield;
4. To develop end user mobile applications for farmer peer-to-peer learning.

Key Outputs



- Data-driven agent-based models and simulation tools
- PhD Thesis
- Research Publications
- Blogs
- Eutrophication Monitoring Framework
- Policy recommendations

Expected Outcomes



- Improved understanding of spatial distribution and extent of eutrophication of lake Tana;
- Improved understanding of the causes and impacts of eutrophication on Lake Tana's ecosystem.



Name: Mahadia Ally Tunga

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Country: Tanzania

Gender: Female



Supervisor: Dr. James Chambua
University of Dar es Salaam (UDSM)

The hybrid approach in verbal autopsy cause of death determination

Research Overview



Physicians are being used to analyze VA data and establish causes of death. However, due to the high volume of cases to be dealt with by physicians, the process becomes sedate, costly and over time the quality is questionable. In the struggle to speed up the process, lower cost, and burden, multiple methods have been proposed to automate the assignment of causes of death from VA data using machine learning models such as Naive Bayes, InterVA, InsilicoVA, and Tariff. The existing models of predicting the individual causes of death produce results with limited accuracy far compared to physicians. These models ignore substantial amounts of data by assigning causes of death based only on the presence of symptoms or signs and disregarding information on medical history and circumstances preceding death. Limited accuracy makes the existing models ineffective. Thus, LMICs fail to reflect the country's condition of morbidity and associated factors resulting in poor functioning health systems. The main objective of this study is to develop a verbal autopsy-based hybrid data analytic model for improved determination of the cause of death in order to produce accurate mortality statistics.

Research Objectives



1. To establish the most significant features for improved prediction of cause of death using VA data;
2. To build a hybrid model for determining the cause of death based on the established features;
3. To validate the performance of the proposed model.

Key Outputs



- A hybrid model for determining the cause of death based on the established features.
- PhD Thesis
- Research Publications
- Blogs
- Verbal autopsy dataset
- Policy Recommendations

Expected Outcomes



- Improved accuracy of cause of death determination compared to traditional methods;
- Enhanced consistency of cause of death determinations across different settings and contexts.



Name: Opio Ronald
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Gender: Male



Supervisor: Dr. Joyce Nakatumba-Nabende
Makerere University

Examining East Africa's precipitation and temperature response to nitrogen dioxide, sulphur dioxide and carbon monoxide

Research Overview



Nitrogen dioxide, sulphur dioxide and carbon monoxide are important gases for air quality and meteorology. They are key contributors to ambient air pollution which accounted for a global sum of 4.2 million premature deaths in 2016 (World Health Organization, 2018). This is because they both trigger and exacerbate diseases such as lung cancer, ischemic heart disease, and lower-respiratory infections (Boogaard et al., 2019). Importantly, these gases also influence meteorology. Once emitted into the atmosphere, they exert a radiative forcing which is able to alter the pattern of temperature and precipitation away from the naturally existing pattern (Lewinschal et al., 2019), and this could have disastrous consequences on human livelihood and biodiversity. For example, given the influence that these parameters have on the hydrological cycle, determining events such as drought and flooding (Ma et al., 2020), any alteration in their natural pattern can have undesirable consequences. It's therefore of paramount interest to simulate the atmospheric abundances of these gases. Atmospheric models are often used for this task, however, they suffer from inherent biases (Long et al., 2020). This study proposes to reduce the bias in such models by performing a bias correction on the model output using neural networks.

Research Objectives



1. To examine the spatial and temporal distribution of NO₂, SO₂ and CO from 2005 to 2020. 2;
2. To examine the skill of the WRF-chem model in simulating the distribution of NO₂, SO₂ and CO in hotspot regions across East Africa;
3. To examine the skill of the WRF-Chem model when its bias corrected using a recurrent neural network and a convolutional neural network;
4. To examine the precipitation and temperature response to an increase in NO₂, SO₂ and CO emissions as simulated by the bias corrected WRF-chem model.

Key Outputs



- Statistical models
- Mapping and visualization
- PhD Thesis
- Research publications
- Blogs

Expected Outcomes



- Improved understanding of the relationship between air pollutants and East Africa's precipitation and temperature pattern;
- Increased stakeholder awareness, engagement, and participation in mitigation and adaptation efforts.



Name: Reine Clarisse
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Country: Cameroun
Gender: Female



Supervisor: Prof. Norbert Tsope
 University of Yaoundé I

School curriculum and learning contents matching using machine learning algorithms

Research Overview



In all education systems, teachers are provided with learning programs called curricula which define the pedagogical learning objectives, i.e. the behaviors that must be observed in learners at the end of their apprenticeship (Mager, 1962). The role of the teacher is to develop these objectives and then deliver the resulting learning content to the learners. Before submitting learning content (lessons and exercises) to learners, we must ensure that this content really corresponds to what is prescribed in the curriculum. This verification must be carried out by experts in the field taught, namely the pedagogical inspectors. The latter, having mastered the curricula and the concepts of the domain taught, have the role of verifying that the learning content proposed by a teacher is in line with what the curriculum requires to be taught. The verification of the adequacy between a learning content and what the curriculum prescribes is done manually by the pedagogical inspectors. As the number of inspectors is very limited, the learning content is very often submitted to the students without having been checked beforehand. We will thus observe in some cases content that is correct but which is not appropriate for the level of the learners and in other cases content at the level of the learners but which is not correct. This will have a negative impact on the actual skills that these learners must develop at the end of their apprenticeship. It is in view of all this that we proposed to set up a model capable of automatically verifying the adequacy between what is taught to learners and what should really be taught to them.

Research Objectives



1. Use the corpora of learning content validated by experts to build a model capable of predicting the degree of correspondence between a learning content and a curriculum;
2. Build corpora with experts and use it to design a model automatic capable of predicting whether a learning content is adequate for a learner of a given level.

Key Outputs



- A model capable of predicting the degree of correspondence between a learning content and a curriculum
- A model of predicting adequacy of learning content
- Phd Thesis
- Research Publications
- Policy Recommendations and blogs

Expected Outcomes



- Enhance the effectiveness of the curriculum by providing students with relevant and engaging content;
- Enable evidence-based decision making, leading to continuous improvement in educational practices.



Name: Christian Leigh
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Gender: Male



Supervisor: Prof. Mbainabeye Jerome
 University of N'Djamena

Development of numerical and statistical weather prediction methods for intelligent management of electrical networks with a high rate of renewable energy

Research Overview



Renewable energies (EnR) being considered as real alternatives to fossil fuels, their strong dependence on the variation of meteorological parameters considerably limits their exploitation. In order to push back this operating limit, new reliability and stability studies are being carried out to adapt the operation of electrical networks with a high rate of renewables. These studies being corrective, numerical weather prediction (NWP) is revealed as a preventive solution for intelligent management of these electrical networks. However, PNT is more complex and requires a huge mobilization of computing resources. Vis-à-vis this situation, research has been subdivided into specific and separate predictions of meteorological parameters strongly influencing the production of renewable energies. Thanks to the deepening of knowledge on artificial intelligence (AI) and the sophistication of models allowing very complex predictions to be made through the neural network, a new path requiring few computing resources is opening up in the field of weather forecast. Faced with the need to control meteorological parameters on the one hand for efficient exploitation of renewable energies and on the other hand the complexity of NWP, it is important to undertake NWP with more powerful AI tools requiring less computing resources. Intelligent management through a good weather forecast will therefore induce major geopolitical decision-making, in energy saving and even in the management of risks and breakdowns on the electrical networks.

Research Objectives



This thesis project aims to develop powerful and easy-to-apply weather forecasting methods by merging Numerical Weather Prediction (NWP) and Artificial Intelligence (AI) to help manage high-rate power grids more efficiently of renewable energy (EnR). The general objective of this thesis is therefore divided into 4 specific objectives:

- 1- List, categorize and simulate the variation of the most influential meteorological parameters in renewable energy power plants;
- 2- Collect meteorological data from the sites, carry out a data analysis in order to determine the correlations between different parameters;
- 3- Propose a model for predicting short-term meteorological parameters that is fairly accurate and requires fewer computer resources;
- 4- Propose an intelligent model for the management of electrical networks with a high rate of renewable energy.

Key Outputs

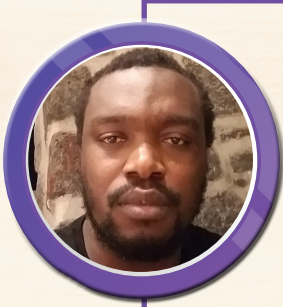


- A model for predicting short-term meteorological parameters;
- An intelligent model for the management of electrical networks;
- PhD Thesis
- Research Publications
- Policy Recommendations and blogs

Expected Outcomes



- Enhance the accuracy and reliability of renewable energy forecasting;
- Optimization of energy storage to mitigate potential risks associated with weather-related fluctuations in renewable energy generation;
- Enable policymakers can design supportive policies and regulatory frameworks that facilitate the transition to a high renewable energy penetration.



Name: Mushagalusa Ciza
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Country: Benin
Gender: Male



Supervisor: Prof. Romain Glele
University of Abomey-Calavi

Practical use of random forest regression for predicting disease vector abundance: application to the abundance of *Rhipicephalus appendiculatus* in permanent livestock pastures

Research Overview



The *Rhipicephalus appendiculatus* tick complex has been associated with several emerging diseases in Africa mostly through ecosystem modifications. Using accurate methods to identify factors driving tick abundance is primordial for tick-borne diseases control. Habitats such as pasture lands can host many ticks as they represent the meeting and interaction place between ticks, potential wild fauna, livestock, and humans. Permanent pastures relay wild animals into tick waterlogging and play an important role in the epidemiology of tick-borne diseases. The Poisson distribution remains the widely used distribution for modeling count data in many research areas despite the violation of its property that the mean and variance are equal. To overcome the Poisson distribution limitation, a variety of models have been introduced. However, count data models do not detect the presence of complex non-linear interactions between predictors and the response variable. Therefore, new modeling approaches, different from traditional techniques, are needed to improve predictive models' accuracy for count data sets. In the last two decades, machine learning (ML) methods have gained more popularity compared to classical methods in many applied sciences, including agriculture and epidemiology. Their performance often exceeds that of traditional statistical techniques, and in some cases, traditional techniques simply aren't appropriate.

Research Objectives



The main target of this work is to contribute to the improvement of RF regression accuracy in statistics and ecological niche assessment of disease vectors. Specifically this study will strive to:

- Assess the influence of data features and over-dispersion on RF regression parameters setting;
- To evaluate RF regression accuracy compared to count data classical methods;
- Assess the performance of different resampling algorithms in RF regression for over-dispersed outcomes with different levels of multicollinearity among covariates;.
- Estimate the predictive power of RF in comparison to Generalized Linear Models, and other ML algorithms in predicting ticks abundance on grazed permanent pasture.

Key Outputs



- A random forest regression model
- PhD thesis
- Research publications
- Policy recommendations and blogs

Expected Outcomes



- Effective disease management and control by public health officials, policymakers, and stakeholders;
- Enhanced understanding of the complex relationships between environmental factors and vector populations.



Name: Atsu Alagah Komlavi
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Gender: Male



Supervisor: Prof. Harouna Naroua
 Abdou Moumouni University of Niamey

Development of an intelligent system for the management of agricultural crop diseases for sustainable development in Niger

Research Overview



The evolution of intelligent systems in the field of agriculture, more specifically in plant pathology is mainly explained by the progress of a subfield of artificial intelligence, intersection between statistics and computer science called artificial learning (or Machine Learning in English) whose advent was also precipitated by two major events which are: computing power extraordinary computers and the availability of data of any kind. And, algorithms so-called stochastic learning methods, in this case support vector machines (SVM), artificial neural networks (ANN), logistic regression (LR), forests Random (RF), K Nearest Neighbors (KNN), Naive Classification Bayesian (NB in English) are applied to the data to build a general model by a procedure called training or learning with the purpose of predicting behavior faced with new data. Among all these algorithms, deep learning or Deep Learning or even more precisely the convolutional neural network (CNN) is the one that offers a lot plus new high-performance applications related to precision agriculture geared towards a new approach for automating phytopathological diagnosis; comparative studies will prove it.

So, under the effect of these different factors in recent years, detection systems of plant diseases become reliable technologies guaranteeing accurate diagnosis pathologies of agricultural crops, hence the growing interest of the multitude of researchers as well as major public and private agricultural services around the world, faced with these real food security issues. Faced with this panoply of technologies that are constantly multiply, it is more than necessary to compare the various works of recent literature, in their performance with a view to determining which methods appropriately require improvement. Like other algorithms, convolutional neural networks (CNN) in addition to their noted high performance, have countless architectures on which it is possible to make modifications that can lead to much higher performance. Hence the fundamental question of proposing a new CNN architecture leading to even higher performance. In the same way, it is possible to act on the different methods of preprocessing and extraction of the characteristic vectors in order to improve the performance of the classical artificial learning algorithms.

Research Objectives



- Establish an intelligent system to solve the problems of diagnosis of existing plant pathologies
- Develop and implement a new architecture of convolutional neural networks

Key Outputs



- An intelligent system for diagnosing plant pathologies
- An architecture of convolutional neural networks
- PhD Thesis
- Research Publications and blogs
- Policy Recommendations

Expected Outcomes



- Empower farmers with valuable knowledge and resources to effectively address crop diseases and promote sustainable agricultural practices;
- Provide evidence-based policy recommendations for disease management strategies, resource allocation, and agricultural policies aimed at sustainable development in Niger;
- Increase crop yields, minimize the environmental impact of disease management practices, and ensure long-term agricultural sustainability;
- More effective crop disease management in Niger.



Name: Tiomela Brice Borel

University: University of Yaoundé I

Country: Cameroun

Gender: Male



Supervisor: Prof. Norbert Tsopze
University of Yaoundé I

Automatic generation of biomedical image captions (biomedical images captioning)

Research Overview



Nowadays, with population growth, the food industry offers less and less organic food, industry in general increases the rate of environmental pollution, also, population growth increases road traffic and at the same time traffic accidents. All this mixture exposes populations to chronic type pathologies requiring the intervention of cutting-edge medical techniques such as radiology. These pathologies are mostly related to the lungs (Tuberculosis, Pneumonia, etc.), the brain (stroke, Epilepsy, etc.), the bones (Bone fractures, etc.), etc. To be able to identify them, the experts in each field use biomedical images from cutting-edge radiology devices. For all these pathologies mentioned in the context, we always have recourse to a human expert for the detection of anomalies on the images obtained from the radiology devices, which implies a relatively long analysis time, enormous costs for examinations of this type of this due to the costs and duration of training of these experts. Also, it should be noted that the use of a human operator for the analysis and detection of anomalies is sometimes subject to errors (the man can be wrong) sometimes due to the fact that the surface describing the anomaly on the image is not always clearly visible to the naked eye. It is important to note that experts are not available outside the big cities in the case of certain countries where experts are becoming increasingly rare.

Research Objectives



1. Experiment a generative adversarial network (GAN) type architecture on a biomedical image dataset and evaluate (quantitative and qualitative evaluation) its performance in order to be able to modify the internal structure of the model if possible for a possible improvement.
2. Experiment with a model based on an Encoder-Decoder architecture with attention to the input image and proceed to an evaluation (quantitative and qualitative) in order to be able to modify the internal structure of the model if necessary for possible improvement.
3. Propose a hybrid architecture which will take advantage of the best of the two methods stated in 1 and 2 and will proceed to an evaluation of the performances of this one compared to those of the two other methods of which it will ensue.

Key Outputs



- Research Publications and blogs
- Case Studies
- Policy Recommendations
- Data sets

Expected Outcomes



- Development of a new captioning model specifically tailored for biomedical images;
- Enhanced accuracy and quality of generated captions for biomedical images;
- Development of evaluation metrics and benchmarking methodologies for biomedical image captioning.

Early Career Academics



Name: Dr Sonia Semedo
University: University of Cabo Verde
Country: Cape Verde
Gender: Female

The use of artificial intelligence in mitigating crop losses in Cape Verde

Research Overview



The emergence of pests and diseases has destroyed agricultural crops in Cape Verde and often farmers do not realise this until late and eventually lose their production. Use AI for agricultural pest detection in Cape Verde has the potential to greatly benefit the country's agriculture sector. Cape Verde is an archipelago located off the coast of West Africa with a largely arid climate. Agriculture is an important sector of the economy, accounting for about 12% of GDP, but is vulnerable to pests and diseases that can devastate crops and threaten food security. Pests and diseases has decimated agricultural crops in Cape Verde and farmers often only realize this later, ending up losing a significant portion of their produce. Now, with technological advances, agriculture has evolved into precision agriculture, which production for each drop of water used, not losing cultures due to diseases and pests. Our research proposal is to monitor crop growth and, with the help of artificial intelligence, detect and identify potential pests that are affecting crops and alert farmers in a timely manner in an attempt to mitigate agricultural loses. This study is an attempt to answer the question: How can we use artificial intelligence to mitigate/prevent crop losses in Cape Verde? To achieve this goal, it is important to note that the application of artificial intelligence requires a comprehensive and integrated database, training and validation models in addition to applications protocols. In the context of this study, Cape Verde does not have database on crops and pests that affect them, which is a big challenge.

Research Objectives



- Assess the feasibility, accuracy, and effectiveness of AI tools in mitigating crop losses and improving overall agricultural productivity in Cape Verde;
- Analyzing the economic viability, social acceptance, and environmental sustainability of using AI in Cape Verde's farming practices;
- Develop a comprehensive and integrated database on pests and diseases for crops in Cape;
- Develop models for training and validation of artificial intelligence tools for mitigating crop loses in Cape Verde;
- Raise awareness on the potential of AI in agriculture among researchers, farmers, policymakers, and other stakeholders in Cape Verde.

Key Outputs



- Training and Validation tools
- Integrated database on pests and diseases for crops in Cape
- Research Publications and blogs
- Policy Recommendations

Expected Outcomes



- Development of practical AI-based tools and systems tailored to the needs of farmers in Cape Verde;
- Improved crop monitoring and disease detection capabilities in Cape Verde;
- Improved agricultural productivity and resilience in Cape Verde;
- Increased incomes, improved livelihoods and enhanced food security for farmers in Cape Verde.



Name: Dr. Thomas Messi Nguele

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Gender: Male

Using machine learning algorithms for efficient complex system analysis on multi-core architectures

Research Overview



Complex systems are prevalent in various domains, ranging from social networks and biological systems to financial markets and transportation networks. Analyzing and understanding these systems present significant challenges due to their intricate interactions and high-dimensional data. Traditional analytical approaches often struggle to handle the complexity and scale of such systems, necessitating the exploration of advanced techniques. Machine learning algorithms, with their ability to extract patterns and insights from large datasets, have emerged as promising tools for complex system analysis. Machine Learning is a subcategory of Artificial Intelligence in which algorithms automatically learn to perform a task from data. Once trained, the models built can be used to solve many problems related to regression, classification or clustering problems on new data with minimal human intervention. The quality of the gotten model depends of the amounts of data. For better inference, models should be trained on large amounts of data; but the greater the amount of data for training, the higher the execution time of the algorithms. The advent of multi/many-core architectures makes it possible to reduce this execution time. However, using them efficiently require to re-think traditional sequential machine learning algorithms into parallel and distributed ones.

This research project aims to explore the application of machine learning algorithms on multi-core architectures for efficient complex system analysis. By harnessing the parallel processing capabilities of multi-core architectures, the project seeks to overcome computational bottlenecks and improve the scalability of complex system analysis.

Research Objectives



- Develop efficient machine learning models on multi-core architectures for efficient complex system analysis;
- Build machine learning models that can be used in other applications (like social network applications);
- Investigate techniques for implementing machine learning algorithms on multi-core architectures.

Key Outputs



- Machine learning models on multi-core architecture
- Research Publications and blogs
- Policy Recommendations

Expected Outcomes



- Enhanced understanding of complex system analysis;
- Development of novel machine learning algorithms specifically designed for efficient analysis of complex systems on multi-core architectures;
- Enhanced knowledge transfer and collaboration among researchers, practitioners, and industry experts;
- Improved decision-making, optimization, and performance in complex systems.



Name: Dr Ugochi Adaku Okengwu

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Country: Nigeria

Gender: Female

An AI enhanced detection and treatment of tomato plant diseases in Africa

Research Overview



Nigeria is estimated to have produced 3.9 Million tonnes (MT) of Tomatoes in 2018 compared to 3.4 Million tonnes MT in 2016 (FAOSTAT, 2020). The bulk of this production occurs mostly in the Northern part of the country by resource-poor farmers as a means of livelihood. Tomato (*Solanum lycopersicum* L.), is an important crop, extensively cultivated as vegetable and fruit worldwide for its nutritional supply of vitamins, minerals, antioxidants and carbohydrates to humans. Its production in Nigeria is dominated by poor resource peasant farmers as their major means of livelihood. This research will adopt the Convolutional Neural Network (CNN) deep learning model which is a Deep Learning algorithm which can take in an input image, assign importance. The ability of the convolutional neural network (CNN) to understand the visual content of the input image makes it suitable for recognizing minute variation between the classes (Raju & Thirunavukkarasu, 2020). This power of CNN makes it a good choice to address image classification problems with multiple classes. Verma and Jain (2019) showed that CNN outperformed other machine learning tools significantly during image classification. Si et al.(2020) developed a novel method for identifying coal and rock based on a deep convolutional neural network (CNN). Virus diseases have been considered as an economically important biotic factor hindering profitable tomato production both during the wet and dry seasons in Nigeria. The increase in the number of virus diseases causing significant yield losses on tomato is of great concern and these vary from one location to another. Crop diseases have significant implications for the achievement of SDG 1 and 2 in Nigeria, as many people are still engaged in agriculture.

Research Objectives



- i. Create robust data repository of tomatoes diseases and possible solutions;
- ii. Develop machine learning model for detecting tomatoes virus disease and recommending possible solutions;
- iii. Design mobile android and web application to implement the predictive model;
- iv. Develop action plan and outreach for output deployment by organizing farmers training, publicity drive and dissemination of information.

Key Outputs



- Repository of tomatoes diseases and possible solutions.
- Machine learning model for detecting tomatoes virus disease
- Mobile android and web application to implement the predictive model.
- Publicity materials
- Research Publications and blogs
- Policy recommendations

Expected Outcomes



- Improved accuracy and speed of disease detection;
- Enhanced disease diagnosis and identification;
- Creation of AI-powered decision support systems for tomato plant disease management;
- Sustainable and cost-effective solutions for tomato plant disease management;
- Reduced crop losses, increasing agricultural productivity, and improving food security.



Name: Dr Sosdito Mananze

University: Eduardo Mondlane University - Higher School of Rural Development

Country: Mozambique

Gender: Male

Statistical and physically based hyperspectral and multispectral reflectance modelling for agricultural monitoring: A case study in Vilankulo, Mozambique

Research Overview



Agriculture faces challenges related to infestation by weeds, diseases and pests; soil treatment; drainage and irrigation. As a result, we are witnessing high crop losses, but also environmental disasters due to the excessive use of agrochemicals and water. Artificial Intelligence (AI), due to its ability to learn rigorously, has become a crucial technique for solving the problems of agriculture (Bannerjee, Sarkar, Das, & Ghosh, 2018). The application of AI in agriculture dates back to 1983 (Baker, Lambert, & McKinion, 1983), however, its use in Mozambique is incipient. In view of the implementation of strategic initiatives for the structural transformation of agriculture in Mozambique, there has been an increase in cultivated areas and in the level of use of agricultural inputs. For example, in the 2020/2021 agricultural campaign, the National Program for the Integration of Family Agriculture into Value Chains, SUSTENTA, made available around 300,000 technological packages to small farmers, supporting them in increasing the areas of cultivation, the level of use of agricultural inputs and, consequently, to increase their production in different cultures (MADER, 2021). If these results can be considered the beginning of the desired structural transformation in the agricultural sector, there are concerns regarding the sustainability of this intensification, above all in terms of efficient use of production inputs. In this sense, it is urgent to develop innovative tools conducive to the establishment of robust, economically competitive, socially responsible and environmentally efficient production systems. Said tools should be able to monitor the cultivation areas and provide timely information that gives the farmer greater decision-making capacity; localized application and, in the appropriate amount and time of inputs and/or interventions necessary to sustain high productivity, thus contributing to the preservation of the environment, namely carbon sequestration.

In this context, this research aims to develop AI algorithms for optimizing the control of weeds, diseases, pests and crop irrigation in Mozambique.

Research Objectives



The main objective of the research is to contribute to a 25% reduction in the costs of cultural operations in corn and tomato crops by June 2024. In order to achieve this general objective, the following specific objectives will be considered:

- i. Calibrate and validate an AI algorithm for identifying diseases in tomato crops by June 2024;
- ii. Calibrate and validate an AI algorithm for identifying pests in corn until June 2024;
- iii. Calibrate and validate an AI algorithm for optimizing irrigation in corn and tomato crops by June 2024

Key Outputs



- Statistical models to analyze hyperspectral and multispectral reflectance data for agricultural monitoring
- Hyperspectral and multispectral datasets
- Research publications and blogs
- Policy recommendations
- Calibration and validation of models

Expected Outcomes



- More accurate models for monitoring agricultural systems using hyperspectral and multispectral reflectance data;
- Better understanding of the spectral signatures of agricultural crops and their relationship to various agricultural parameters;
- Efficient and automated methods for processing hyperspectral and multispectral reflectance data;
- Development of customized monitoring solutions tailored to specific agricultural systems or regions;
- Adoption of the developed models and methodologies in agricultural monitoring practices.



Name: Devotha Nyambo

University: Nelson Mandela African
Institution of Science and Technology

Country: Tanzania

Gender: Female

Leveraging multi-agent models for learning recommendations and improvement of farmer-to-farmer interactions in small scale dairy

Research Overview



Governments employ extension officers who support farmers with advisory, animal health management and breeding services among others. However, there is an imbalance between available extension workers and farmers to be served, leaving a service gap in smallholder dairy production. Although Governments have put up strategies for increased milk yield, on-going initiatives have left behind the power of data, emerging technologies in Artificial Intelligence (AI) and mobile computing. Studies have shown that deploying a sufficient ground force for extension service to smallholder farmers is cost prohibitive. This makes the case for a digital extension model to be the most viable option. Nonetheless, Artificial Intelligence provide approaches for simulating the real world to test results/outcomes of various interventions before they are deployed. Researchers are yet to embrace the power of data driven multi-agent models where agents can better learn based on data from the real world. The proposed research envisages to leverage real data to construct and improve multi-agent models for their output to be used in development of an end user mobile application for farmer-to-farmer learning.

Research Objectives



The main objective of this project is to develop intelligent multi-agent models for learning recommendation and improvement of farmer-to farmer learning for increase in milk yield. The proposed research will accomplish the following specific objectives:

1. To collect data on management choices, constraints and milk yield and defining requirements for the mobile application for peer-to-peer learning tool;
2. To develop a complete dataset by cleaning, sorting and labelling on-farm management and milk data based on 6 dairy production clusters;
3. To develop data-driven agent-based models and simulate peer to-peer farmer learning and networking for increase in milk yield;
4. To develop end user mobile applications for farmer peer-to-peer learning.

Key Outputs



- Data sets
- Data-driven agent-based model and simulation tool
- End user mobile applications
- Research Publications
- Policy Recommendations

Expected Outcomes



- Enhanced knowledge sharing among farmers through the use of multi-agent models;
- Improved decision-making capabilities, resulting in more efficient and effective farming practices;
- Adoption of improved farming techniques, leading to increased productivity, sustainability, and profitability;
- Formulation of policies and strategies that create an enabling environment for knowledge exchange, collaboration, and the use of advanced technologies in the dairy sector;
- Generation of scientific knowledge that can inform future research, policy-making, and agricultural development initiatives.



Name: Dr. Frederic Nzanywayingoma

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Country: Rwanda

Gender: Male

Crop conditions monitoring and yield prediction using IoT systems and machine learning techniques for precision agriculture (Case study of maize in Rwanda)

Research Overview



Fall Armyworm (FAW) has been causing broad damages as well as losses particularly to maize fields on African continent since it was reported in 2016. Basically, there are three factors that make FAW the most dangerous pest. Firstly, FAW destroys many crops completely by consuming them. Secondly, FAW gets spread very quickly as it can move larger distances. And thirdly, FAW endures for years due to the favourable conditions in Africa. Awareness-raising through different communication mechanisms and training sessions on how to manage FAW is one of the key approaches put into service by FAO. IoT and ML can transform agricultural practices into perspective precision agriculture to address pests and disease difficulties to achieve sustainable development goals of poverty alleviation and zero hunger by 2030. Big data analytics and Machine Learning techniques show great potential to identify gaps when monitoring and interpreting. The following research questions are to be considered: Is data collected from IoT tools and machine learning technics better at detecting agricultural issues (e.g: FAW) than farmers on field? How can we bridge the difference in knowledge between farmers and UAVs and machine learning technics? How can we inform farmers about how to understand presence of FAW? The general objective of this project is to increase crop yield by using emerging technologies in order to fight against food insecurity. Basically, with the use of IoT tools in precision agriculture the ability to analyse each plant's condition individually improves; and as consequence, errors that are usually found with agronomists when sampling small areas of the field are minimized This project aims to provide quality services to farmers with the deployment of IoT tools and the use of ML skills; thus, the responsible authority and farmers will get notifications in due course concerning the health and yield of the crop. From the given information right decisions and measures will be taken.

Research Objectives



- To develop an autonomous UAV imagery crop conditioning system to detect FAW;
- To design IoT System integrated with machine learning technics for crop stress localization system;
- To design an IoT system for ground truth information;
- To detect crop diseases in early stages hence increase crop yield by using ML techniques;
- To assess and analyze crop health and help in prediction of crop yield using ML techniques.

Key Outputs



- An autonomous UAV imagery crop conditioning system
- IoT System for crop stress localization
- IoT system for ground truth information
- Reserch Publications
- Blogs
- Policy Recommendations

Expected Outcomes



- Improved Crop Monitoring;
- Enhanced Yield Prediction;
- Empower farmers with actionable information to optimize their agricultural practices.



Name: Dr. Mesfin Fikre Woldmariam

University: Addis Ababa University

Country: Ethiopia

Gender: Male

Application of AI/ML approaches in targeting aid beneficiaries

Research Overview



In least developing countries, identifying and targeting the right and needy people is not easy. Aid beneficiaries are nominated by officers who work in government administration structure. While doing so, the officers do not screen the right targets. (They usually include people who do not deserve to benefit as compared to the neediest. It is also common to see fictitious names of people on the payroll of aid programs. The officers collect money in the names of fictitious people and share among themselves. Even though the community knows who deserve and who do not, they do not air their concerns to relevant authorities. Given the wastage of resources which go to undeserving cases it is imperative to develop a transparent system that can address this anomaly.

Research Objectives



The main objective of this project is to explore the application of AI/ML approaches in targeting aid beneficiaries and thereby avoid avoidable costs and frauds endemic in the process of identification of targets, distribution of funds, as well as monitoring their productivity. Specifically, the research will develop an AI classification model that fairly classify individuals as vulnerable, needy, less needy and not needy.

1. Develop an integrated AI/ML model that can effectively identify and target aid beneficiaries
2. Evaluate the performance of the developed AI/ML models;
3. Contribute to the collective understanding and advancement of AI/ML applications in targeting aid beneficiaries;
4. Assess the feasibility of applying AI/ML approaches in targeting aid beneficiaries.

Key Outputs



- An integrated AI/ML model that can effectively identify and target aid beneficiaries
- A dataset specifically tailored for aid targeting
- An evaluation metrics and a comparative analysis of the AI/ML models' performance against traditional targeting methods
- Case Studies
- Policy Recommendations

Expected Outcomes



- Enhanced the accuracy of aid targeting by leveraging AI/ML techniques;
- Streamlined aid targeting process, leading to increased efficiency in resource allocation;
- More equitable distribution of aid resources, ensuring that vulnerable populations are not left behind.



Name: Dr. Neema Mduma

University: The Nelson Mandela African
Institution of Science and
Technology

Country: Tanzania

Gender: Female

Deep learning techniques for early detection of crop diseases

Research Overview



Despite the fact that the agricultural sector is the national economic development priority in most countries in sub-Saharan Africa, crop diseases have been the challenge affecting major food security crops. The current state of data collection and disease diagnosis is transitioning from disease identification using visible symptoms to the use of data-driven solutions applying machine learning and computer vision techniques. Several studies demonstrated the potential for the use of these tools for disease diagnosis for tomatoes (Mkonyi, et al., 2020; Shijie, et al., 2017), cassava (Nabenda, et al., 2020; Ramcharan, et al., 2017) and bananas (Sanga, Mero, Machuve, & Mwanganda, 2020; Owomugisha, Quinn, Mwebaze, & Lwasa, 2014). However, the image data previously collected have not been sufficiently curated, prepared and shared with the wider machine learning community. Moreover, by the time image data is captured, diseases have already manifested in different parts of the plant and little can be done to salvage the situation. The efforts on data collection workable solutions for early diseases detection are still limited, biased and the data is not reproducible. Therefore, it is crucial that more datasets made available to increase the adoption of machine learning research and spur innovations to address food security.

Research Objectives



The main objective of this research is to develop deep learning techniques for early detection of crop diseases.

1. To assess farmers knowledge on crop diseases diagnosis;
2. To collect image data in the identified study sites;
3. To extract features of the collected image data;
4. To develop, evaluate and deploy a model for detection of crop diseases.

Key Outputs



- Crop disease dataset
- Case Studies
- Research publications
- Blogs
- Policy Recommendations

Expected Outcomes



- Improved crop disease detection;
- Increased crop yield and improved crop quality;
- Cost savings, reduced environmental impact, and improved agricultural sustainability.



Name: Dr. Judith Keebisilo Leo

University: Nelson Mandela African Institution of Science and Technology

Country: Tanzania

Gender: Female

An integrated AI, IoT and mobile App based tool for early-prediction and control of mycotoxin in grains case-study: maize and peanuts crops in Tanzania

Research Overview



In Sub Saharan Africa (SSA), the agricultural sector employs more than half of the total workforce, and the majority of this workforce are women who live in rural areas. Tanzania is among the SSA countries whose economy depends on agriculture, accounting for 60% of the Gross Domestic Products (GDP), 90% of the countries' rural employment, and 85% of recorded export earnings (DTMA 2012). Major food crops grown in these countries are grains including maize, peanuts, and rice crops which contribute to major per capita calories consumed. These crops have the potential to upsurge small-scale producers' (SSPs) incomes, reduce poverty and assist close the food gap (FAO and IFAD, 2005). Despite their potentials for SSPs and the economic development of SSA countries at large, there is still a lack of precise and cost-effective mechanisms for early-warning analysis, prediction, and control of food-poisoning in grains hence its agricultural economic development has remained lower in Tanzania. Food poisoning with mycotoxins produced by fungi is global food safety. The consumption of mycotoxin-contaminated food is responsible for several foodborne disease outbreaks worldwide. While peanuts and maize are important crops with both economic and nutritional significance in tropical and subtropical regions, their vulnerability to aflatoxin contamination makes them unsuitable for consumption. This research study aims at assessing the aflatoxin contamination of locally stored and processed maize and peanut in Tanzania then develop a precise and cost-effective tool for early analysis, prediction, monitoring, and control of aflatoxin using emerging technologies including AI, Internet of Things, and Mobile Applications.

Research Objectives



The following are specific objectives with their activities and deliverables which will be used to realize and obtain our main objective:

1. To identify requirements and recruit a group of small-scale farmers and entrepreneurs especially women-farmers who are dealing with maize and peanut crops agricultural and mycotoxin experts;
2. To collect, review and validate the identified requirements with the assistance of the recruited small-scale farmers and entrepreneurs' groups and agricultural and mycotoxin experts;
3. To design, develop and evaluate an integrated AI, IoT, and Mobile-App based Tool for Early-Prediction and Control of Mycotoxin in Maize and Peanut crops.

Key Outputs



- An integrated AI, IoT, and Mobile-App based Tool for Early-Prediction and Control of Mycotoxin in Maize and Peanut crops
- Research Publications blogs
- Policy recommendations
- Case Studies

Expected Outcomes



- Early detection and prediction of mycotoxin contamination in maize and peanut crops;
- Enhance crop management practices through the integrated tool;
- Empower farmers and stakeholders with accessible and user-friendly information;
- Adaptable solutions that can be applied to other regions and grain types beyond maize and peanuts;
- Promote sustainable farming practices, reduce mycotoxin contamination and improve crop productivity.



Name: Dr. Ismaël Koné
University: Open University
Country: Cote D'Ivoire
Gender: Male

Machine Translation (MT) and Automatic Speech Recognition (ASR) for Dioula

Research Overview



Recent advances in natural language processing (NLP) have enabled a wealth of innovations in many areas like: sentiment analysis, corpus summarization, name entity recognition (NER), machine translation (MT), automated speech recognition (ASR). However, benefits of these advancements are restricted to a few high resources languages in the world. Technology advances have enabled a huge flow and spread of knowledge through the entire globe. People can communicate in different languages and still understand one another thanks to ASR technologies. Communications between human and machine is rapidly progressing with many successful applications in vocal assistants like Alexa from Amazon, Siri from Apple and Google voice. All these globally contribute to improve human life quality. However, accessing this wealth of knowledge benefit is tightened among people talking a handful of languages. Unfortunately, a large portion of people do not speak such languages. Thus, they are deprived from accessing all these benefits like education. For example, we have high quality free educational contents accessible online but are only worthy if you speak a high resource language. Likewise, such people are deprived from making connection with people around the globe. Moreover, including a local language like “Dioula” in digital products is a significant advantage as it expands the market size of local businesses which could potentially increase their revenues. Thus, we need to build datasets for these languages and train baseline models for translation and speech-to-text (ASR) tasks. A great advantage of working on “Dioula” language is that it is also spoken in several West African countries: Mali, Burkina Faso, Guinea (Conakry), Senegal and Gambia. However, no NLP has been done on them so far

Research Objectives



To build baseline machine learning models for translation from “Dioula” to “French” and “English” as well as “Dioula” speech recognition

Key Outputs



- Research Publications
- Two datasets: - Parallel corpora in Dioula, French and English triplets
- Audio-transcription pair of “Dioula”

Expected Outcomes



- Improved accuracy and fluency in translation between Dioula and other languages;
- Improved cross-cultural exchanges, commerce, and diplomacy arising due to enhanced communication;
- Increasing visibility and utility of Dioula language in the global context.

AI4D Africa Scholarship Project Events

- 1. National workshops:** Eleven national workshops have been convened in different countries and the reports from these workshops are very impressive in terms of the calibre of workshop attendants and participants. They have provided effective and most efficient channels to disseminate and communicate especially to the university communities and researchers what AI4D Africa Program is all about and it is contributing towards realization of priority agenda to Africa countries. Engaging and or committing supervisors directly in the convening and budget utilization of these events has really enabled the supervisors to feel part and parcel of the project and hence ensuring sustainability beyond the project period. Through these events, the students make paper presentation as it forms part of their expected deliverables – this will make increase also their completion rate and graduate hopefully within the slated project period.

Outcomes

- a. Capacity of the beneficiaries to organise workshops, disseminate knowledge and influence policy enhanced;
 - b. Access to knowledge by researchers and practitioners on AI and ML enhanced.
- 2. Supervisors experience sharing workshop:** This event provided great opportunity for supervisors of the PhD scholars and ECAs to converge physically to share experiences pertaining to the AI4D Africa scholarship project. This enabled them to deliberate on not only how to overcome teething challenges experienced by beneficiaries on various research related activities including how to support their students in financial accounting but also to share opportunities through networking. The workshop also presented an opportunity for the supervisors to be sensitized and trained about the complementary short courses delivered virtually through the online platform. Finally, the workshop accelerated the concept or idea of a well-established network of supervisors to create a network of not only senior researchers but also early career researchers within the larger AI4D Africa family, in order to moot strategic scholarly collaborations.

Outcomes

- a. Capacities of the supervisors and the ECAs on supervision enhanced through peer-to-peer learning and mentorship of the ECAs by senior supervisors.
- 3. PhD summer school academy:** This academy presented a number of lessons to be learnt as we continue to implement the project as well as for future design/ planning. First and foremost it provided a very important platform or forum for branding and publishing AI4D Africa as a program driving key agenda revolutionizing promotion and uptake of AI/ML and other emerging tech in the continent. Key discussions around the completion rate of the MSc and PhD studies by the beneficiaries, which is directly linked to the project's objective of creating a pool of scholars in AI and ML in the continent. Another discussion and lesson sharing was on establishment or creation of a pool of knowledge in AI and ML to address key socio-economic challenges facing the continent. This is also closely related to the idea of strengthening AI4D Africa Scholarship network, which was a key pillar in the design of the project. Finally, deliberations and sharing of experiences about the complementary short courses delivered virtually to the scholarship beneficiaries should be mainstreamed and made available not only to the beneficiaries but also to a wider group so as to enhance the capacity of scholars in AI and ML in the continent.

The conference offered participants great opportunities to deepen their understanding on Artificial Intelligence and Machine Learning as a subject matter; opportunities for mainstreaming, strengthening, and expanding access to knowledge on AI/ML as well as other emerging tech.

Outcomes

- Capacity of African scholars to undertake research and development in AI and ML is being enhanced. These are being manifested in the publications being produced by the project beneficiaries.
- The contribution of African scholars to global AI and ML research and debate is being enhanced as evidenced by the events organized and convened to discuss AI/ ML related activities in Africa.

Complementary Activities

The AI4D Africa Scholarship Project has also offered complementary activities to build the capacity of beneficiaries (PhD and MSc students, ECA, and Supervisors). These include short-courses, a PhD Academy, quarterly seminars, annual workshops, regional conferences, online training workshops (for supervisors) and PhD mentorship.

Short Courses

During the period covering January-December 2022, five short courses have been delivered online targeting PhD scholars, ECAs as well as interested supervisors. The courses are outlined below:

Intellectual Property and Artificial Intelligence: This course is intended to expose beneficiaries to the importance of intellectual property and technology transfer on responsible AI research and its development. This training will be offered by Kwame Nkrumah University of Science and Technology (Ghana) - currently offering MSc degree in Intellectual Property - in collaboration with ACTS.

Gender and Artificial Intelligence: This course was designed to enable researchers, scholars and practitioners to integrate gender in AI and ML research,

development and practice. A training programme on gender and artificial intelligence was developed and delivered online by the Research ICT Africa (RIA), South Africa.

AI Research for Policy Influence: The course is intended to expose AI4D Africa scholarship beneficiaries on the steps necessary to enhance uptake of research outputs for policy formulation. This training programme will be delivered online by ACTS.

Artificial Intelligence Ethics - The African Context: This course will be delivered by the Institute for Humanities in Africa based at the Faculty of Humanities, University of Cape Town (UCT). It will focus on AI Ethics in the African context.

Artificial Intelligence and Ethics - Global Context: There are several ethical issues (global) related to AI research, development and deployment. A training session was developed and delivered by the University of California to equip the beneficiaries with appropriate knowledge on these issues.

Understanding Responsible AI Development and deployment: Taking into consideration the focus of AI4D Africa programme on responsible AI and ML development and deployment, a short course has been prepared and delivered by the University of Linköping (LiU), Sweden, to equip all beneficiaries with better understanding of what this means.



Participants of the AI4D Africa Scholarship Supervisors meeting held in October, 2022 in Nairobi, Kenya. This event provided great opportunity for supervisors of the PhD scholars and ECAs to converge physically to share experiences pertaining to the AI4D Africa scholarship project.

2



Dr. Jennifer Batamuliza (centre, in red gown), the first AI4D Africa Scholarship beneficiary to complete her PhD studies. She graduated with a PhD in Data Science from the University of Rwanda.

3



Dr. Mahadia Tunga being conferred with a Phd in Data Science from University of Dar es Salaam in Tanzania. She was also appointed as the Executive Director of Tanzania Data Lab (dLab) effective May 2023. Dr. Tunga is among the four founders of dLab and has been part of the Senior Management of dLab from the time it was a project

4



Participants of one of the AI4D Africa Scholarship national workshops organised by Nelson Mandela African Institution of Science and Technology in Tanzania. Eleven (11) national workshops have been held in different countries.

Research Publications

| Title | Author (s) and institution(s) | Author (s)' gender | Venue (journal, book, series, etc.) | Date submitted/ accepted/ published | Link (if available online) |
|---|---|--------------------|--|-------------------------------------|---|
| Aplicação de Inteligência Artificial na Identificação da BBTV na cultura da Bananeira (musa spp.) em Moçambique | A.A. Simango, J. Bila, S. Mananze | All male | UEM Research Conference proceedings | 30 August 2023 | https://uem.edu.in/news-events/13518/ |
| Review on technologies applied for classification of tomato leaf virus diseases | Ugochi A. Okengwu, Hillard. A. Akpughe, Eyananabo. Odogu and Taiye Ojetunmibi University of Port Harcourt | 2 male 2 Female | European Journal of Artificial Intelligence and Machine Learning | June 2023 | https://www.researchgate.net/publication/374828214_Review_on_Technologies_Applied_to_Classification_of_Tomato_Leaf_Virus_Diseases |
| Transfer Learning for Tomato Leaf Disease Detection using Convolutional Neural Networks on Mobile Platforms | Ugochi A. Okengwu, Hillard. A. Akpughe, Eyananabo. Odogu and Taiye Ojetunmibi University of Port Harcourt | 2 male 2 Female | | | https://sci-hub.se/uptodate/S0168169921002969.pdf |
| The impact of global changes in near-term climate forcings on East Africa's climate | Ronald Opio, Isaac Mugume, Joyce Nakatumba-Nabende, Alex Nimusima and Isaac Tom Okurut. Makerere University | 3 Male 1 Female | Journal – Springer Environmental Systems Research | June 2023 | https://link.springer.com/article/10.1186/s40068-023-00304-9 |
| Predicting Optical Water Quality Indicators from Remote Sensing using Machine Learning Algorithms in Tropical Highlands of Ethiopia | Elias S. Leggesse, Fasikaw A. Zimale Dagnenet Sultan, Temesgen Enku, Raghavan Srinivasan and Seifu A. Tilahun | All Male | Water Journal | May 2023 | https://doi.org/10.3390/hydrology10050110 |
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| Retrieval of trophic status index of Lake Tana using ML from Landsat 8 OLI image – Upper Blue Nile | Elias S. Leggesse, Fasikaw A. Zimale Dagnenet Sultan, Temesgen Enku, Raghavan Srinivasan and Seifu A. Tilahun | All Male | EAI ICAST 2023 - 11th EAI International Conference on Advancements of Science and Technology | August 2023 | https://icast-conf.eai-conferences.org/2023/registration/ |
| Finding optimum climatic parameters for high tomato yield in Benin (West Africa) using frequent pattern growth algorithm | S. C. Ariane HOUETOHOSSOU 1, V. Ratheil HOUNDJIZ and Romain L. GLELE KAKAÏ University of Abomey-Calavi, 01 BP 526 Cotonou, Benin | 1 Female 2 Male | PLOS ONE | April 2023 | https://doi.org/10.1016/j.aiaa.2023.08.001 |
| Hardware security for IoT in the quantum era: survey and challenges | Doudou DIONE, Boly Seck, Idy DIOP, Pierre-Louis Cayrel, Demba Faye, Ibrahima GUEYE/ Cheikh anta diop university | All Male | Journal | May 2023 | https://doi.org/10.4236/jis.2023.144014 |
| Blockchain-based IoMT and secure EHR model: Case of Senegal | Doudou Dione; Idy Diop; Demba Faye; Ibrahima Gueye; Khadidiatou Wane Keita; Sidi Mohamed Farssi/ Cheikh anta diop university | All Male | Conference series | May 2023 | 10.1109/CSNT57126.2023.10134619 |
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| | | | | | |
|--|---|--------------------|---------------------|---|---|
| Bidirectional Long short-term memory and Recurrent Neural Network model for speech recognition. | Mercy Wairimu Kimani Dr Lawrence Nderu Dr Dalton Ndirangu Dr Tobias Mwalili | 1 Female 3 Male | Engineering reports | Preprint pending peer-review | https://doi.org/10.22541/au.168857312.29438464/v1 DOI: 10.22541/au.168857312.29438464/v1 |
| Locust Infestations and Mobile Phones: Exploring the Potential of Digital Tools to Enhance Early Warning Systems and Response Mechanisms | 1 Brian Halubanza, 2 Jackson Phiri, 3 Mayumbo Nyirenda, 4 Phillip O.Y Nkunika, 5 Douglas Kunda, 6 James Mulenga. 1,6 Mulungushi University, Kabwe; 2-4 University of Zambia; 5 ZCAS University, Lusaka. | All Male | ZAPUC | 09/06/2023 Accepted (Awaiting Publication) | |
| Low cost IoT-based automated Locust monitoring System, Kazungula, Zambia. | Brian Halubanza- Mulungushi University, Jackson Phiri- University of Zambia, Phillip O.Y Nkunika - University of Zambia, Mayumbo Nyirenda- University of Zambia, Douglas Kunda- ZCAS University | All Male | Springer | 15/07/2023 | https://link.springer.com/chapter/10.1007/978-3-031-35317-8_59#:~:text=The%20low%20cost%20IoT%20employed,GPRS%20module%20provided%20the%20internet |



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