

Carnegie Mellon University Africa
Certificate I: Understanding AI and Machine Learning in Africa

Course AIML02: AI and Machine Learning in Africa

Module 4: Deployment of AI and Machine Learning in Africa
Lecture 2: Artificial Intelligence Deployment in Africa

Welcome to the second lecture in Module 4 in which we examine the factors that must be considered when deploying AI in Africa.

In the first lecture we looked at machine learning for the developing world.

In this lecture, we zone in on what is necessary for successful deployment in Africa, specifically.

Here we will summarize the key points of an article by Gwagwa et al. (2020): “Artificial Intelligence (AI) Deployments in Africa: Benefits, Challenges and Policy Dimensions”.

We begin by highlighting what's special about the deployment of AI in Africa. We discuss the key policy challenges and potential risks. We focus on three key issues that are particularly relevant for the successful – or unsuccessful – deployment of AI in African settings:

1. AI and gender equity.
2. AI and cultural and linguistic diversity.
3. Labour market shifts.

We then look at the opportunities for influencing policies at national, regional, continental, and global levels. We will finish up by summarizing what we have covered and identifying the articles that you should read to consolidate what you have learned.

As we will see, the issues we raise resonate strongly with the messages in the two lectures in Module 1. Please revisit these two lectures once you've completed this one.

We have four learning objectives, so that, after studying the material covered in this lecture, you should be able to do the following.

1. Summarize the benefits of AI in African settings.
2. Explain why challenges facing AI in Africa are different to those in developed countries.
3. Identify the issues that need to be addressed to ensure socio-economic inclusion in African settings.
4. Identify the types of policies that are necessary to address these challenges.

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“Artificial Intelligence (AI) Deployments in Africa: Benefits, Challenges and Policy Dimensions”.

Slide 2 At this point in the course, we've encountered many definitions of AI (see Course AIML01, Module 1, Lecture 1). The target article offers a few more.

Slide 3 The target article then focusses on the core elements of AI that impact on decision-making processes in the public and private sector.

Algorithmically controlled automated decision-making (ADM) systems, or decision-support systems,

(these are socio-technological frameworks that use models to make decisions)

and algorithms that translate the models into computable code

Slide 4 Focusing on the socio-technological aspect of AI, and the role it plays in decision-making processes in the public and private sector is, as we will see, an essential element of the message the article seeks to convey.

This message is that AI, in general, and ADM systems, make material decisions that have a direct effect on the finances, health, and liberty of African citizens.

Accordingly, they can have a far-reaching impact on the weakest members of society, with potentially significant negative consequences for individuals, organisations, and society as a whole.

Slide 5 AI technologies and applications have the potential to address many of humanity's most pressing problems.

creating a world that is less sick, less hungry, more productive, better educated, and better prepared to deal with the effects of climate change.

We have seen many examples of this throughout this and previous courses.

Slide 6 AI technologies and applications can also reinforce and amplify social inequality.

As we have also seen in this course and previous courses,

AI grounded in non-representative or biased data can entrench existing social and economic inequities,

with AI systems reproducing the representation gaps and biases of the data sets on which they are trained.

Slide 7 AI can be used by already-dominant technology firms to further entrench their economic and social power,

or by governments to violate the privacy and other human rights of citizens.

Slide 8 While this is true everywhere, AI's potential risks are particularly acute in the developing world,

risking the entrenchment of inequalities within developing countries,

and between developing countries and more developed regions.

Slide 9 A study of startups in East Africa found that 90% of funding had gone to the startups' foreign founders.

Slide 10 Applications of AI deployed in Africa tend to originate from outside the continent,

and thus lack contextual relevance, particularly in respect of cultural and infrastructural factors.

You will recognize this as a recurring theme throughout this course.

Slide 11 Instances of foreign-controlled and/or foreign-designed AI tools in African settings are increasingly being seen in neo-colonial terms,

i.e., as elements of

“algorithmic colonization” (see Birhane, 2019)

“data colonialism” (see Couldry & Mejias, 2019), and

“digital colonialism” (see Coleman, 2019).

Slide 12 If African nations are to build inclusive AI ecosystems, enlightened policymaking is essential.

Slide 13 The review by Gwagwa et al. (2020) uses an analytical framework drawing on two taxonomies:

Calo's 2017 taxonomy for interrogating AI policy challenges (Calo, 2017);

and Smith and Neupane's taxonomy of AI's potential risks in developing-world settings (Smith & Neupane, 2018).

Calo's taxonomy has a developed-world focus.

Smith and Neupane's "proactive research agenda for the ethical and equitable application of AI in the Global South" provide the balance.

There are three areas of overlap between Calo's policy-challenges taxonomy and Smith and Neupane's potential-risks framework.

The two themes most central to understanding the implications of AI in Africa are *equity* and shifts in the *labor market*.

Privacy and surveillance are, of course, important issues, but they don't require a distinctly African policy.

On the other hand, matters of equity and labor require an approach that is specific to Africa.

Slide 14 While there are many aspects to equity, two specific aspects are addressed here

gender equity and *cultural and linguistic diversity*.

We address these three issues in turn.

Slide 15 African nations are experiencing a transformative “feminization” of technology entrepreneurship (Monehin, 2017).

According to the 2017 Mastercard Index of Women’s Entrepreneurship (MIWE),

Sub-Saharan Africa had the world’s highest rate of female entrepreneurs (27%)

34.8% of businesses in Uganda, were owned by women

34.6% in Botswana, were owned by women.

In Egypt, women are adopting AI technologies to engage in ride-sharing platform services as drivers.

This is unprecedented in the country’s male-dominated taxi driving culture, and it empowers the women, not only by improving their ability to provide for their livelihoods, but also by breaking down social taboos and using digital technologies to ensure their safety (Rizk et al., 2018).

Slide 16 However,

Women are typically disadvantaged by data and algorithm biases,

which reflect and amplify existing inequities already.

AI algorithms are typically developed in the Global North,

and trained on datasets representing circumstances that are significantly different from the realities of African contexts

Slide 17 The digital divide is gendered.

A study found that 44% of women in Kenya were poor in terms of at least one dimension, and that women who lived in rural areas tended to be multi-dimensionally poor (Patel, 2018).

In 2017, the employment gender gap reached nearly 80% in Algeria and 69% in Egypt (WEF, 2017).

Africa is the only continent whose digital gender gap has widened since 2013.

Of the 60% of African women who own a mobile phone, only 18% have internet access, with over 200 million left unconnected (Majama, 2019).

Slide 18 Women in Africa are likely to be marginalised by AI

The data can be inaccurate, with women being absent for a variety of reasons.

For example, informal workers, many of whom are women, are not represented.

In Sub-Saharan Africa, informal employment constitutes 92% of total female employment and 83% of total female non-agricultural employment (Bonnet et al., 2019).

Slide 19 These missing data points feed into biases in policymaking and other decision-making based on AI algorithms.

Consider algorithm-based decision-making in the financial sector, where women constitute 60% of the 400 million people in Africa who lack access to digital financial services across the continent.

Slide 20 Without policy intervention, AI can be expected to have a profound negative impact on cultural and linguistic diversity

This affects the world's poor countries, in particular, who are not home to the dominant AI and digital content companies.

Slide 21 It is estimated that 17% of the world's languages, many of them in Africa, are "low resource languages" in the digital realm (Marivate et al., 2020),

That is, there are insufficient examples of use of the languages available online for the purposes of training NLP applications.

These languages are marginalised by technology deployments, including AI deployments, developed in the Global North.

Slide 22 The impact of AI and machine learning on jobs has long been a source of concern.

In 2016, a World Bank report make an alarming prediction that the "share of occupations that could experience significant automation is actually higher in developing countries than in more advanced ones, where many of these jobs have already disappeared" (World Bank, 2016).

Slide 23 However, the impact of AI and machine learning may not be as bad as it seems if one considers the distribution of the labor force in Africa.

Approximately 54% of all workers in sub-Saharan Africa are in the agricultural sector, and in some specific countries this figure surpasses 70% (Fuglie et al., 2019).

In the agricultural sector, AI has two primary uses that have, or are expected to have, significant impact and value.

These are

- Data analysis
- Agricultural robots

Slide 24 Analysing data: AI can help predict weather patterns, optimize planting and harvesting schedules, and determine appropriate fertiliser needs.

This use of AI has the potential to increase yields and overall land productivity or efficiency

It is unlikely to negatively affect the African labor force in the agricultural sector.

Slide 25 By improving the ability to predict floods and drought, optimize land usage, and increase yields, AI may increase the need for workers in the agricultural sector

This use of AI complements human labor, rather than displacing it.

Slide 26 AI-powered agricultural robots are expected to exceed human abilities for harvesting crops and picking weeds.

Although this use of AI is competitive with human labor, the reality of African agricultural practices reduces the overall impact that AI is likely to have.

The economic advantage of using robots is greater on large farms but smallholder farms account for 40% of farmland in sub-Saharan Africa.

Daily wages for farm laborers in sub-Saharan Africa are substantially below those in highly developed countries.

Slide 27 Taken together, there is less economic incentive in sub-Saharan Africa than in developed-world settings to invest in agricultural robots.

The negative impact of AI on farm labor could, therefore, be substantially less in sub-Saharan Africa, compared with developed countries.

Slide 28 AI offers many potential benefits and potential challenges for African nations, regions, and the continent as a whole.

However, the appropriate policies must be in place to realize the benefits and mitigate the risks.

In the words of the authors of the target article, Gwagwa et al. (2020)

"If African nations are to build inclusive AI ecosystems, enlightened policymaking is essential"

Slide 29 These policies are needed at many levels, e.g., the African national, regional, and continental levels, and the global level.

Gwagwa et al. (2020) present an extensive catalogue of current policy-making bodies and forums, at all four levels.

Slide 30 We leave the final words to the authors of the article.

"Sound policy ... will be needed to enable African nations to build ecosystems that are inclusive, socially beneficial, and adequately integrated with on-the-ground realities"

Slide 31 "African AI stakeholders will ultimately chart a course that is substantially dictated

by the unique characteristics of the continent"

The need to recognize this reality is the consistent, recurring theme of this course.

To summarize,

1. AI offers many potential benefits and significant challenges for African nations.
2. Africa presents different challenges to those in developed countries.
3. These include gender equity, cultural and linguistic diversity, and labor market shifts.
4. The appropriate policies must be in place to realize the benefits and mitigate the risks.

Here is the article on which this lecture is based. Please take the time to read it and then review this lecture again.

Gwagwa, A., Kraemer-Mbula, E., Rizk, N., Rutenberg, I., & De Beer, J. (2020). Artificial Intelligence (AI) Deployments in Africa: Benefits, Challenges and Policy Dimensions. *The African Journal of Information and Communication (AJIC)*, 26, 1-28.
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Here are the references to support the key points in the lecture and the target article.

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