NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Faculty of Computing and Informatics

2022 Research Day Programme

Theme: Digital Technologies for Enabling Societal Transformation

Date: Friday, 20 May 2022
Time: 08:00 - 16:00
Venue: 6th Floor, HTTPS, NUST Lower Campus and MS Teams

TABLE OF CONTENTS

Programme

Date: Friday, 20 May 2022
Time: 08:00-16:00
Venue: 6th Floor, HTTPS, NUST Lower Campus and MS Team

Director of Ceremonies: Mr Isaac Nhamu and Ms Jordania Andima

Official Opening		
08:00	**Registration**	
08:15	**Welcoming Remarks**	**Fungai Bhunu-Shava** *Acting Executive Dean: Faculty of Computing and Informatics*
08:30	**Remarks**	**Colin Stanley** *Acting Deputy Vice-Chancellor: Research, Innovations and Partnerships*
08:40	**Keynote Remarks**	**Stanley Shanapinda** *Chief Executive Officer: Telecom Namibia*
09:00	**Remarks**	**Ankur Kathuria** *Commissioner, Head: IT Namibian Correctional Service*
09:15	**Remarks**	**Zoe Titus** *Director: Namibia Media Trust*
09:30	**Remarks**	**Monica Nehemia** *Chief Technology Officer: MTC Namibia*
09:45	**Project Services Unit**	**Anna Matros Goreses** *Executive Director: Research, Innovations and Partnerships*
10:00	**Vote of Thanks**	**Suama Hamunyela** *Acting Associate Dean: Research and Innovations*
Tea Break **Exhibit 1: A Gesture-Controlled VR Narrative co-created with the Ju/'hoansi Community of Donkerbos** **Exhibit 2: Connecting Children A d cross the Globe – a Virtual Learning Space Station**		**IKDW Cluster** **Rosetta Kays** *Convener*

10:25	**Faculty Research Focus Areas Overview**	**Mercy Chitauro** *Senior Lecturer: Computer Science*
	Focus Area 1: Smart and Secure Environment	**Dharm Singh Jat** *Professor: Computer Science*
	Focus Area 2: Big Data: Infrastructure and Analytics	**Jose Quenum** *Associate Professor: Computer Science*
	Focus Area 4: Digital Transformation	**Gloria Iyawa** *Senior Lecturer: Informatics, Journalism and Media Technology*
	Focus Area 3: Indigenous Knowledge in Digital World (IKDW)	**Heike Winschiers -Theophilus** *Professor: Computer Science*
Session 1: **Smart and Secure Environment**		**Guy-Alain L Zodi** *Chair*
11:00	**Blockchain-Based Secure Edge Computing Paradigm for Time Constraint Applications**	**Arpit Jain** *Centre Head: India-Namibia Centre of Excellence in Information Technology (INCEIT)*
11:10	**Design and Development of System for Post Infection Behaviour Analysis**	**Toivo Herman Eeno Kamati** *Masters Scholar*
11:20	**Analysis of Energy Hotspots on Mobile Devices**	**Simon Muchinenyika** *PhD Scholar*
11:30	**Designing An Intelligent Platform to Improve Online Safety Knowledge for Parents, Guardians and Caregivers**	**Marsela Nur Rita** *Masters Scholar*
11:40	**Using Co-Design to Craft Cybersecurity Secure Practices for Rural Communities in Africa**	**Gabriel T Nhinda** *PhD Scholar*
12:00	**Conceptual Design of a Sensorless Smart Parking Payment Solution**	**Attlee Gamundani** *Lecturer: Computer Science*
Session 2: **Big Data: Infrastructure and Analytics**		**Jose Quenum** *Chair*
12:10	**Towards Trustworthy Algorithms in Healthcare**	**Lameck Amugongo** *Lecturer: Computer Science*
12:20	**Design and Develop a Prediction Model for Improving Start-Up Success Using Machine Learning**	**Ajai Kumar Misra** *PhD Scholar*

12:30	**Using Computer Vision to Confirm Qualities of Bay Chickens**	**Hubert Mouton** *Masters Scholar*
12:40	**Application of Machine Learning Techniques to Predict Student Attrition: A case of the University of Namibia Bachelor of Chartered Accountancy Programme**	**Samuel N Nakale** *Masters Scholar*
12:50	**Comparison Between Lime and Shap XAI Methods**	**Takunda Hwaire** *Masters Scholar*
13:00	**Lunch Break** **Exhibit 1: A Gesture-Controlled VR Narrative co-created with the Ju/'hoansi Community of Donkerbos** **Exhibit 2: Connecting Children Across the Globe – a Virtual Learning Space Station**	**Ms Helvi I Wheeler** *Convener*
14:00	**A Federated Explainable Artificial Intelligence for Combating Fraudulent Credit Card Transactions**	**Ambrose Azeta** *Lecturer: Computer Science*
Session 3: **Digital Transformation**		**Phillip Santos** *Chair*
14:10	**Investigating the Implications of Covid-19 on the Sustainability of the Print Media in Namibia: A Case Study of The Namibian, Confidante and New Era**	**Hilary Mare** *Masters Scholar*
14:20	**Mobile Apps for Stress Management: A Case Study of University Students**	**Benjamin Akinmoyeje** *PhD Scholar*
14:30	**Effectiveness of Outsourced Information Systems in Public Sector**	**Petrus Helao Haixula** *Masters Scholar*
14:40	**Mobile Apps for Smart Cities: A Scoping Review**	**Sinte Mutelo** *Lecturer: Informatics, Journalism and Media Technology*

Closing Session		
15:00	**Awards (Best Poster/Speaker Honours/Masters/PhD)**	**Telecom Namibia**
15:20	**Closing Remarks**	**Andrew Niikondo** *Deputy Vice Chancellor: Academic Affairs*
15:30	**Vote of Thanks**	**Dharm Singh Jat** *Professor: Computer Science*

ABOUT THE FACULTY OF COMPUTING AND INFORMATICS

Our Vision

To be the leading enabler of societal digital transformation.

Our Mission

To graduate innovative leaders and advance computing and journalism knowledge through excellent education, research, and community service to the benefit of society.

Our Values

Professionalism: We will employ highly skilled/qualified staff in our field of specialisation so us to impart it ethical, respectfully without in our spheres of influences.

Creativity: We promote creativity at all levels to enable freedom and flexibility in sharing to enable freedom flexibility in sharing and creating knowledge.

Integrity: We will conduct business honest, upright, honorable ways at all times.

Responsiveness: staff will respond to communication and societal needs timely.

Humanness: We will treat students, staff, partners and stakeholders in a humane way offering empathy, kindness, self-control and rationality.

Research in the Faculty

We have active research clusters and strive to solve national and international problems by using ICT as an enabler to societal digital transformation. Besides offering qualifications in different specialisations and different exit levels in Computer Science and Informatics and endeavouring to keep up with the rapid changes and evolution of technology, we also consider community service as a priority.

Research Focus

Computing research and the concomitant knowledge investigation cut across all domains of human endeavours. Faculty research addresses the needs of the country, the region, and the world at large. Our partners include many local and international entities. Domestic partnerships in industry and academia are forged constantly.

The Faculty focuses on four main research areas:

- Big Data: Infrastructure and Analytics
- Indigenous Knowledge in the Digital World
- Smart and Secure Environment
- Digital Transformation

Faculty research clusters:

- Indigenous Knowledge Management Systems (IKMS)
- Dependable Advanced Network Systems (DANS)
- Marginalised Community Development (MCD)
- Smart Communication Systems (SCS)
- Digital Forensics and Information Security (DFIS)
- E- Participation (EP)
- Business and Policy Analytics (BPA)
- Journalism and Media Technology
- The Artificial Intelligence of Things (AIoTs) for Information and Communication Technologies for Development (ICT4D) is cut across all the research clusters.

ABSTRACTS

SESSION 1: SMART AND SECURE ENVIRONMENT

Blockchain-Based Secure Edge Computing Paradigm for Time Constraint Applications

Arpit Jain, Dharm Singh Jat

Department of Computer Science: Namibia University of Science and Technology, Namibia

Email: ajain@nust.na, dsingh@nust.na

Presenter: Arpit Jain (PhD Scholar)

Abstract

The global pandemic COVID-19 is an infectious disease which produced devasting effects on mankind and the entire health community. The disease shown the multiple variants by the time and due to the severity, many people have lost their lives. The predetermination, early predictions based on symptoms and the quick responses in a critical situation can increase the survival rate. Many studies have proposed the prediction model using conventional machine learning techniques. In this research work, an intelligent ensemble model has been designed to provide the prediction with high accuracy to the time critical application at the Edge layer. The proposed ensemble machine learning model approach predicts the covid results based on specific features. Further, the historical clinical data has been stored using blockchain technology, ensuring reliability, traceability, and security with decentralised temper-resistant computational trust. With blockchain technology, the security standards are enforced to transactions between various users regarding access, storage, and data analysis with distributed trust. The research proposed the blockchain-based secure edge computing paradigm, which is evaluated based on the accuracy, precision, recall and F1 score performance metrics. By fitting the model on an open-source data, the performance is improved for time constraint applications with data integrity

Keywords: Blockchain Technology, Hyperledger Fabric, Chaincode, Edge Computing.

Design and Development of System for Post Infection Behaviour Analysis

Toivo Herman Eeno Kamati, Dharm Singh Jat

Department of Computer Science, Namibia University of Science and Technology

Email: toivo_k@yahoo.com, dsingh@nust.na

Presenter: Toivo Herman Eeno Kamati (Master Scholar)

Abstract

The infection has emerged as a key method in which targeted attacks violate behaviour in an enterprise communication system. This research considers the problem of designing and developing a system of Post Infection Behaviour Analysis that renders an analysis of behaviour complexity. The developed system has schemes for systematically analysing anomalous behaviour from complex security data observed on the experimental network. A Post-infection analysis framework is proposed logically composed of distillation algorithms and Artificial Intelligence engines. The analysis framework is applied to random security states to deduce behaviour resultant from infection. Analytics of deception data verify the performance of the proposed system based on a comparative evaluation of Artificial Intelligence models. Analysis of honeypot traffic flow with Deep learning showed patterns depicting the spread of attacks launched. The key successes of this study are discovering mass e-Mail marketing attacks and the designed distillation algorithm. The System of Post-Infection Behaviour Analysis is probably essential to help analysts understand behavioural changes. The alteration is responses caused by infections whose influence on behaviour patterns is analysed for early attack detection and future attack predictions. The outcome of the design research shows a framework of methods for honeypot-based data collection and Deep learning analytics. Moreover, modelling reveals a bimodal relationship between attack pattern schema and the unified cyber kill chain. In a general conclusion, the proposed Multilayer Deep Neural network optimised with RMSProp is a good fit. With performance measures of the accuracy of 89.23, F-measure of 89.23 and Precision of 93.55 in detecting mass advertisement e-mail. Design and computation results were combined to define a Post-Infection Behaviour Infection Behaviour Analysis System.

Keywords: Mass Email Marketing, Honeypot Behaviour, Deep Learning.

Analysis of Energy Hotspots on Mobile Devices

Simon Muchinenyika, Hippolyte Muyingi, Edmore Chikohora

Department of Computer Science, Namibia University of Science and Technology

Email: smuchinenyika@nust.na, hmuyingi@nust.na, echikohora@nust.na

Presenter: Simon Muchinenyika

Abstract

Hardware advancements improved broadband speeds, and a vast pool of mobile application developers have made it possible to realise services on mobile devices that were conventional for desktop computers decades ago. Mobile users can now use their devices to edit office documents, participate in remote video meetings, or even play some resource intensive games. However, despite all these successes, battery capacity remains a limitation to mobile computing prowess. Most of the research efforts towards mitigating battery drainage on mobile devices were directed towards lower layers of computing, with little complementing efforts at software development level. Short development lifecycle for mobile applications, lack of tools and guidelines are some of the reasons cited in literature as the cause. In this study, a case study of Samsung Galaxy S-Series and iPhone devices is presented as a solution in identifying energy hotspots on smart devices. As a common assertion to the mobile computing limitation, we managed to isolate device' screens as the key limitation to mobile platforms' advancement, as other components are progressing yearly. Some recommendations are then made on how software development can be used to mitigate energy consumption on the identified energy hotspots on mobile devices.

Keywords: Energy, Hotspots, Mobile Devices.

Designing an Intelligent Platform to Improve Online Safety Knowledge for Parents, Guardians and Caregivers

Rita Nur Marsela, Fungai Bhunu Shava, Mercy Chitauro

Department of Computer Science, Namibia University of Science and Technolog

Email: 200709160@NamibiaUST.onmicrosoft.com, fbshava@nust.na, mchitauro@nust.na

Presenter: Rita Nur Marsela (Master Scholar)

Abstract

The COVID-19 Global Pandemic has heightened online dangers. As children, parents, guardians, and caregivers are encouraged to work remotely and be dependent on the Internet for work, studies, and other use. Internet safety awareness, however, has not heightened, only the dangers that go hand in hand. Children learn online habits, digital hygiene, and online safety from their parents. But there are only a few platforms known to parents to educate themselves on topics of online safety. Often parents need to sift through the information to find appropriate information to equip them in the digital parenting era. Multitasking with electronics while in the presence of people has become a norm. Digital platforms and electronic devices have formed part of ad-hoc parenting. This research aims to design an intelligent platform to improve online safety knowledge of parents, guardians, and caregivers. Where access to information on online safety is easily accessed and utilised. Due to generational gaps, many parents did not grow up with instant access to smart phones, digital platforms, applications, and the Internet. Sometimes it is hard to classify what is safe and unsafe on the Internet. With so many applications constantly developed, it has become challenging to keep up with safety features. Findings shows that although there is a gap in knowledge about online safety, children still turn to their parents for guidance. The use of Artificial Intelligence on an application, focusing on Natural Language Processing (NLP) on chatbots on a mobile application that houses information and a "how-to" guide on internet safety can improve usability. The impact of parents having access to an intelligent platform, can promote digital hygiene, online safety for parents, guardians, caregivers, and children at home and anywhere, in the palm of their hand.

Keywords: Child Online Protection, Digital Hygiene, Online Safety, Cybersecurity, Awareness, Artificial Intelligence.

Using Co-Design to Craft Cybersecurity Secure Practices for Rural Communities in Africa

Gabriel Tuhafeni Nhinda, Fungai Bhunu Shava

Department of Informatics, Namibia University of Science and Technology
Department of Computer Science, Namibia University of Science and Technology

Email: gnhinda@hotmail.com, fbshava@nust.na

Presenter: Gabriel Tuhafeni Nhindaa (PhD Scholar)

Abstract

With the advent of the COVID-19 pandemic, many services moved onto the internet forcing more people to become first-time internet users, especially on the African continent. However, the internet is laden with many opportunities and cyber threats. In this abstract, we present our ongoing research utilising co-design to create a cybersecurity secure practices framework for rural and underserved communities in Africa. Co-designing has been used in various areas of research, from Marketing research to Land use planning and human-computer interaction studies. Having roots in participatory methods, which aim to remove the knowledge diffusion from the researcher to a more equal participation between participants and researchers. Another noted advantage of co-design is the reported level of ownership of artifacts, therefore, for our research, we hope that the best practices framework to be developed would be embodied African communities. Cybersecurity research often focuses on technical solutions within sorganisations and tends to neglect the human factor, when referred to, it is castigated and denoted as the weakest link in any Cybersecurity program. In addition, most studies in cybersecurity practices emanate within Western sorganisations and countries that have a different ethos and philosophy. We ascribe to what (Zimmermann & Renaud, 2019) referred to as cybersecurity differently, wherein the human is considered as part of the solution in cybersecurity. In our given context, we focus on communities in underserved rural African settings where culture plays a major role in how community members behave (Nhinda & Bhunu Shava, 2021). We rely on Ubuntu and Uushiindaism as lenses to understand the decisions community members make when interacting with the internet via end-user computing devices (i.e., Smartphones, etc.) (Mbenzi & Ashikuti, 2018). We conducted 4 focus groups and co-design sessions at 4 villages in the Engela Constituency and employed convenience sampling to interview 12 community members. Our focus groups and codesign sessions had a diverse set of participants. In the Engela and Onghala Villages, all the participants were youths, this is uncommon for African villages, as often, the elders would attend the community meetings. The Ouhongo and Omatunda villages had a mixture of youth and adults. We planned to engage 5 villages, however, the respective Headman did not give permission, stating "I do not know who you are, why don't you conduct the study in your village?" this after all relevant and supporting documents were sent to his office. We experienced further distrust as we sought permission to collect data within the constituency from the respective councilor. He remarked that his office is cautious of permission requests made via technological communication, as this is the modus operandi of criminals who

seek to exploit his constituents. To this end, the researchers were asked to physically visit the constituency office to get permission. The above instances are indications that trust, which is a tenet of Ubuntu in some African settings is earned and not a given to strangers. The preliminary data analysis shows that community members are engaged in various cybersecurity practices, such as the sutilisation of in-device security features, not sharing passwords, creation of codes based on a combination of events only they are aware of. However, there is also a sense of inter-community trust that may expose even those with strong passwords to phishing attacks through mobile applications like WhatsApp if the phishing messages originate from a trusted source like a neighbour, congruent with the theory of Uushiindaism. This also confirms the findings of (Mokobane & Botha, 2020) who found that Ubuntu tenets can be exploited by cybercriminals to ensure phishing attacks are successful. We thus argue that national efforts to educate the citizenry of cybersecurity practices need to move from policy and legislation to tangible efforts, ideally in our indigenous languages.

Keywords: Cybersecurity, Africa, Co-design, Ubuntu, Uushiindaism.

Conceptual Design of a Sensorless Smart Parking Payment Solution

Simon H. Muchinenyika, Attlee M. Gamundani, Colin Stanley, Excallent Moyowashe Garawaziva, and Roseline Liyawo Petrus

Computer Science Department, Namibia University of Science and Technology Windhoek, Namibia

Email: smuchinenyika@nust.na, agamundani@nust.na, cstanley@nust.na, 4218106076@namibiaust.onmicrosoft.com and 5214020339@namibiaust.onmicrosoft.com

Presenter: Attlee M Gamundani

Abstract

Finding parking in the central business district of Windhoek can be challenging during peak hours due to high influx of cars moving in and out of the area. This is further confounded by lack of effective parking payment solution as several parking meters along most streets are malfunctioning. Apart from the city authorities losing out on revenue, drivers who fail to make payment can face penalty fees as high as 600% of the normal parking fees. In this work we present a smart parking payment solution that will enable drivers to pay for their parking through their mobile devices without the need of then carrying coins that are currently required on the present system. The solutions are presented at different precision levels that allows city authorities to implement them incrementally. At inception, we recommend a solution that do not use car sensors to determine whether a parking slot is occupied or not but still allows some payment to be done cashless and remotely, similar to all our proposed solutions. We then present a smart parking payment solution that can also be conveniently used as an alternative by drivers with smartphones. Lastly, as resources are availed, a design of a more costly but precise solution that makes use of LoRa sensors is presented. We also discuss the benefits and limitations of each presented solution in addition to the benefits it brings to both drivers and city authorities.

Keywords: IoT, feature phones, local authority, LORa, on-street parking, smart payment

SESSION 2: BIG DATA: INFRASTRUCTURE AND ANALYTICS

Application of Machine Learning Techniques to Predict Student Attrition: A Case Study of the University of Namibia Bachelor of Chartered Accountancy Programme

Samuel N Nakale, Lameck Amugongo

Department of Informatics, Namibia University of Science and Technology
Department of Computer Science, Namibia University of Science and Technology

Email: snakale@unam.na , lamugongo@nust.na

Presenter: Samuel N Nakale (Master of Data Science Scholar)

Abstract

It has been established that student attrition has become a challenge for higher education institutions. Therefore, in order to develop effective student retention management systems, it is essential to understand the reasons behind student attrition. This project develops machine learning models to predict student attrition for the Bachelor of Chartered Accountancy programme at the University of Namibia based on the 2012 to 2018 cohorts. Information related to student's demographic, secondary education background and academic performance in the core modules is used to train various classification models. Preliminary results indicate that on average 44 percent of each cohort of students dropped out, majority of them dropping out in the first year of their studies. Of the five classifiers considered in the preliminary experiments, the support vector classifier performed the best, with a prediction accuracy of 58 percent. Some of the most important features in predicting student attrition for the programme include information on whether the student articulated or not, whether they did both accounting and mathematics in grade 12 or not and their gender. Data on academic performance in the core modules is being prepared to be included in the models and it is expected to improve the models' performances.

Keywords: Machine Learning, Student Attrition, Accounting Programme.

Towards Trustworthy Algorithms in Healthcare

Lameck Amugongo

Department of Computer Science: NUST

Email: lamugongo@nust.na

Presenter: Mr Lameck Amugongo

Abstract

The advent of sensors and other data sources such as imaging devices has resulted in unprecedented volumes of data in healthcare facilities. Accordingly, the availability of computing processing power allows for the development of complex algorithms that use artificial intelligence (AI) to derive insights from data. In healthcare, the insights from AI models are integrated into clinical decision support systems to help clinicians in diagnosis and treatment. Thus, improving patient outcomes. However, despite the positive benefits presented by AI, ethical concerns such as data privacy, bias and lack of interpretability have limited the clinical adoption of AI systems in healthcare. We propose a framework that developers of AI systems can use to demonstrate the trustworthiness of their algorithms, using quantitative measures to evaluate explainability (how systems make decisions/features that influence decisions), reliability (consistency in decisions), fairness (reduce societal bias and injustice) and agility (ability to capture complex clinical changes over time).

Keywords: Child Online Protection, Digital Hygiene, Online Safety, Cybersecurity, Awareness, Artificial Intelligence.

Design and Development of a Prediction Model for Improving Start-Up Success Using Machine Learning

Ajai Kumar Misra, Dharm Singh Jat, Durgesh Kumar Mishra

Department of Computer Science, Namibia University of Science and Technology, Namibia
Sri Aurobindo Institute of Technology, India.

Email: misra.ajai@gmail.com, dsingh@nust.na, durgesh.mishra@sait.ac.in

Presenter (online): Ajai K Misra (PhD Scholar)

Abstract

Machine learning (ML) has the ability to capture and analyse a huge amount of data without human interference. These ML techniques have become popular in recent years in academics and industries. They are being used to analyse real-world data to provide better and sustainable business, lifestyle, and success. Machine learning algorithms can measure and predict some application-oriented consequences in an industrial application. The Machine Learning based conceptual framework is developed based on a literature review of existing studies for improving start-up success. This presentation explains how to construct a conceptual Prediction Model for Improving Start-Up Success Using Machine Learning, which will be able to predict, diagnose and recommend the consequences for Improving Start-Up Success. The research will introduce an algorithm to identify the essential attributes among the available datasets. This algorithm evaluates the features available in different dataset files and prepares a new dataset by consolidating the various files. A hybrid deep learning algorithm will be developed using a Convolutional Neural Network (CNN) and a modified k-means clustering algorithm to predict start-up success and failure. The research work will use crunch base data and maintain the freshness of the data. Further, it will introduce a heuristic algorithm that utilises the facts of the success and failure of the industries. This framework will provide a road map and actionable insights to improve the start-up performance.

Keywords: Machine Learning, Convolutional Neural Network, Heuristic Algorithm, Start-up Success Prediction.

Using Computer Vision to Confirm Quantities of Baby Chickens: A Mobile Verification Tool for Chicken Farmers

Hubert P Mouton, Lameck Amugongo

Department of Informatics, Namibia University of Science and Technology
Department of Computer Science, Namibia University of Science and Technology

Email: lamugongo@nust.na

Presenter: Hubert P Mouton (Master of Data Science Scholar)

Abstract

Computer Vision is increasingly being used as a tool for real-time poultry monitoring. In baby chicken farming, farmers have identified that upon collection of baby chicks they face two problems: difficulty to verify quantities of baby chicks ordered and determining the condition of baby chicks. This study proposes an image-based baby chick quantity estimation system. Using a mobile application to verify the quantities of baby chicks in each box. K-Means algorithm was used to segment the baby chicks. Two convolutional neural networks were used to extract the features of both individual and grouped baby chicks. The YOLOv4 model outperformed the other models. The contributions of this paper are as follows: (1) A public dataset consisting of baby chicks (2) A light-weight mobile-based algorithm to detect and estimate baby chicks from an image. Our proposed solution can be used to accurately estimate baby chicks. Therefore, alleviating the concerns of farmers.

Keywords: Computer Vision, Mobile, Chicken Farmer.

A Federated Explainable Artificial Intelligence for Combating Fraudulent Credit Card Transactions

Ambrose A Azeta

Department of Computer Science, Namibia University of Science and Technology

Email: aazeta@nust.na

Presenter: Ambrose A Azeta

Abstract

In recent years, credit card fraud has cost both banks and consumers a significant amount of financial crisis. As a result, an effective fraud detection technique is critical for banks and cardholders to avoid losses. Artificial Intelligence (AI) approaches such as machine learning can be effective in combating fraudulent credit card transactions. However, these AI models lack transparency and trustworthiness because they do not explain their decision logic. Another challenge is the issue of aggregating user data in a central location for machine learning training, which may violate privacy regulations and make data more susceptible to data breaches. To address the problems, this study presented a federated explainable AI (XAI) to prevent fraudulent credit card transactions while ensuring privacy of the training data distributed among several banks. The study also explains the essential features that influence the model decision. The SecureBoost technique based on Federated AI Technology Enabler (FATE) Framework was utilised to implement the Gradient Boosting Decision Tree (GBDT) centralised model and the federated averaging, while the model-agnostic post-hoc explainability technique was used to explain essential features that influence the model performance. The results of the model-agnostic explainer reveals that the 'V14' feature has the highest negative impact on the proposed model, while the feature ''Amount' has the biggest positive effect on the proposed model output. The research findings revealed that the prediction accuracy of federated model is the same with the centralised model. Most importantly, the issue of data leakage was eliminated, and data privacy guaranteed.

Keywords: AI, Credit Card, FATE, Federated Learning, Fraud, GBDT, XAI.

Comparison between Lime and Shap XAI Methods

Takunda Hwaire, Lameck Amugongo

Department of Informatics, Namibia University of Science and Technology
Department of Computer Science, Namibia University of Science and Technology

Email: lamungongo@nust.na

Presenter: Takunda Hwaire (Master of Data Science Scholar)

Abstract

In the past fast few years, the adoption of Artificial Intelligence has been wide across different domains. However, the deployment of machine learning in critical sectors such as the healthcare sector is still at an early stage as deep learning models used usually fail at providing human-readable explanations, hence the introduction and establishment of Explainable AI(XAI). XAI aims to provide simple and easy-to-understand explanations to provide trust, transparency, and fairness. Researchers have developed two main XAI tools which are Local Interpretable Model Agnostic Explanations (LIME)and Shapley Addictive Explanations (SHAP). LIME is mainly used to provide local interpretability in which we try to understand how a single variable contributed to the model's final prediction whereas SHAP is used to provide global interpretability in which we try to understand the machine learning model as a whole and how each variable contributed to the prediction. Knowing the right tool for XAI is always a challenge for developers hence the need to compare LIME and SHAP to get a more concise and clearer understanding of these tools. In this study, we used the Pima Indians Diabetes Dataset on Logistic Regression, Gradient boosting and Category Boost models for prediction and Tuberculosis Chest X ray on a Convolutional Neural Network using Lenet5 and AlexNet architecture for classification. SHAP values indicates that glucose and Blood pressure contribute significantly to the prediction while LIME values applied bright green and red colours on the CNN image output to show areas which contributed the most to the prediction.

Keywords: Lime, Shap, XAI.

SESSION 3: DIGITAL TRANSFORMATION

Investigating the Implications of Covid-19 on the Sustainability of the Print Media in Namibia: A Case Study of The Namibian, Confidente and New Era

Hilary Mare, Hugh Ellis
Department of Informatics, Journalism and Media Technology, Namibia University of Science and Technology

Presenter: Hilary Mare

Abstract

Using case studies of The Namibian, New Era and Confidente newspapers, this study set out to investigate the implications of Covid-19 on the sustainability of Namibian newspapers, measures being employed by these newspapers to respond to these influences, and whether these measures are helping the three newspapers sustain their operations. This study applied a qualitative methodology and purposefully sampled 21 participants which included an editor, marketing manager and distribution manager, as well four journalists from each of the three newspapers. In-depth interviews were conducted with the participants. The study found that Covid-19 has adversely impacted the operations of the newspapers studied, with declining advertising, copy sales, job losses and reconfiguration of news work in both production and distribution. This has prompted the newspapers to respond by adopting a myriad of measures which include retrenchments, salary cuts, reduced employee benefits, salary payment date changes, and reducing both print runs and the number of pages. They have also resorted to expanding their operational scope by bidding for printing jobs, as well as to write Annual Reports for corporates. Apart from attempting to deepen stories to escape online competition, newspapers are also now using digital platforms to generate interest for their print editions by sharing snippets of articles on social media prior to publication of fuller articles in the print edition. Further, the study also observed that the newspapers have resorted to giving clients advertising discounts to keep them engaged with their print editions. All the three newspapers have developed packages that include digital platforms to further lure clients amid Covid-19. Lastly, the study revealed that journalists are responding to slimmer staff complements, induced by Covid-19, through up-skilling. While the acknowledgement that newspapers will cease to exist at one point is unanimous, the study notes that this can be either delayed or derailed by Namibian newspapers in changing the way stories are told, deepening coverage of community stories, and seeking cost-cutting interventions from the government, among others.

Keywords: Sustainability, Covid-19, Implications, Newspapers, Response, Resilience

Mobile Apps for Stress Management: A Case Study of University Students

Benjamin Akinmoyeje, Gloria Iyawa1, Suama Hamunyela
Department of Informatics, Journalism and Media Technology, Namibia University of Science and Technology
Email: benakin@gmail.com, giyawa@nust.na, slhamunyela@nust.na

Presenter: Benjamin Akinmoyeje (PhD Scholar)

Abstract

Mobile Health (mHealth) apps have been used to support stress management. However, the literature suggests that these apps have been less utilised in developing contexts. Furthermore, there is a dearth of research in the area of identifying persuasive strategies within this domain to support stress management among university students in developing countries. Identifying persuasive strategies for mHealth apps will improve the efficiency of stress management mHealth apps in developing countries as this will address the needs of students within developing contexts. This study is a qualitative study conducted in two phases, in which student participants and mHealth experts identified components of persuasive strategies for mHealth apps relevant to university students. The findings extended existing knowledge on persuasive strategies used in mHealth apps for stress management. The findings of this study can be used by mobile app developers to develop persuasive mHealth apps to support students in managing stress within developing contexts.

Keywords: Mobile Apps, Stress Management, University Students.

Effectiveness of Outsourced Information Systems in Public Sector

Petrus Helao Haixula, Jude Osakwe

Department of Informatics, Namibia University of Science and Technology

Presenter: Petrus Helao Haixula (Master of Informatics Scholar)

Abstract

Recent studies on the outsourcing of Information Systems (IS) have shown that there is a growing trend and widely accepted management practice of IS outsourcing in the public sector. Therefore, it is important to investigate the effectiveness of outsourcing Information Systems in these government agencies and parastatals. A quantitative research design was used for this study, and data was collected from the staff of the Namibia Ministry of Labour. Purposive sampling technique was used to select 25 staff members, while descriptive statistics was used to analyse data using the Statistical Package for Social Sciences (SPSS). The findings of this study reveal the lack of due process being followed which leads to the failure of the process and systems, while proper record keeping, and backup systems is required in case of failures.

Keywords: Outsourcing, Information Systems, Public Sector.

Mobile Apps for Smart Cities: A Scoping Review

Sinte Mutelo, Gloria Iyawa

Department of Informatics, Department of Journalism and Media Technology: NUST

Email: smutelo@nust.na, giyawa@nust.na

Presenter: Sinte Mutelo (PhD Scholar)

Abstract

Smart cities facilitate information sharing through the use of digital technologies. The emergence of smart cities has also led to citizens receiving improved government services. Digital technologies such as mobile apps have been used to provide smart city services to citizens. However, the scope and the range of literature on mobile apps for providing smart city services is not known. The aim of this research was to identify the range and scope of literature on mobile apps for providing smart city services. A scoping review of the literature was conducted from IEEE Xplore, Science Direct, ACM Digital Library, Google Scholar and Scopus. This study explores key aspects of smart city apps and how they are used in cities to facilitate government services in different countries. It also highlights the challenges and barriers to implementation.

Keywords: Mobile Apps, Smart City, Review.

Exhibitions

Indigenous Knowledge in the Digital World (IKWD): A Gesture-controlled VR Narrative Co-created with the Ju/'hoansi Community of Donkerbos

Freja B K Johansen, Mads Rosengreen, Thomas K K Kjeldsen, Samka3, Heike Winschiers-Theophilus, Emilie Maria Nybo Arendttorp

Aalborg University1
Namibia University of Science and Technology

Presenter: Freja B K Johansen

Abstract

Virtual Reality (VR) applications have gained in popularity, meanwhile expanding their use contexts to many different fields. Recent developments in VR headsets, with optical-based tracking, such as the Oculus Quest 2, support hand gesture-based interactions. However, currently a very limited repository of implemented gestures exists. With the aim of designing VR applications for diverse user groups we use an inclusive and participatory approach to the development of early-stage technologies, such as VR gesture interactions. In collaboration with members of the Ju/'Hoansi community in Donkerbos, we have co-created a gesture-controlled VR application of a hunting story, as told by the elders in the village, demonstrated in the field by an elder and youth, as well as 3D models and scenes described and designed by community members and interpreted by the researchers. The story has been implemented in VR using the Unity game engine. The application consists of a number of scenes, where the user progress in the story, either through object interactions, or through gesticular interactions with the Non-player characters (NPCs), using their hands only. The VR application is being validated by community members in Donkerbos. An analysis of user immersion, expectation satisfaction and observed gesture use will guide further research and developments of such systems. During the demo, participants can play through the VR narrative wearing an Oculus Quest 2 headset.

Keywords: Virtual Reality, Community, Participatory Approach.

Connecting Children across the Globe – A Virtual Learning Space Station

Isaac Makosa, Heike Winschiers-Theophilus, Helvi Itenge

Department of Computer Science, Namibia University of Science and Technology

Email: makosaisaac@gmail.com, hwinschiers@nust.na, hweheeler@nust.na

Presenter: Isaac Makosa

Abstract

Current communication platforms have not been designed for children's users and are therefore lacking affordances to support agentic and collaborative design-based learning activities with children. We present a virtual learning space station (VLSS), which was co-designed with 63 school children from three continents, namely Namibia, Malaysia and Finland. The design space station was developed on the Ohyay platform based on design concepts brought forward by the children, the on-line facilitator, researchers, and developers on the interdisciplinary and international team. The VLSS consists of different rooms, such as a cockpit, eating room, fun space, relaxing room, and a presentation room among others, which all serve different purposes ensuring children are engaged. We have implemented facilitation and feedback features, such as a talking mic, communication cards, emojis and a chat box, among others. In our current research we are exploring different media, forms, and control of feedback features for children's presenters and audiences. In our hands-on demonstration, attendees can organise/join a design session and test the online collaboration and facilitation tools provided by the space station.

Keywords: Children, Namibia, Virtual Learning.

NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Faculty of Computing and Informatics

2022 Research Day Programme

Physical Address:
13 Jackson Kaujeua Street,
Windhoek, Namibia
Private Bag 13388, Windhoek,
NAMIBIA
www.nust.na