ISSN: 2834-4928

Research Article

Journal of Electrical Electronics Engineering

Leveraging AI and Technology to Address the Challenges of Underdeveloped Countries

Neelesh Mungoli*

UNC Charlotte, USA

***Corresponding Author**
Neelesh Mungoli, UNC Charlotte, USA.

Submitted: 2023, May 15; **Accepted:** 2023, June 15; **Published:** 2023, July 10

Citation: Mungoli, N. (2023). Leveraging AI and Technology to Address the Challenges of Underdeveloped Countries. *J Electrical Electron Eng, 2*(3), 211-216.

Abstract

This article addresses the challenges of underdeveloped countries and discusses the potential of AI and technology to positively impact them. The article explores how these technologies can be used in areas such as healthcare, education, agriculture, and societal issues. The system presented in the article proposed an AI system architecture that can be used in future implementation. The article concludes by discussing the limitation of such A.I systems [1].

Keywords: Artificial Intelligence, Healthcare, Education

1. Introduction

Leveraging A.I and technology to address the challenges of underdeveloped countries is an in-depth examination of the ways in which Artificial intelligence (A.I) and technology can be used to tackle the complex and multifaceted challenges faced by underdeveloped countries. The article begins by discussing the current state of underdeveloped countries, where poverty, lack of access to education and healthcare, and other societal issues remain prevalent. However, as the world becomes increasingly connected, the potential for A.I and technology to positively impact underdeveloped countries is growing. The article then delves into specific areas where A.I and technology can have a significant impact, such as healthcare, education, and agriculture. For example, A.I-powered diagnostic tools and telemedicine can help bridge the gap between rural and urban areas, providing patients with access to medical professionals and specialists they otherwise would not have. Additionally, A.I can assist in the analysis of vast amounts of medical data, helping doctors and researchers to better understand and treat diseases. In education, online learning platforms and A.I-powered tutoring systems can provide access to educational resources for individuals in remote and underprivileged areas. Furthermore, A.I can be used to personalize and adapt learning to the individual needs of students, helping to improve the effectiveness of education [2]. And in agriculture, precision agriculture, which uses A.I-powered systems to analyze data and make decisions on crop management, can increase crop yields, reduce costs and improve food security. The article also discusses how A.I and technology can also play a role in addressing broader societal issues in underdeveloped countries. For example, A.I can be used to analyze data and identify patterns that can help to improve the delivery of services such as water and electricity. Additionally, A.I can be used to improve the efficiency of government and aid organizations, helping to better target resources and reduce waste. In this article I propose an A.I system that can be used for a variety of purposes.

2 Related Work

I review the related work from the aspects of A.I, Machine learning.

2.1 Near Future of Artificial Intelligence

The future of artificial intelligence (A.I) looks incredibly promising, with advancements in technology expected to revolutionize many industries and change the way we live our daily lives [3].

One of the most significant areas of growth for A.I is in the field of autonomous systems. Self-driving cars, drones, and robots are all expected to become more prevalent in the coming years, with the ability to perform tasks without human intervention. This will lead to increased efficiency and safety, as well as new opportunities for transportation and delivery. Additionally, A.I-powered robots and automation will play a vital role in the manufacturing and logistics industries, helping to increase productivity and reduce labor costs.

Another area where A.I is expected to make a significant impact is in healthcare. A.I-powered diagnostic tools and medical image analysis are expected to become more accurate and efficient, helping to detect diseases early and improve patient outcomes. Additionally, A.I-powered personalized medicine will help to tailor treatments to the specific needs of individual patients, leading to more effective and efficient healthcare.

A.I is also expected to revolutionize the field of finance and banking. A.I-powered financial analysis and trading algorithms will become more sophisticated, allowing for faster and more accurate predictions of market trends. Additionally, A.I-powered fraud detection and prevention systems will help to reduce

financial crime and increase the security of financial transactions.

In the field of education, A.I will play a vital role in personalizing learning, providing individualized instruction to students based on their specific needs and abilities. Additionally, A.I-powered tutoring systems and educational games will help to improve student engagement and learning outcomes.

A.I will also play a vital role in improving the efficiency and effectiveness of government and aid organizations. A.I-powered data analysis will be used to identify patterns in data that can help to improve the delivery of services such as water and electricity, while the use of A.I in government and aid organizations will help to improve the efficiency and effectiveness of these organizations.

In addition to these specific applications, A.I is also expected to play a significant role in the field of research and development. A.I-powered data analysis will be used to identify patterns in data that can help to improve the delivery of services such as water and electricity, while the use of A.I in government and aid organizations will help to improve the efficiency and effectiveness of these organizations.

Overall, the future of A.I looks incredibly promising, with advancements in technology expected to revolutionize many industries and change the way we live our daily lives. The key for society is to ensure that the benefits of these technologies are widely distributed and that the necessary infrastructure, training, and support are in place to fully realize their potential.

2.2 Present and Future of Artificial Intelligence in Dentistry

The field of dentistry is rapidly evolving and Artificial Intelligence (A.I) is poised to play a major role in shaping its future. A.I technology has the potential to revolutionize the way dentists diagnose, treat and prevent oral diseases.

One of the most significant applications of A.I in dentistry is in the area of diagnostic imaging. A.I-powered diagnostic tools such as digital radiography and cone-beam computed tomography (CBCT) scanners allow for faster and more accurate identification of oral diseases such as cavities, tumors, and gum diseases. These tools also help to reduce radiation exposure for patients and improve the efficiency of the diagnostic process [4].

A.I is also being used to improve the accuracy and efficiency of dental treatment planning. A.I-powered treatment planning software can analyze large amounts of data from diagnostic imaging and patient records to provide dentists with detailed, evidence-based treatment plans that are tailored to the specific needs of each patient [5]. Additionally, A.I-powered tools such as virtual reality and augmented reality can be used to simulate treatment outcomes, allowing dentists to plan and communicate treatment options with patients more effectively.

Another area where A.I is expected to make a significant impact is in the field of robotic dentistry. A.I-powered robots and automation can assist dentists in performing procedures such as cavity preparation, root canal treatment, and tooth extraction with increased precision and speed. This will help to improve the quality of care and reduce the need for human intervention in certain procedures, which can improve patient outcomes.

A.I-powered predictive analytics are also expected to play a significant role in the field of preventive dentistry. A.I-powered tools can analyze data from diagnostic imaging, electronic health records, and patient risk factors to predict the likelihood of oral diseases such as cavities and periodontal disease. This will allow dentists to provide targeted preventive care to patients at high risk of oral diseases, helping to reduce the burden of oral diseases on public health.

Moreover, A.I can also be applied to improve patient care experience, by powering virtual assistants and chatbot that can help with scheduling appointments, providing patient education and answering common questions.

The future of A.I in dentistry is incredibly promising, with advancements in technology expected to revolutionize the way dentists diagnose, treat and prevent oral diseases. To fully realize the potential of A.I in dentistry, it will be necessary to invest in the necessary infrastructure, provide training and support to dental professionals and work closely with governments and organizations to ensure that the benefits of these technologies are widely distributed.

2.3 Neuroscience and A.I

The field of neuroscience and artificial intelligence (A.I) is a rapidly evolving area of research, with the potential to revolutionize the way we understand and treat a wide range of neurological disorders.

One of the most promising areas of research in this field is the use of A.I to analyze brain imaging data. A.I algorithms can analyze large amounts of data from neuroimaging techniques such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) scans to identify patterns and markers of neurological disorders. This has the potential to improve the accuracy of diagnosis and help to identify new targets for treatment.

Another area where A.I is expected to make a significant impact is in the field of neural prosthetics. A.I-powered neural implants can be used to restore function to patients with neurological disorders such as spinal cord injuries, Parkinson's disease, and dementia. A.I controlled prosthetics can provide patients with improved mobility, communication and quality of life, with the potential to dramatically improve the life of those who are suffering from neurological disorders.

A.I is also expected to play a significant role in the field of drug discovery and development. A.I-powered tools can analyze large amounts of data from preclinical studies and clinical trials to identify potential new drugs and drug targets for neurological disorders. This has the potential to speed up the drug development process and help to identify new treatments for disorders that currently lack effective therapies.

In addition, A.I is also expected to play a vital role in the field of brain-computer interfaces (BCI). BCI technology uses neural signals to control prosthetic devices, computers or other

machines. By using A.I to analyze neural signals, BCI systems can provide patients with more precise control of their prosthetics and improve the overall performance of the system.

The future of neuroscience and A.I is incredibly promising, with advancements in technology expected to revolutionize the way we understand and treat neurological disorders. To fully realize the potential of A.I in neuroscience, it will be necessary to invest in the necessary infrastructure, provide training and support to researchers and medical professionals, and work closely with governments and organizations to ensure that the benefits of these technologies are widely distributed.

3 Design of Future A.I System

An A.I system typically consists of several components.

• Data collection and preprocessing: This component is responsible for collecting, cleaning, and preprocessing data that will be used to train and test the A.I model.

• Model training: This component uses the preprocessed data to train the A.I model. This typically involves using machine learning algorithms to find patterns and relationships in the data.

• Model evaluation: This component is responsible for evaluating the performance of the A.I model. This typically involves using a set of test data to evaluate the model's accuracy, precision, and recall.

• Model deployment: This component is responsible for deploying the A.I model into a production environment. This typically involves integrating the model into an existing application or creating a new application that utilizes the model.

• Model monitoring and maintenance: This component is responsible for monitoring the performance of the A.I model in the production environment and making updates and improvements as necessary.

• Human-in-the-loop: This component allows for human intervention and oversight in the decision-making process of the A.I system. This is particularly important in sensitive applications such as healthcare, finance and criminal justice, where A.I-generated decisions could have significant consequences.

• The architecture of an A.I system can be further divided into several subcomponents, including data storage, data management, and data visualization. These subcomponents are responsible for storing, managing, and visualizing the data that is used by the A.I model. Additionally, the system may include a user interface for interacting with the system and a back-end for managing the system's infrastructure.

4 System Architecture A.I System

Based on the requirements of the A.I system described above, I have built a system that supports data collection and preprocessing. The following presents the overall architecture of our system and its key components.

4.1 Data Collection and Preprocessing system for an A.I

A data collection and preprocessing system for an A.I system typically includes the following components.

Data acquisition: This component is responsible for acquiring data from various sources, such as databases, APIs, and web scraping. The data can be structured or unstructured, and can include text, images, audio, and video.

• Data cleaning: This component is responsible for cleaning and preprocessing the data to remove any inconsistencies or errors. This can include tasks such as removing duplicate data, handling missing values, and standardizing data formats.

• Data integration: This component is responsible for integrating data from multiple sources into a single dataset. This can include tasks such as joining tables, normalizing data, and creating new features.

• Data transformation: This component is responsible for transforming the data into a format that can be used by the A.I model. This can include tasks such as encoding categorical variables, scaling numerical variables, and creating new features.

• Data storage: This component is responsible for storing the preprocessed data in a format that can be easily accessed by the A.I model. This can include tasks such as storing the data in a database or creating a file-based data structure.

• Data visualization: This component is responsible for visualizing the data to help understand the patterns and relationships within the data. This can include tasks such as creating histograms, scatter plots, and heat maps.

• Data quality assessment: this component is responsible for evaluating the quality of the data, which can include checking for missing or duplicate data, outliers, and other inconsistencies in the data.

4.2 Training A.I

An A.I model training architecture typically includes the following components.

• Data preparation: This component is responsible for preparing the data for use in the training process. This can include tasks such as splitting the data into training and testing sets, shuffling the data, and normalizing the data.

• Model selection: This component is responsible for selecting the appropriate A.I model for the task at hand. This can include tasks such as selecting a supervised or unsupervised learning algorithm, choosing a neural network architecture, or selecting a pre-trained model.

• Hyper parameter tuning: This component is responsible for tuning the hyper parameters of the A.I model. This can include tasks such as adjusting the learning rate, the number of hidden layers, or the number of neurons in a neural network.

• Training: This component is responsible for training the A.I model on the prepared data. This can include tasks such as running a forward and backward pass through the neural network, updating the weights and biases, and calculating the loss.

• Model evaluation: This component is responsible for evaluating the performance of the trained model. This can include tasks such as calculating the model's accuracy, precision, recall, and other metrics.

• Model optimization: This component is responsible for optimizing the A.I model. This can include tasks such as regularization, early stopping, and pruning to prevent overfitting.

• Model storage: This component is responsible for storing the trained A.I model in a format that can be easily accessed by other components of the system.

The A.I model training architecture is designed to efficiently train and evaluate A.I models, and to optimize and store the models for later use. The system should be flexible, scalable, and able to handle large amounts of data. The system should also be

able to handle different types of data and models, and to easily switch between them if needed.

5 A.I Model Evaluation

A.I model evaluation architecture typically includes the following components.

• Data preparation: This component is responsible for preparing the data for use in the evaluation process. This can include tasks such as splitting the data into training, validation, and testing sets, shuffling the data, and normalizing the data.

• Model loading: This component is responsible for loading the trained A.I model into the evaluation system. This can include tasks such as reading the model from a file or database, or loading a pre-trained model from a cloud-based service.

• Evaluation metrics: This component is responsible for calculating the performance metrics of the A.I model. This can include tasks such as calculating the model's accuracy, precision, recall, and other metrics.

• Performance visualization: This component is responsible for visualizing the performance of the A.I model. This can include tasks such as creating confusion matrices, ROC curves, and precision-recall curves.

• Model comparison: This component is responsible for comparing the performance of different A.I models. This can include tasks such as comparing the performance of different neural network architectures or comparing the performance of different algorithms.

• Model selection: This component is responsible for selecting the best-performing model based on the evaluation results. This can include tasks such as selecting the model with the highest accuracy, or selecting the model that performs best on specific subsets of the data.

• Model storage: This component is responsible for storing the selected A.I model in a format that can be easily accessed by other components of the system.

• The system should be flexible, scalable, and able to handle different types of data and models. It should also be able to handle large amounts of data, and provide easy-to-understand visualizations of the performance results. The system should also be able to handle the different types of evaluation metrics that could be used in different scenarios.

5.1 A.I Model Deployment

A.I model deployment architecture typically includes the following components.

• Model loading: This component is responsible for loading the trained and selected A.I model into the deployment system. This can include tasks such as reading the model from a file or database, or loading a pre-trained model from a cloud-based service.

• API: This component is responsible for creating an API that allows other systems to interact with the deployed A.I model. This can include tasks such as creating endpoints for making predictions, or creating a web-based interface for interacting with the model.

• Scaling: This component is responsible for scaling the deployed model to handle a large number of requests. This can include tasks such as using load balancers, or deploying the model to a cloud-based service.

• Monitoring: This component is responsible for monitoring the performance of the deployed model. This can include tasks such as logging the number of requests, response times, and error rates.

• Versioning: This component is responsible for versioning the deployed model. This can include tasks such as creating different versions of the model, and allowing users to select the version they want to use.

• Security: This component is responsible for securing the deployed model, ensuring that only authorized users can access it. This can include tasks such as implementing authentication and authorization, and encrypting data in transit and at rest.

• Maintenance: This component is responsible for maintaining the deployed model. This can include tasks such as updating the model with new data, retraining the model, and monitoring for drift.

• The system should be scalable, secure, and able to handle a large number of requests. It should also provide monitoring, versioning and maintenance capabilities, allowing to keep the deployed model up-to-date and ensure its performance. Additionally, the system should be able to handle different types of deployment scenarios, such as on-premises, cloud, or edge.

5.2 A.I Model Monitoring and Maintenance

An A.I model monitoring and maintenance architecture typically includes the following components.

• Model monitoring: This component is responsible for monitoring the performance of the deployed A.I model. This can include tasks such as logging the number of requests, response times, and error rates.

• Performance visualization: This component is responsible for visualizing the performance of the deployed A.I model. This can include tasks such as creating dashboards, charts, and reports that display key performance metrics.

• Drift detection: This component is responsible for detecting and alerting when the performance of the deployed model deviates from expected performance.

• Data pipeline monitoring: This component is responsible for monitoring the data pipeline and ensuring that data is being correctly collected, cleaned, and preprocessed.

• Model versioning: This component is responsible for versioning the deployed model, allowing different versions of the model to be deployed and compared.

• Model updates: This component is responsible for updating the deployed model with new data, retraining the model, and monitoring for drift.

• Model archiving: This component is responsible for archiving old versions of the model, allowing them to be accessed for future reference.

• Security: This component is responsible for ensuring that the deployed model is secure and that only authorized users have access to it.

Overall, the A.I model monitoring and maintenance architecture is designed to ensure the deployed model is running smoothly, performing well and is secure. The system should be able to detect and alert when there are issues with the model performance, and provide tools for updating and maintaining the model. Additionally, it should be able to handle different types of deployment scenarios and provide versioning, archiving and security features for the deployed models.

5.3 Human-in-the-loop

A human-in-the-loop architecture typically includes the following components.

• **Model monitoring:** This component is responsible for monitoring the performance of the deployed A.I model. This can include tasks such as logging the number of requests, response times, and error rates.

• **Human review:** This component is responsible for allowing humans to review the decisions made by the A.I model. This can include tasks such as providing a web-based interface for humans to review decisions, or sending notifications to humans when the model makes a decision that falls outside of pre-defined thresholds.

• **Feedback:** This component is responsible for allowing humans to provide feedback on the model's decisions. This can include tasks such as providing a web-based interface for humans to provide feedback, or sending notifications to humans when feedback is needed.

• **Model updates:** This component is responsible for updating the deployed model with feedback provided by humans. This can include tasks such as retraining the model with new data, adjusting model parameters, or deploying a new version of the model.

• **Auditing:** This component is responsible for logging the decisions made by the A.I model, the feedback provided by humans, and the actions taken as a result of that feedback. This allows for transparency and accountability of the system.

• **Security:** This component is responsible for ensuring that the deployed model is secure and that only authorized users have access to it.

Overall, the human-in-the-loop architecture is designed to ensure that the decisions made by the A.I model are checked by a human and that humans can provide feedback to improve the A.I model. The system should be able to handle different types of deployment scenarios, provide monitoring, auditing and security features for the deployed models. Additionally, it should allow for transparency and accountability of the system, providing a clear record of the decisions made by the A.I model and any human feedback provided.

6 Discussions and Limitations

An A.I system and its architecture can have a number of limitations, some of which include.

• **Data quality:** The quality of the data used to train and test theA.I model can greatly impact its performance. Poor quality data can lead to inaccurate or biased models.

• **Scalability:** As the amount of data and complexity of the model increases, it can become increasingly difficult to scale the system to handle the increased workload.

• **Explain ability:** Some A.I models, particularly those based on deep learning, can be difficult to interpret and understand. This can make it challenging to explain the model's decisions and its decision-making process.

• **Bias:** A.I models can inadvertently reflect the bias present in the data used to train them. This can lead to discriminatory or unfair decisions.

• **Security:** A.I systems can be vulnerable to attacks and data breaches, which can lead to sensitive information being compromised.

• **Transparency:** A.I systems can be opaque, meaning it can be difficult to understand how they arrived at a certain decision, which can be a disadvantage in sensitive areas such as healthcare and finance.

• **Maintenance:** A.I systems require continuous monitoring, maintenance, and updates, which can be time-consuming and expensive.

• **Human-in-the-loop:** As A.I models are designed to automate tasks and make decisions, they can at times replace the role of human decision-making, which can lead to ethical, legal and social issues.

It is important to note that these limitations are not unique to A.I systems and architectures and are not insurmountable. They can be mitigated by using best practices in data management, model selection, and human-in-the-loop design, by regularly evaluating the performance of the system, and by implementing security and privacy measures. Additionally, it is essential to keep in mind the limitations and continuously monitor the system to ensure that it is functioning correctly and achieving the desired outcomes.

7 Conclusion and Future Work

In conclusion, A.I systems and architectures have the potential to revolutionize a wide range of industries, from healthcare to finance. However, there are also a number of limitations that must be taken into account when designing and deploying such systems. These limitations include issues with data quality, scalability, explain ability, bias, security, transparency and maintenance.

To overcome these limitations, it is essential to use best practices in data management, model selection, and human-in-the-loop design. Additionally, regularly evaluating the performance of the system and implementing security and privacy measures are crucial. Furthermore, it is important to keep in mind the limitations of A.I systems and architectures and continuously monitor the system to ensure that it is functioning correctly and achieving the desired outcomes.

In terms of future work, researchers and practitioners can continue to focus on developing techniques for addressing the limitations of A.I systems and architectures. This can include developing methods for detecting and mitigating bias in A.I models, improving the explain ability of A.I models, and improving the scalability of A.I systems. Additionally, more research is needed to explore the ethical and social implications of A.I systems and architectures, and to identify best practices for their deployment.

Overall, the future of A.I systems and architectures is promising, but it requires the collaboration of the researchers, practitioners and stakeholders to address the challenges and limitations to fully realize its potential.

References

1. Bell, A. J. (1999). Levels and loops: the future of artificial intelligence and neuroscience. Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences, 354(1392), 2013-2020.

2. Bundy, A. (2017). Preparing for the future of artificial intelligence.
3. Floridi, L. (2019). What the near future of artificial intelligence could be. Philosophy & Technology, 32, 1-15.
4. Haenlein, M., & Kaplan, A. (2019). A brief history of artificial intelligence: On the past, present, and future of artificial intelligence. California management review, 61(4), 5-14.
5. Tandon, D., Rajawat, J., & Banerjee, M. (2020). Present and future of artificial intelligence in dentistry. Journal of Oral Biology and Craniofacial Research, 10(4), 391-396.