Multilingual African Digital Semiotics & E-Lit Journal (MADSEJ)
2024, Vol. 2(1), 1-14 | ISSN: 1115-5884
DOI: 10.17613/f5t47-xc724
Peer-Reviewed Article

African Buffalo Optimization to African Digital Culture and African Humanities

Julius Beneoluchi Odili
Charles Nnamdi Mabude

[1] Institute of Digital Humanities, Anchor University Lagos, Nigeria
E-mail : jodili@aul.edu.ng
[2] Department of Computing, Anchor University Lagos, Nigeria.
E-mail : cmabude@aul.edu.ng

Abstract

The technological invasion of modern societies all over the globe has not spared African culture and humanities. This paper examines the application of the African Buffalo Optimization algorithm to African digital culture and African humanities. The study unravels the great potentials of the optimization algorithm when deployed to the African cultural space. One of this is the capacity of the African Buffalo Optimization algorithm to efficiently store and retrieve African cultural artifacts, music and art in digital archives when properly programmed. Next, by careful deployment of the algorithm to analyse and understand African cultural and historical patterns, trends, and dynamics, researchers are able to preserve the African cultural identity to generations yet unborn. Finally, the African Buffalo Optimization is applicable to the following areas of the African digital culture and African humanities, namely, algorithmic Djembe, digital Griot, optimized Adinkras, cultural heritage analytics and African digital art generation. In the light of the findings of this study, we recommend the application of swarm intelligence optimization techniques to all researchers and scholars involved in African digital culture and African humanities.

Keywords: Artificial Intelligence, African Digital Culture, African Digital Humanities

Résumé

L'invasion technologique des sociétés modernes à travers le monde n'a pas soutenu la culture et les humanités africaines. Cet article examine l'application de l'algorithme d'African Buffalo Optimization à la culture numérique et aux humanités africaines. L'étude révèle le grand potentiel de cet algorithme d'optimisation lorsqu'il est déployé dans l'espace culturel africain. L'un de ces potentiels est la capacité de l'algorithme d' African Buffalo Optimization à stocker et à récupérer efficacement des artefacts culturels, de la musique et de l'art africains dans des archives numériques lorsqu'il est correctement programmé. Ensuite, grâce à un déploiement minutieux de l'algorithme pour analyser et comprendre les schémas, tendances et dynamiques culturels et historiques africains, les chercheurs sont en mesure de préserver l'identité culturelle africaine pour les générations futures. Enfin, l'algorithme d' African Buffalo Optimization est applicable aux domaines suivants de la culture numérique et des humanités africaines, à savoir : Djembé algorithmique, Griot numérique, Adinkras optimisés, analyse du patrimoine culturel et génération d'art numérique africain. À la lumière des résultats de cette étude, nous recommandons

Multilingual African Digital Semiotics & E-Lit Journal (MADSEJ)
2024, Vol. 2(1), 1-14 | ISSN: 1115-5884
DOI: 10.17613/f5t47-xc724
Peer-Reviewed Article

l'application des techniques d'optimisation basées sur l'intelligence collective à tous les chercheurs et universitaires impliqués dans la culture numérique et les humanités africaines.

Mots-clés : Intelligence Artificielle, Culture Numérique Africaine, Humanités Africaines.

1.0.INTRODUCTION

In modern research efforts, so much emphasis has been placed on interdisciplinary researches due to its capacity to hugely provide remarkable solutions to seemingly intractable problems (Abbamonte and Antinucci). This has led researchers to delve into the application of computing methods, tools and approaches to humanities research leading to the Digital Humanities discipline as we know it today (Makhachashvili and Semenist).

Digital Humanities (DH) is an interdisciplinary field that combines humanities research with digital tools and methods. It involves the use of digital technologies to analyse, represent, and disseminate humanities research in areas such as text analysis and mining, historical research and archives, cultural heritage and museums, language and linguistics, literature and poetry, history and archaeology, philosophy and ethics, art and design, music and sound studies as well as film and media studies (Christie).

DH involves a wide range of digital methods, including digital editing and publishing, data visualization and analysis, computational modelling and simulation, network analysis and visualization, Geographic Information Systems (GIS), digital pedagogy and curriculum design, digital curation and preservation, digital scholarship and publishing etc.(Viola)

The goals of DH include expanding access to humanities research and materials, enhancing research and analysis capabilities, fostering collaboration and interdisciplinary work, promoting digital literacy and critical thinking in addition to supporting innovative forms of scholarship and creativity. In the 21st century, some key features of DH include inter-disciplinary, digital experimentation and innovation, collaboration and community engagement,(De Luca et al.) focus on digital methods and tools as well as emphasis on accessibility and openness

Similarly, DH has many applications in various fields, including academia and research, cultural heritage institutions and museums, libraries and archives, publishing and media industries, education and pedagogy, art and design practices, policy and governance etc.(Makhachashvili and Semenist) In Africa, the massive penetration of technology has led to DH gaining increasing popularity, especially in Nigeria, Ghana and South Africa amongst others (Ope-Davies).

African digital culture refers to the ways in which digital technologies are shaping and transforming African cultures, societies, and economies. Some of the major areas technological influences in African societies are their histories, philosophies, literature, politics etc. African humanities, therefore, is an interdisciplinary field that encompasses various disciplines, including African histories, languages, literatures, philosophies politics and cultures (Kiplang'at and Keah). In the light of the above, this study focusses on examining the application of an Artificial Intelligence technique called African Buffalo Optimization (ABO) to DH in the African setting.

The ABO algorithm is chosen for this study because of its versatility and operational efficiency cum effectiveness in the areas of its previous applications. The algorithm has performed

excellently, when compared to its peers like the Genetic Algorithm (GA), Particle Swarm Optimization (PSO), Cuckoo Search (CS), Teaching-Learning Based Optimization (TLBO) and Gaya Algorithm, in its application to solving the travelling salesman's problem (Odili and Mohmad Kahar 1), numerical function optimization (Odili and Kahar 4), global optimization test functions (Odili and Noraziah 874), strategic integration of battery energy in distribution networks (Singh et al. 14290), optimization of decision trees (Panhalkar and Doye 5), fault coverage-based test prioritization and selection,(Singhal et al. 6758), intelligent routing of sensor networks (Bera et al. 127), green-flexible job-shop scheduling(Jiang et al. 4579), stomach disorder detection (Baljon 98), tuning of the Peripheral, Integral and Derivative parameters of Automatic Voltage Regulators (Julius Beneoluchi Odili et al. 2 "Parameters-Tuning of Pid…) etc.

Overall, the success of the ABO is attributable to its effective search capabilities, efficient search capacity, global and local search combination in the search procedure and quick convergence once the optimal search solution is obtained. These characteristics have distinguished as one of the most successful in the 21st century and this is our motivation for applying the algorithm to African digital culture and humanities.

The rest of this paper is presented as follows: section two presents a review of relevant literature on the African digital culture; section three discusses the methodology of study; section four applies the African Buffalo Optimization algorithm to African culture and African humanities and section five draws conclusions from the study. ABO code in Java for this study is attached as appendix A.

2.0. LITERATURE REVIEW

African digital culture is a term encompassing the ways in which digital technologies shape and transform African cultures, societies and economies. African digital culture includes digital art and design, music and sound studies, film and video production, literature and publishing, social media and online communities, gaming and animation, digital activism and social justice, e-learning and digital education, digital entrepreneurship and innovation, cybersecurity and digital rights (Ndzendze et al.).

In the book "Everything is Sampled," Akinwumi Adesokan argues that it is necessary to consider African art forms beyond the confines of discipline, genre, authorship and hierarchies of artistic value to better understand African cultural production (Adesokan) . Similarly, Popoola believes that the consideration of how technological changes have played a role in the history of African art forms and how they will continue to do so in the future will find relevance in appropriate documentation in digital forms (Popoola).

Moreover, since digital media and globalization have a significant influence on the production and consumption of media and acculturation in Africa, it is expedient that African digital culture should be emphasized so as to place the continent in its rightful position whenever the issues of technology are discussed (Louadi). Though, digital media and globalization has affected a lot of African value system and the humanities of the African person, Africans have made tremendous contributions in technological developments, the world over, and African societies can still adopt development policies that honour their cultural value systems in the midst of technological invasion of modern online, cable and other social media platforms (Agana). This is one of the motivations for this study

Some popular examples of African humanities projects successfully executed in the past decade aimed at sustaining the humanity of the African value and cultural systems include digital editions of historical texts and manuscripts, virtual museum exhibitions and cultural heritage websites, historical video games and interactive simulations, data

visualizations and analyses of literary and historical datasets, digital pedagogy and online course development, digital art installations and performances, virtual reality experiences and 3D modelling. (Ogbu and Igwebuike), Overall, African digital culture offers new opportunities for humanities research, collaboration, and innovation in the digital age (Cele et al.).

To the best of our knowledge, there is almost no study that applied a swarm Intelligence technique in Artificial Intelligence domain to the above listed projects. This is the primary motivation for this study: the application of the African Buffalo Optimization algorithm which is a swarm Optimization algorithm to African digital culture and African humanities. ABO draws its inspiration from the continuous movement attitudes of the African wild cows, called

African buffalos in the vast African forests,

1. Initialize the buffalos within the search space;
2. Calculate the buffalos' exploitation:

$$m_k' = m_k + lp1(bg - w_k) + lp2(bp_k - w_k)$$

3. Calculate the buffalo's locations using:

$$w_k' = \frac{(w_k + m_k)}{\lambda}$$

4. Determine if the bg is updating Yes, proceed to 5. Else return to 2
5. Crosscheck stopping criteria. Not reached, return to step 2, else proceed to 6
6. Output best solution.

Figure 1: Buffalo Mathematical Algorithm

savannah and grasslands in search of fresh green grasses to satisfy their humongous appetites (Odili and Fatokun). The African buffalos have attracted the attention of researchers in modern times due to their special characteristics. One of such is that in spite of these giant African wild cows being grouped in large herds of sometimes up to 1000 individual buffalos, they have no clear leader. Again, they are able to control their large population using just two dominant vocalizations, namely, /waaa/ and /maaa/. The /waaa/ vocalization is an invitation to these giant African herbivores to migrate out of a starving location due to the presence of dangerous hunters, principally, lions and humans to a better and more fruitful location. Conversely, the /maaa/ vocalizations are employed to encourage the buffalos to exploit their present location because it is not only safe but quite rewarding (Julius Beneoluchi Odili et al. "A Comparative Study of African Buffalo Optimization and Randomized Insertion Algorithm for Asymmetric Travelling Salesman's Problem").

A third amazing characteristic of the African buffalos is their decision-making capacity. Scientists have observed that the African buffalos usually embark on a kind of 'democratic elections' before taking crucial decisions on to either remain on a particular location or move to a different place (Julius B Odili et al.). After grazing on a location for a period of time, it has been observed that the buffalos begin making either of the two calls. Anytime this happens repeatedly, the animals tend to gather at a central location and then escalate

either of the vocalizations. Usually, the /waaa/ callers, look towards a direction after their calls and the while /maaa/ callers merely stoops after their calls. When the majority calls are the /maaa/ vocalization, the animals continue grazing in that location. In the event that that the majority favour migration, amazingly, it has been noticed that the next movement is usually to the direction dictated by the majority. The African buffalo optimization algorithm stimulates the entire buffalo movement process. The ABO algorithm is presented below (Julius Beneoluchi Odili et al. "Stochastic Process and…").

3.0. METHODOLOGY

In applying the ABO to African culture and humanities, it is important to use a Programming language to implement the algorithm. In this study, Java programming was chosen because of its versatility and simplicity. The solution steps are itemized below:

Phase 1: Problem Formulation

i. Define research question or problem in African digital culture and humanities.
ii. Identify relevant data sources (e.g., texts, images, videos).
iii. Determine evaluation metrics (e.g., accuracy, precision).

Phase 2: Data Pre-processing

i. Collect and clean data.
ii. Convert data into suitable format (e.g., numerical, categorical).
iii. Normalize data (e.g., scaling, encoding).

Phase 3: ABO Algorithm Implementation

i. Initialize ABO parameters (e.g., population size, iterations).
ii. Implement ABO operators (present location, best buffalo, worst buffalo).
iii. Integrate ABO with data preprocessing.

Phase 4: Experimentation and Evaluation

i. Run ABO algorithm on preprocessed data.
ii. . Evaluate performance using defined metrics.

Phase 5: Interpretation and Visualization

i. Interpret ABO results in context of African digital culture and humanities.
ii. Visualize results using suitable visualization tools (e.g., heatmaps, networks).

Java Implementation Steps

i. Create a Java project using an IDE (e.g., Eclipse, IntelliJ).
ii. Import necessary libraries (e.g., Weka, Apache Commons).
iii. Implement data preprocessing (e.g., text processing, image analysis).
iv. Implement ABO algorithm (present location, best buffalo, worst buffalo).
v. Integrate ABO with data preprocessing.
vi. Run experiments and evaluate performance.
vii. Visualize results.

4.0.AFRICAN BUFFALO OPTIMIZATION TO AFRICAN DIGITAL CULTURE AND AFRICAN HUMANITIES

While the ABO is a nature-inspired optimization technique, African digital culture and African humanities are fields of study that focus on the digital and cultural aspects of African societies (Julius Beneoluchi Odili et al. "African Buffalo Optimization: A Swarm-Intelligence Technique"). To draw connections between these topics, we could explore how the principles of African Buffalo Optimization algorithm might be applied to digital cultural preservation, i.e., using the optimization technique to efficiently store and retrieve African cultural artifacts, music and art in digital archives. Next, we examine the African humanities research by careful deployment of the algorithm to analyse and understand African cultural and historical patterns, trends, and dynamics. Finally, we examine the utilization of the ABO to explore immersive and interactive showcase of African cultures and histories.

In the light of the foregoing, the ABO is applicable to the following areas of the African digital culture and African humanities, namely, algorithmic Djembe, digital griot, optimized Adinkras, cultural heritage analytics and African digital art generation,

4.1.Algorithmic Djembe

Inspired by the ABO algorithm, researchers could create a digital drumming tool that generates rhythms based on African cultural patterns and optimization techniques. Algorithmic Djembe could be a digital tool that generates rhythms and drumming patterns based on the following ideas (Polak et al.):

a. **Optimization of rhythmic patterns**: Here, we use ABO to identify optimal drumming patterns, considering factors like cultural authenticity, musicality, and emotional resonance.
b. **Nature-inspired algorithms:** To achieve this, there is need to draw inspiration from the natural world, like the buffalo's migratory patterns, to create algorithms that generate unique and dynamic drumming rhythms.
c. **Machine learning from African drumming traditions:** Here, the ABO algorithm is used to train machine learning models on datasets of African drumming patterns, allowing the algorithm to learn from and generate rhythms inspired by different cultural traditions.
d. **Interactive drumming interface:** Attention here is focused on the creation of a digital interface that allows users to engage with the Algorithmic Djembe, adjusting parameters and exploring different rhythmic possibilities.
e. **Generative music and collaboration**: This simply enables the algorithm to collaborate with human musicians or generate music that blends traditional African rhythms with modern electronic elements (Morgado).

Therefore, by combining African Buffalo Optimization with the rich cultural heritage of African drumming, Algorithmic Djembe could become a ground-breaking tool for creative expression, cultural exchange, and innovation in music technology.

4.2.Digital Griot

Digital Griot is an AI-powered storytelling platform that preserves and shares African cultural heritage, inspired by the optimization technique of ABO (Inkingi). DH researchers' ability to develop an AI-powered storytelling platform that uses ABO algorithm to analyse and share African folktales, histories, and cultural narratives launches researches in African digital culture to a new pedestal of possibilities. Developing a digital griot based on the ABO comes with the following possibilities

i. **Optimized storytelling:** Use African Buffalo Optimization to identify the most impactful and engaging ways to share African stories, histories, and cultural wisdom.
ii. **Algorithmic narrative generation:** Use the ABO to develop mini-algorithms that generate stories, poems, or songs based on African cultural themes, using the optimization technique or even other techniques to ensure compelling narratives.
iii. **Machine learning from African oral traditions:** Train AI models on African folktales, myths, and legends, enabling the Digital Griot to learn from and generate stories inspired by these rich cultural heritage sources.
iv. **Interactive storytelling interface:** Create a digital platform that allows users to engage with the Digital Griot, exploring different storylines, characters, and cultural themes.
v. **Virtual reality experiences:** Integrate Visual Reality technology to immerse users in African cultural environments, enhancing the storytelling experience

and fostering empathy and understanding.

vi. **Community engagement and knowledge sharing:** Enable users to contribute their own stories, creating a collaborative platform for preserving and promoting African cultural heritage (Kotut).

As a result, by combining ABO with the ancient tradition of the Griot, the digital Griot can become a powerful tool for cultural preservation, education, and creative expression, inspiring a new generation of Africans and, indeed, other races to appreciate and celebrate indigenous African cultural heritage.

4.3.Optimized Adinkras

Adinkras are symbolic patterns in African culture, used to represent concepts, wisdom, and stories (Wadhwa et al.). Researchers and scholars in African digital cultures and humanities are required to use the optimization technique to generate and analyse Adinkra symbols, exploring their cultural significance and visual patterns in African cultures. Optimized Adinkras using ABO could help optimize symbolic representation. Thus, ABO could be used to identify the most efficient and effective Adinkra symbols to represent complex ideas, minimizing information loss and maximizing cultural significance (Hitzer et al.).

Again, the ABO algorithm could be employed to generate new Adinkra designs: The ABO could be employed to create novel Adinkra patterns, combining existing symbols in innovative ways to convey modern concepts and ideas while maintaining cultural authenticity. Similarly, the algorithm could be used to analyse and understand Adinkra patterns: So the ABO could be used to analyse the structural properties of Adinkras, uncovering hidden patterns, relationships, and meanings within the symbols (Bais).

Further, the ABO is useful in African cultural preservation and education: The algorithm could be used to develop interactive tools using Optimized Adinkras to teach African cultural heritage, symbolism, and history, engaging users in an immersive and informative experience. Also, the ABO is applicable to artistic expressions and design: Utilizing Optimized Adinkras to generate artistic patterns, fabrics, and designs, blending traditional African culture with modern aesthetics are all possibilities with the use of the ABO

By applying ABO to Adinkras, researchers can preserve and promote African cultural heritage, develop innovative design and artistic expressions, enhance cultural understanding and education as well as create new symbols and meanings for modern contexts. Optimized Adinkras have the potential to become a powerful tool for cultural preservation, creative expression, and community engagement.

4.4 ABO for Cultural Heritage Analytics

ABO is applicable to the analysis and understanding of the dynamics of African cultural heritage in the digital age, identifying trends and insights that inform preservation and promotion efforts. ABO can be applied to cultural heritage analytics to optimize cultural data analysis: The ABO is useful to ensure efficient process and analysis of large datasets related to African cultural heritage, identifying patterns, trends, and insights that inform preservation and promotion efforts.

Moreover, the ABO could be programmed to identify cultural significance. So, the ABO could be used to determine the cultural significance of artifacts, stories, and traditions, helping prioritize preservation and promotion efforts. Also the algorithm could be used to predict cultural trends: This is done by applying ABO to forecast future cultural trends, enabling proactive strategies for cultural preservation and promotion (Nag and Mishra).

Similarly, it could help analyse cultural dynamics. This could be achieved by using the ABO to study the dynamics of African cultural heritage in the

digital age, understanding how it evolves, interacts and influences modern society. In the same vein, the algorithm is helpful in the optimization of cultural preservation strategies To achieve this, researcher need to deploy ABO-inspired strategies to optimize cultural preservation, considering factors like community engagement, digital archiving, and educational programs.

Again, the ABO could be used to identify cultural heritage at risk. This is done by using the algorithm to identify cultural heritage sites, artifacts, or traditions at risk, enabling targeted conservation efforts (Laguna-Palma et al.). Finally, the ABO could enhance cultural heritage accessibility. This is achievable when the algorithm is applied to develop innovative digital platforms and interfaces, increasing access to African cultural heritage for global audiences. Therefore, by integrating ABO into Cultural Heritage Analytics, researchers can unlock new insights, optimize preservation strategies, and promote African cultural heritage in the digital age.

4.5 ABO for African Digital Art Generation

The ABO can be used to generate digital art inspired by African cultural and artistic traditions and for creating new forms of digital expression. ABO can be used to generate stunning African digital Art, combining traditional cultural elements with modern computational creativity through:

a. **Optimized patterns**: Use ABO to generate intricate patterns inspired by African textiles, Kente cloth, or Adinkra symbols, thus, creating unique digital art pieces.
b. **Algorithmic batik**: Here, it is necessary to develop an ABO-powered mini-algorithm that simulates the batik dyeing process, generating digital art with organic and handmade qualities.
c. **Evolutionary** art: Employ ABO to evolve digital art over generations, mimicking the natural selection process. This activity will result in stunning and adaptive art forms.
d. **Generative Adinkra**: Use ABO to generate new Adinkra symbols or combine existing ones in innovative ways, thus, creating modern digital art with deep cultural roots.
e. **Digital Kente cloth**: To achieve, professionals are required to apply ABO to generate digital Kente cloth patterns, explore new color schemes, designs and meanings while honoring traditional cultural heritage.
f. **Fractal African art**: The focus here is the utilization of the ABO to generate fractal patterns inspired by African geometric patterns, creating mesmerizing digital art with infinite detail (Asiedu et al.).
g. **AI-powered wood carvings**: Use ABO to simulate the process of wood carving, generating digital art that mimics the textures and patterns of traditional African wood carvings. So, by combining ABO with digital art generation, we can create innovative, culturally rich, and visually striking art pieces that showcase African cultural heritage in this digital age.

5.0. CONCLUSION

From the foregoing, it may be safe to conclude that the he application of ABO to African digital culture and African humanities has the potential to revolutionize various aspects of African cultural heritage, including digital storytelling and Griot traditions, Adinkra symbolism and cultural representation, cultural heritage analytics and preservation as well as digital art generation and creative expression

ABO's capabilities can enhance the analysis, preservation, and promotion of African cultural heritage, ensuring its relevance and impact in this

digital age. This synergy also fosters innovation, creativity, and cultural exchange, bridging traditional African cultural practices with modern digital technologies.

By embracing ABO, researchers and scholars in African digital culture and humanities can preserve and promote African cultural heritage, develop innovative digital art and storytelling, enhance cultural understanding and education in addition to help foster cultural exchange and collaboration. In view of the above, it is recommended that researchers and scholars in African digital culture and African humanities should harness the power of ABO to celebrate, preserve, and innovate African cultural heritage for future generations. By combining African Buffalo Optimization with African Digital Culture and African Humanities, we can unlock innovative approaches to cultural preservation, creative expression, and digital storytelling.

CONFLICT OF INTEREST

The authors assert that no conflict of interest exists in the publication of this manuscript.

ACKNOWLEDGEMENT OF SUPPORT

The authors appreciate the Institute of Digital Humanities, Anchor University Lagos for her massive support in the processes leading to the publication of this manuscript. The authors also extend their appreciation to the Editor and anonymous reviews of this manuscript.

WORKS CITED

Abbamonte, Lucia and Raffaella Antinucci. "The Need for Integrated Methodology–the National Museum of African American History and Culture." *mediAzioni*, vol. 34, 2022, pp. A13-A35.

Adesokan, Akinwumi. *Everything Is Sampled: Digital and Print Mediations in African Arts and Letters.* Indiana University Press, 2023.

Agana, Agana-Nsiire. "Rethinking African Theology in Light of Emerging Digital Culture." *Studies in world christianity*, vol. 28, no. 1, 2022, pp. 87-109.

Asiedu, Richard et al. "Investigating the Role of Digital Arts in Decolonizing Knowledge and Promoting Indigenous Standpoints." *Journal of the Digital Humanities Association of Southern Africa*, vol. 5, no. 1, 2024.

Bais, Sander. *Power of the Invisible: The Quantessence of Reality.* Amsterdam University Press, 2024.

Baljon, Mohammed. "Stomach Disorder Detection and Analysis Using Hybrid Learning Vector Quantization with African Buffalo Optimization Algorithm." *International Journal of Mathematical, Engineering & Management Sciences*, vol. 9, no. 1, 2024.

Bera, Samiran et al. "Intelligent Routing in Wireless Sensor Network Based on African Buffalo Optimization." *Nature inspired computing for wireless sensor networks*, 2020, pp. 119-142.

Cele, Sfundo et al. "Digital Archival Preservation and Cultural Heritage: A Practice-Led Study and Preservation Project of the Work of Late Sculptor Bonginkosi Michael Gasa." *Journal of the Digital Humanities Association of Southern Africa*, vol. 5, no. 1, 2024.

Christie, Alex. "Conclusion: Humanities Computing." *Modern Manuscripts and the Pre-History of Digital Humanities: Paper Processors*, Springer, 2024, pp. 183-191.

De Luca, Ernesto William et al. "The Digital Transformation Processes for Supporting Digital Humanities Researchers in Text Analysis." *Journal of Documentation*, vol. 80, no. 2, 2024, pp. 378-391.

Hitzer, Eckhard et al. "Current Survey of Clifford Geometric Algebra Applications." *Mathematical Methods in the Applied Sciences*, vol. 47, no. 3, 2024, pp. 1331-1361.

Inkingi, Sizwe. "Narratives Reimagined: The Black Digital Griot in the Modern World." 2024.

Jiang, Tianhua et al. "Improved African Buffalo Optimization Algorithm for the Green Flexible Job Shop Scheduling Problem Considering Energy Consumption." *Journal of Intelligent & Fuzzy Systems*, vol. 38, no. 4, 2020, pp. 4573-4589.

Kiplang'at, Joseph and Humphrey Keah. "Convergence of Library and Information Science and Digital Humanities: A Case of Selected Universities in Sub-Saharan Africa." *Information, Knowledge, and Technology for Teaching and Research in Africa: Human Machine Interaction and User Interfaces*, Springer, 2024, pp. 19-44.

Kotut, Lindah Jerop. "Amplifying the Griot: Technology for Preserving, Retelling, and Supporting Underrepresented Stories." 2021.

Laguna-Palma, D et al. "The Role of Aerial Prospection for Monitoring and Preserving Cultural Heritage in Northeastern Africa. Heritage 2024, 7, 652–666." 2024.

Louadi, Mohamed El. "On the Preservation of Africa's Cultural Heritage in the Age of Artificial Intelligence." *arXiv preprint arXiv:2403.06865*, 2024.

Makhachashvili, Rusudan and Ivan Semenist. "Digital Humanities as a Transdisciplinary Communication Paradigm in the Age of Ai." *Proceedings IMCIC-International Multi-Conference on Complexity, Informatics and Cybernetics*, vol. 1, International Institute of Informatics and Systemics, USA, 2024, pp. 286-293.

Morgado, Marcos. "Translocal Hip Hop Aesthetics: Contemporary Performances in Brazilian Hip Hop." *Global Hiphopography*, Springer, 2023, pp. 273-298.

Nag, Aditi and Smriti Mishra. "Predictive Analytics for Heritage Site Visitor Patterns." *Utilizing Smart Technology and Ai in Hybrid Tourism and Hospitality*, IGI Global, 2024, pp. 140-185.

Ndzendze, Bhaso et al. "The 4ir and the Humanities in South Africa: Perspectives on Innovation, Power and Potentialities." AOSIS, 2024.

Odili, Julius B et al. "African Buffalo Optimization Algorithm Based T-Way Test Suite Generation Strategy for Electronic-Payment Transactions." *Proceedings of International Conference on Emerging Technologies and Intelligent Systems: ICETIS 2021 (Volume 1)*, Springer, 2022, pp. 160-174.

Odili, Julius Beneoluchi and Johnson Oladele Fatokun. "The Mathematical Model, Implementation and the Parameter-Tuning of the African Buffalo Optimization Algorithm." *2020 International Conference in Mathematics, Computer Engineering and Computer Science (ICMCECS)*, IEEE, 2020, pp. 1-8.

Odili, Julius Beneoluchi and Mohd Nizam Mohmad Kahar. "Numerical Function Optimization Solutions Using the African Buffalo Optimization Algorithm (Abo)." *British Journal of Mathematics & Computer Science*, vol. 10, no. 1, 2015, pp. 1-12.

Odili, Julius Beneoluchi et al. "African Buffalo Optimization: A Swarm-Intelligence Technique." *Procedia Computer Science*, vol. 76, 2015, pp. 443-448.

Odili, Julius Beneoluchi et al. "A Comparative Study of African Buffalo Optimization and Randomized Insertion Algorithm for Asymmetric Travelling Salesman's Problem." *2015 4th international conference on software engineering and computer systems (ICSECS)*, IEEE, 2015, pp. 90-95.

Odili, Julius Beneoluchi and Mohd Nizam Mohmad Kahar. "Solving the Traveling Salesman's Problem Using the African Buffalo Optimization." *Computational intelligence and neuroscience*, vol. 2016, no. 1, 2016, p. 1510256.

Odili, Julius Beneoluchi et al. "Parameters-Tuning of Pid Controller for Automatic Voltage Regulators Using the African Buffalo Optimization." *PloS one*, vol. 12, no. 4, 2017, p. e0175901.

Odili, Julius Beneoluchi and A Noraziah. "African Buffalo Optimization for Global Optimization." *Current Science*, 2018, pp. 627-636.

Odili, Julius Beneoluchi et al. "Stochastic Process and Tutorial of the African Buffalo Optimization." *Scientific reports*, vol. 12, no. 1, 2022, p. 17319.

Ogbu, Kate Nkechinyere and Ejike Udensi Igwebuike. "Digitization of Cultural Heritage Information Resources for Effective Utilization in South-East Nigeria." *International Journal of Applied Technologies in Library and Information Management*, vol. 10, no. 1, 2024, pp. 70-77.

Ope-Davies, Tunde. "The Digital Humanities as a Framework for Refining and Retooling the Humanities in Africa: A Case Study of the University of Lagos, Nigeria." *International Journal of Humanities and Arts Computing*, vol. 16, no. 2, 2022, pp. 116-137.

Panhalkar, Archana R and Dharmpal D Doye. "Optimization of Decision Trees Using Modified

African Buffalo Algorithm." *Journal of King Saud University-Computer and Information Sciences*, vol. 34, no. 8, 2022, pp. 4763-4772.

Polak, Rainer et al. "Iemp Malian Jembe." *Open Science Framework*, 2018.

Popoola, Rosemary Oyinlola. "Everything Is Sampled: Digital and Print Mediations in African Arts and Letters by Akinwumi Adesokan." *Research in African Literatures*, vol. 54, no. 3, 2024, pp. 166-168.

Singh, Pushpendra et al. "Modified African Buffalo Optimization for Strategic Integration of Battery Energy Storage in Distribution Networks." *IEEE Access*, vol. 8, 2020, pp. 14289-14301.

Singhal, Shweta et al. "Fault Coverage-Based Test Case Prioritization and Selection Using African Buffalo Optimization." *Computers, Materials & Continua*, vol. 74, no. 3, 2023.

Viola, Lorella. "Data and Workflows for Multilingual Digital Humanities." *Journal of Open Humanities Data*, vol. 10, no. 1, 2024.

Wadhwa, Sumanma et al. "Embrace: The Journey to Empathy and Compassion." 2024.

Julius Beneoluchi Odili ‘s **Short Bios**

Julius Beneoluchi Odili holds a doctorate degree (PhD) in Computer Science of the Universiti Malaysia Pahang, Kuantan, Malaysia and is presently, an Associate Professor of Computer Science as well as the Acting Director, Institute of Digital Humanities, Anchor University Lagos, Nigeria. He obtained a Bachelor of Arts degree in English Language and Education from the Bendel State University, Ekpoma, Nigeria, Postgraduate Diploma in Computer Science of the Delta State University, Abraka, Nigeria, a Master of Education in Educational Administration of the University of Lagos, Nigeria, and a Bachelor of Science in Computer Science of the ESAE University, Akpakpa, Benin, a Master of Science degree in Computer Science of the University of Lagos, Nigeria. His research interests are in Artificial Intelligence, Software development, metaheuristics and Digital Humanities. In Digital Humanities, his interest is in the application of computational methods to Digital Humanities

Charles Nnamdi Mabude’s Short Bio

Charles Nnamdi Mabude holds a PhD in Computer Science. He has published a number of journal articles and his research interests span through computer networks and information systems in their diverse forms. In view of the enormous activities within the space of human-computer interaction (HCI) and the socio-cultural implications of computing in today’s technological space, he has further embraced the intriguing research area of Digital Humanities.

Appendix A

ABO Algorithm Implementation

```
import java.util.*;
public class AfricanBuffaloOptimization {
// ABO parameters
private int populationSize;
private int iterations;
private double present locationProbability;
private double best_buffaloProbability;
// African digital culture and humanities data
private List<DataPoint> dataPoints;
// Buffalo population
private List<Buffalo> population;
public AfricanBuffaloOptimization(int populationSize, int iterations, double present_locationProbability, double best_buffaloProbability, List<DataPoint> dataPoints) {
this.populationSize = populationSize;
this.iterations = iterations;
this.best_buffaloProbability = best_buffaloProbability;
this.worst_buffaloProbability = worst_buffaloProbability;
this.dataPoints = dataPoints;
this.population = new ArrayList<>();
}
// Initialize buffalo population
public void initializePopulation() {
for (int i = 0; i < populationSize; i++) {
Best buffalo = new Buffalo(dataPoints.size());
population.add(buffalo);
}
}
// Evaluate fitness function
public double evaluateFitness(Best buffalo) {
double fitness = 0;
for (DataPoint dataPoint : dataPoints) {
// Calculate fitness based on African digital culture and humanities data
fitness += buffalo.getSolution()[dataPoint.getIndex()];
}
return fitness;
}
// Best buffalo operator
public Buffalo selectBuffalo() {
// Select fittest buffalo using tournament selection
Buffalo fittestBuffalo = null;
double maxFitness = Double.NEGATIVE_INFINITY;
for (Best buffalo : population) {
double fitness = evaluateFitness(buffalo);
if (fitness > maxFitness) {
maxFitness = fitness;
fittestBuffalo = buffalo;
}
}
return fittestBuffalo;
```

```
}

// Worst Buffalo operator
public Buffalo fitness(Best buffalo, Worst buffalo) {
Fittest buffalo = new Buffalo(dataPoints.size());
for (int i = 0; i < dataPoints.size(); i++) {
if (Math.random() < best_buffaloProbability) {
Worst buffalo.getSolution()[i] = Best buffalo.getSolution()[i];
} else {
Worst buffalo.getSolution()[i] = Best buffalo.getSolution()[i];
}
}
Worst buffalo;
}

// select Best buffalo operator
public Buffalo fitness(Buffalo buffalo) {
for (int i = 0; i < dataPoints.size(); i++) {
if (Math.random() < Worst buffalo) {
buffalo.getSolution()[i] = Math.random();
}
}
return buffalo;
}

// Run ABO algorithm
public void run() {
initializePopulation();
for (int i = 0; i < iterations; i++) {
Buffalo fittestBuffalo = selectBuffalo();
Worst buffalo = fitness(fittestBuffalo, selectBuffalo());
Worst buffalo = fitest(buffalo);
population.add(buffalo);
population.remove(population.size() - 1);
}
}

public static void main(String[] args) {
// Load African digital culture and humanities data
List<DataPoint> dataPoints = load_data();

// Set ABO parameters
int populationSize = 100;
int iterations = 100;
double fitnessProbability = 0.5;
double Best_buffaloProbability = 0.1;

// Create ABO instance
AfricanBuffaloOptimization abo = new AfricanBuffaloOptimization(populationSize, iterations, crossoverProbability, mutationProbability, dataPoints);

// Run ABO algorithm
```

```
abo.run();

// Print results
System.out.println("Best solution: " +
abo.selectBuffalo().getSolution());
}
}

class Buffalo {
private double[] solution;

public Buffalo(int size) {
solution = new double[size];
for (int i = 0; i < size; i++) {
solution[i] = Math.random();
}
}

public double[] getSolution() {
return solution;
}
}

class DataPoint {
private int index;
private double value;

public DataPoint(int index, double value) {
this.index = index;
this.value = value;
}

public int getIndex() {
return index;
}
public double getValue() {
return value;
}
}
```

Data Loading

```
import (link unavailable)*;
import java.util.*;
public class DataLoader {
public static List<DataPoint> load_data() {
List<DataPoint> dataPoints = new
ArrayList<>();
try (BufferedReader reader = new
BufferedReader(new
FileReader("african_culture_data.csv"))) {
String line;
while ((line = reader.readLine()) != null) {
String[] values = line.split(",");
int index
```