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The Future is Intelligent: Empowering Future Ready Workforce Through Artificial Intelligence (AI) Education At Academic City University College, Accra Ghana.

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ABSTRACT

With the current advancements of automation and robotics, it is expected that AI is going to transform the global economy in an exponential manner. To leverage the new opportunities, there is a need for preparation as well as learning and developing new skills for those new jobs. It is in this regard that Academic City is taking the AI agenda into the forefront, nurturing and empowering the African student to lead the continent into the new AI era. Academic City University College (ACity) is set to lead the sub-region in technology and innovation education with the introduction of an undergraduate degree in Artificial Intelligence (AI). The university becomes the first in Africa to offer a degree in AI. The program, which has commenced already forms part of the university's short-term effort to develop a cadence of new programs that will invariably push the boundaries of knowledge while establishing a foothold for successful graduates in the jobs of the future. This paper projects the innovative attempt at addressing the manpower challenges in Artificial Intelligence by ACity, Accra, Ghana and her pioneering efforts in the West African sub-region that led to the launch of a new Bachelors Programme in Artificial Intelligence. The programme style and curriculum are presented while also providing perspectives on how the programme fits into the global and African quest to develop skills and strategies to upscale technological advancement as we face an intelligence-driven future.

Keywords – ACity, Artificial Intelligence (AI), Robotics, BSc, Ghana, Degree, Education, University, UNESCO, Make Centre

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1. INTRODUCTION

In a world that is progressively characterized by ubiquitous networks, connectivity, digital networks and recommender systems enabled by Artificial Intelligence, data sciences and machine learning, where information exchange and granulated data has continued to influence decisions and choices and where data is as pervasive and as valuable, Africa has a one of a kind opportunity to pioneer, adopt and use new advanced innovations to drive enormous societal change on all fronts.

Artificial intelligence for Africa presents opportunities to put the continent at the forefront of the Fourth Industrial Revolution. Before Africa can lead this transformation, though, there are important steps that must be undertaken. First, the region needs to develop critical work force in new and emerging fields of studies, prompted by user demand and the unique needs of the continents. Institutions of higher learning and the research and scholarship community in Africa must take leadership by embracing inter-tertiary, multidisciplinary and collaborative research that addresses the myriads of challenges faced by the continent beyond sparks of disjointed and “silo” activities that has characterized institutional research in the continent over the years.

Artificial intelligence (AI)-driven information and communication technology (ICT) theory and applications have advanced fast in recent years, resulting in numerous accomplishments in domains such as business, industry, education, agriculture, and others. Most current studies, on the other hand, rely significantly on large-scale labeled datasets, which come at a considerable cost of data collection and annotation. Few-shot learning is a necessary supplement that seeks to learn from minimal labeled data to obtain a generalized model. In addition, technocrats, governments, society, thought leaders and of course the general populace must embrace technology transfer, formulate a comprehensive continental blueprint to guide its AI strategies by involving key stakeholders, institutions, academia, and the private and public sectors in its conception, adoption, uptake and diffusion of new and emerging technologies.

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. The ideal characteristic of artificial intelligence is its ability to rationalize and take actions that have the best chance of achieving a specific goal. The term “artificial intelligence (AI)” has many connotations, depending on the specific industry it is used in. Most often, however, “when people say ‘artificial intelligence,’ what they actually mean is machine learning.



Fig 1: Artificial Intelligence in Perspective

AI is a large umbrella term that incorporates a lot of statistical and machine learning methods. Machine learning software allows computers to “witness” human behavior through the intake of data. These systems then undergo advanced processes to analyze that data and identify patterns within it, using those findings to apply the discovered knowledge and replicate the behavior. Yousef & Kevin (2020) opined Africa's use of artificial intelligence has the potential to propel the region to the forefront of the Fourth Industrial Revolution. However, there are essential actions that must be performed before Africa can lead this revolution.



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To begin, the area must develop a comprehensive continental plan to guide its AI strategy, incorporating important Pan-African institutions, academics, as well as the corporate and governmental sectors in its development. In order for AI to be a viable economic alternative, these stakeholders must also invest in developing a digital identification framework for all Africans with accurate data banks.

For this, it is imperative to leverage readily available local talent as a means to promote and democratize AI technology continent-wide. Finally, we must harmonize regulatory policies that encourage ethically built AI systems so as to guarantee a more inclusive economic development for Africa. Francis, Hind and Hamid (2021) in their paper “Developing an Artificial Intelligence for Strategy for Africa” submitted that Africa confronts a number of well-known obstacles in creating AI products and strategies, including a lack of funding, a scarcity of specialized personnel, and a lack of access to the most up-to-date global research. Due to African innovation and investments by global businesses such as IBM Research, Google, Microsoft, and Amazon, which have all created AI labs in Africa, these barriers are being gradually surmounted, albeit slowly. Deep Learning Indaba (a Zulu word for gathering), a platform that challenges African data scientists to solve the continent's toughest challenges, and Zindi, a platform that challenges African data scientists to solve the continent's toughest challenges, are two examples of innovative trans-continental collaboration that are gaining traction.

Nature (2018) reported that Artificial intelligence (AI) is having the same profound impact on civilization as the steam engine and electricity. However, unlike previous technical revolutions, the AI revolution presents a once-in-a-lifetime opportunity to improve people's lives without widening or exacerbating global inequities. This will necessitate expanding the areas where AI is performed. North America, Europe, and Asia account for the vast majority of experts. The continent of Africa, in particular, is underrepresented. Unintentional algorithmic biases and discrimination might be included in AI products due to a lack of diversity. Not only that, but there are fewer African AI researchers and engineers, which means fewer opportunities to apply AI to enhance Africans' lives.

The research community is also losing out on outstanding individuals who have not gotten the appropriate education. It is therefore heartwarming that in support of this trend and ACity's demonstrable commitment to seek new and exciting approaches that positively impact and advance society as well as to educate future-ready leaders who can innovatively solve complex problems within an ethical, entrepreneurial and collaborative environment. The University is pioneering a programme in Artificial Intelligence aimed at producing the much needed manpower of the future in this domain. Academic City's BSc in Artificial Intelligence (AI) seeks to equip graduates with knowledge in emerging advances in computational, decision-making sciences and technologies that allow computers and machines to function in an intelligent manner both in accurate prediction of events and outcomes and in decision-making.



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Fig 1: ACity’s Engineering Workshop and Laboratories

The university recently introduced BSc. in Biomedical Engineering and BSc. in Robotics Engineering. These new programs are deliberately designed to play comfortably at the intersection of AI providing further impetus to new programs in Data Analytics and Advanced Autonomous Systems.

2. THE UNIVERSITY’S MISSION AND VISION

ACity as it is popularly called has a vision be a world-class center for learning, innovation and entrepreneurship that nurtures future leaders. Her mission is to educate future-ready leaders who can innovatively solve complex problems within an ethical, entrepreneurial and collaborative environment. With a balanced blend of technical, social, cultural and unified leaning paradigms, the University is poised to develop the total person while fuifiling her mission



Industry experts are estimating that by 2030, AI could be contributing nearly \$16 trillion to the global economy. However, the emergence of new technologies is anticipated to cease many existing job opportunities whiles creating new jobs



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Fig. 2: Academic City University College Campus Environment

Speaking on the new program, Prof. Fred McBagonluri, President of Academic City University College remarked “The Artificial Intelligence programme in our institution intends to explore the ethical dimensions of AI, its strategic impact as well as the core programs and adjacencies such as robotics, informatics, and data analytics.

By this approach, the programme is intended to create versatile graduates conversant in the broad area of robotics, AI, informatics while poised also for research in the rapidly evolving fields of AI”.



Fig 2: The President of ACity – Dr. Fred McBagonluri Interacting with Students

According to him, AI holds great promise for Ghanaian and African workforce of the future as many opportunities for its application abound in healthcare, education, transportation, governance, finance, marketing, journalism among others. He further opined that Africa’s future industrialization efforts across the spectrum of key strategic areas such as manufacturing, agriculture, education, healthcare, etc. are pivoted around robotics. Hence, Africa can no longer wait to join the AI and robotic wagon”

2.1 AI and ACity's Mandate

In initiating the AI programme, ACity is fulfilling her mandate to provide high quality education driven by innovation, impact, engagement and to being in the top 100 of the leading young, new universities in the world. It intends through this programme to further inspire, motivate, and empower students to become excellent engineers, entrepreneurs and leaders within a campus environment that is evolving to become a breeding ground for exceptional teaching, learning and community development that parades world class faculties and manpower.

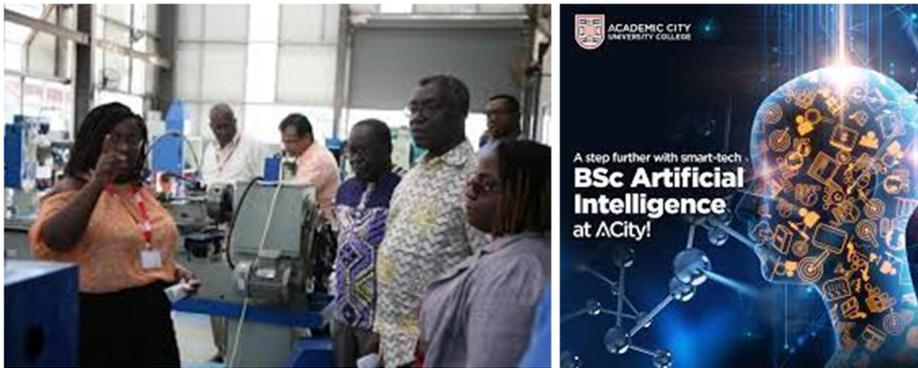


Fig 2: Faculty Stakeholders Interactions & The ACity's AI Programme Call for Interest

The AI programme will also further entrench the utilization of the great infrastructure, unified teaching, best practices, methodologies, innovative curriculum and unique teaching methods and a team-based approach to ensure the provision of experiential learning that combines theory & practice for future ready leaders in the domain of Artificial Intelligence, machine learning, Data Sciences, data Analytics and Robotics.

3. CURRENT TRENDS & FUTURE PROSPECTS OF AI IN GHANA

AI has progressed to a point where programs have been developed to positively impact almost every industry through the streamlining of business processes, the improving of consumer experiences, and the carrying out of tasks that have never before been possible. AI makes it possible for us to unlock our smartphones with our faces, ask our virtual assistants questions and receive vocalized answers, and have our unwanted emails filtered to a spam folder without ever having to address them. AI Scientists work in the science of developing artificial intelligence algorithms, flexible automation, semantic analysis. They are responsible for designing, testing, and building systems that utilize inference machine and deductive and inductive reasoning to assist us with day-to-day usage of IT facilities and devices. Recommender systems that support business processes, decision support systems, transaction support systems, surveillance systems are also part of the AI Scientists purview. As the world ushers in the Fourth Industrial Revolution (4IR) – which is characterized by increasingly blurred lines between the digital, biological, and physical worlds (UN, 2021) – technologists are coming to grips with the opportunities of emerging technologies such as Artificial Intelligence (AI), robotics, and the Internet of Things.



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These and other emerging technologies offer exciting possibilities; in theory, they might allow us to galvanize unprecedented socio-economic change and democratise access to services such as the internet, education, and healthcare. Africa will be impacted by AI in a variety of ways. Many have lauded it as a game-changer for African cultures, promising to reduce inequality, alleviate poverty, and enhance access to public services such as health and education. However, on the continent, deployment of these strong technologies is still in its infancy, and considerable hurdles remain in establishing capacity to fully realize their potential. One of the most significant is a global lack of diversity in the field, which pervades all aspects of AI, from dataset development through system development and implementation. In this context, diversity refers to the inclusion of persons from various socioeconomic backgrounds.

In their paper titled “State and Future Prospects of Artificial Intelligence (AI) in Ghana” Amegadzie, Kanubala, Cobbina, & Acquaye reiterate the fact that the global connectivity index (GCI, 2020) reported that Ghana has seen a marginal growth of 6 connectivity points growing from 24/120 to 30/120 over the span of 5 years. It is expected that this index will grow even further with policies being put in place by the government.



Fig: The ACity's Tech & Entrepreneurship Hub & Computer Laboratory

With a growing population and a lot more connectivity on the horizon, more industries need to be empowered with capabilities for the adoption of AI in the near future. The paper concluded that salient AI usage will positively impact Africa in such sectors as Education, Banking and Finance, Agriculture, Health, Engineering and Manufacturing. AI already finds usage in some of these sectors in some forms and therefore require manpower development that can expand usage and develop new innovative ways of applying AI. The government of Ghana has recently moved to digitalize all government agencies which in turn makes it easier to collect/generate data. The said digitalization will also facilitate the implementation of new technologies such as AI. Also the birth of CSquared which led the charge of fiber optic connectivity along with MainOne has enabled the capacity of major cities in the country to connect to the internet see an exponential growth since 2015 (CSquared, 2021) (Finley, 2015). The upspring of technology-related start-ups as well as the presence of multinational companies in Africa, is a contributing factor to the growing adoption of ET in various industries. Ghana, located in the west of Africa, continues to attract multinational IT firms (Amegadzie et al, 2021).



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Twitter's CEO announced in April 2021 that, it will establish its African headquarters in Ghana due to its support of online freedom, free speech, the Open Internet and a champion for democracy (Daniel, 2021). In April 2019, Google also opened its first AI lab in Ghana, headed by Mustapha Cisse, to spearhead African AI research (Adeoye, 2019).

4. COLLABORATIVE EFFORTS WITH NATIONAL AND INTERNATIONAL STAKEHOLDERS

Academic City University College has continued to forge collaborations and linkages that can support programme offerings across different faculties both nationally and internationally. The University College has developed the following partnerships and alliances in the past years to further its academic and intellectual development. Besides the existing collaborations mentioned above Academic City is also in the advanced stages of discussions with several universities and institutions in Ghana and the United States of America so as to provide further opportunities for Faculty Members and students to work on cross border collaborative projects, experiential learning and exposure on technologies beyond the classrooms. The University is also collaborating and engaging with stakeholders such as the Data protection Commission of Ghana, The United Nations Global Pulse (UNGP) Organization, the Artificial Intelligence for Sustainable Development Group, the Forward – Artificial Intelligence for All (FAIR) Group and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH (GIZ).

In setting up the pioneering programme in Artificial Intelligence, ACity draws on her existing mentoring institution nationally and international collaboration with world class institutions in the West. . Following are a few linkages that the institution has at present.

1. University of Mines and technology, Ghana
2. University of Cape Coast, Ghana
3. Chartered Institute of Bankers, Ghana (CIBG)
4. Ghana Institution of Engineering (GhIE)
5. Institute of ICT Professional of Ghana (IIPGH)
6. IBM – Centre of Excellence
7. IEEE Ghana – Student Branch
8. Accra College of Education, Ghana
9. Worcester Polytechnic Institute (WPI), Worcester, Massachusetts, USA
10. University of Dayton, Dayton, OH, USA
11. Millersville University, Millersville, PA, USA
12. St. Mary's University, San Antonio, TX, USA
13. Engineers Without Borders (Columbia University Chapter), New York, NY.
14. Virginia Military Institute, Lexington, VA, USA
15. Engineers Without Borders (at the Columbia University, USA)
16. The University of Northern Kentucky.
17. Industry experts from the field of Artificial Intelligence such as Darling Ahiale Akogo of Minohealth
18. Technology fair for Secondary School level Students across the nation to sensitize and spur their interest in AI and Robotics



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These institutions and other collaborating professional bodies, stakeholders and organizations provides the needed crucible to fan into flames the intrinsic potentials in candidates admitted into the Bachelors programme in AI at ACity.

5. AI CURRICULLUM AT ACITY

The Artificial Intelligence (AI) programme at Academic City College is initiated as part of the institution's short-term efforts at developing cadence of new programs that will invariably push the boundaries of knowledge while establishing a foothold for successful graduates in the jobs of the future. The programme is therefore designed to address the need to create a future-ready workforce that can take leadership and provide the needed traction to deliver the benefits of artificial intelligence in terms of policies, ethics, engineering, education, practice and professionalism.

5.1 Programme Aims

The AIMS of the BSc in Artificial Intelligence (AI) are to tool successful graduates with emerging advances in computational and decision-making sciences and technologies that allow computers and machines to function in an intelligent manner; to use machine learning, deep learning and reinforced learning to discover patterns in data and to make predictions based on complex patterns to so as to complex business questions and decisions; to prepare students for the job market of the future, where complex computational capabilities will augment and in most cases surpass human computational abilities in predictions and decision-making.

5.2 Programme Objectives

The objectives of the BSc in AI are to provide successful graduates with the tools and capabilities:

- ✓ To utilize computer systems and machines to simulate and analyse natural human intelligence processes.
- ✓ To design, develop and deploy complex algorithms which provide basis for learning, reasoning and self-correction.
- ✓ To provide students with techniques and technologies for designing systems capable of intelligent decision and actions.
- ✓ To expose students to the applications of AI in expert systems, speech recognition and machine vision.
- ✓ To develop competent and ethical AI professionals who able to analyse technical requirements in their field of study and apply their knowledge in a highly professional manner for the benefit of society.
- ✓ To produce doers who can conceptualize, design, develop, and produce modern systems drawing from a comprehensive tool-kits of multi-disciplinary engineering and informatics.
- ✓ To train graduates to practice lifelong learning for continuing professional development

5.3 Components of the Programme Curriculum

The programme curriculum consist of a set of general courses taken across disciplines such as languages, entrepreneurship, communication skills, French, leadership and business, Innovation, computer Programming calculus, mathematics and several seminars and projects. Courses are designated as Core, Mandatory and Electives. Major Specialization courses are also offered in specific domains of AI at the end of the programme.



Students are also expected to undergo an internship and execute a Senior Design Project at the end of the programme. Unique technical course offerings on the programme curriculum include: Introduction to Artificial Intelligence (AI), Data Structures and Algorithms, Machine Learning, Computational Neural Networks, Natural Language Processing, Introduction to Deep Learning, etc. Other unified learning contents of interest for seminars and expanded teaching, research and community engagements in the programme which cuts across other academic departments and units include

- Blockchain technologies and Fintech backbone network
- Ethics in AI, Data security and privacy in the AI-driven information systems
- Data mining and information evaluation for AI-based applications
- Data warehousing and encapsulation
- Technical Informatics and protocol for content protection
- Advanced framework of few-shot learning and deep learning
- New techniques and theory for few-shot learning systems
- Multi-source data fusion for deep learning-based systems
- Cloud computing for deep learning or few-shot learning
- Information extraction and evaluation from images and videos
- Quantitative techniques Structural Equation Modelling
- Qualitative techniques using Invivo and other software tools
- Model acceleration and edge computing based on AI methods
- Android systems, Sentiment Analysis and Mobile Systems for Social media
- Special hardware deployments, such as FPGA, Mobile phone
- Software packages of advanced deep learning or few-shot learning

The following tangential contents are also expected to be covered:

- Recommendation systems
- Anomaly detection using AI
- AI Policy and Governance
- Autonomous driving
- Smart agriculture
- Smart Cities
- Smart Health
- Game decision-making
- Industrial quality inspection
- Requirement Analysis Using AI

6. POSSIBILITIES FOR GROWTH AND EMPLOYMENT UPON GRADUATION

Graduates of this programme will be able to select, create, apply, integrate, and administer computing technologies using AI skills in order to meet the needs of users within societal and organizational contexts. Possible career paths include:

- Data Scientist
- AI Research Scientist
- Computer Vision Engineer
- Cyber security analyst
- Software engineer
- Robotics Scientist
- Application analyst
- Business Intelligence Developer
- Systems analyst
- Machine Learning Engineer
- Applications developer



7. THE FUTURE IS INTELLIGENT – AI AT ACITY

AI, since its early inception at institutions such as MIT, has evolved into machine learning, deep learning, reinforced learning, amongst others. Applications of AI abound in natural language processing, computer vision, computational photography, computational perception, and machine learning and text mining, etc. These advances offer tremendous opportunities across the spectra of human endeavors and are poised to reshape future technologies and workforces. It also holds great promise for Ghanaian and African work-force of the future. Opportunities for its application abound in Healthcare, Education, Transportation, Governance, Finance, Marketing, etc. All these fields stand to benefit from advances in AI technologies.

At Academic City University College, Accra, Ghana the AI programmes provides the crucible to groom and prepare new sets of intelligent future ready experts who can provide the needed skills to address the interplay of social-technical, political, cultural and economic dynamics required to upscale in an intelligent future. Graduates are also empowered to be positioned to function and address the worlds future industrialization efforts across the spectrum of key strategic areas such as manufacturing, agriculture, education, healthcare, etc. are pivoted around intelligent systems, hence, we must take the initiative to be future ready by making deliberate conscious efforts at creating and developing versatile graduates in AI conversant in a broad area of robotics, informatics, data Science, Machine Learning, Language Processing and other tangential domains that are required to survive and make a mark in a rapidly evolving data and technology-driven world.

African organizations both private and public will expand and flourish at a quick pace as AI infrastructure and application adoption expands. We foresee a future where Africa becomes a talent breeding ground for AI experts as the cost of developing AI applications and products falls. This will in turn expand the innovation potential of African organizations, in particular Ghana thus giving global competitiveness a flip. The question then is not if AI can become a driver for Africa's development, but how quickly we can take the lead in work force development for indigeneous and globally relevant AI solutions. In the light of the UNESCO's needs assessment gaps for Africa on emerging AI pressing concerns related to AI's rapid development in Africa (UNESCO, 2021) it is definite that graduates from the ACity's AI Programme will serve the African and Global AI ecosystem by increasing manpower pool, lower AI development costs, and support the creation of localized and indigenous AI applications and products tailored to local needs, and utilize the dynamics of their interactions, training and intelligence to reduce dependence on foreign technological handouts – The future is indeed intelligent.

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