Certificate I: Understanding AI and Machine Learning in Africa

Course AIML01: Artificial Intelligence – Past, Present, and Future

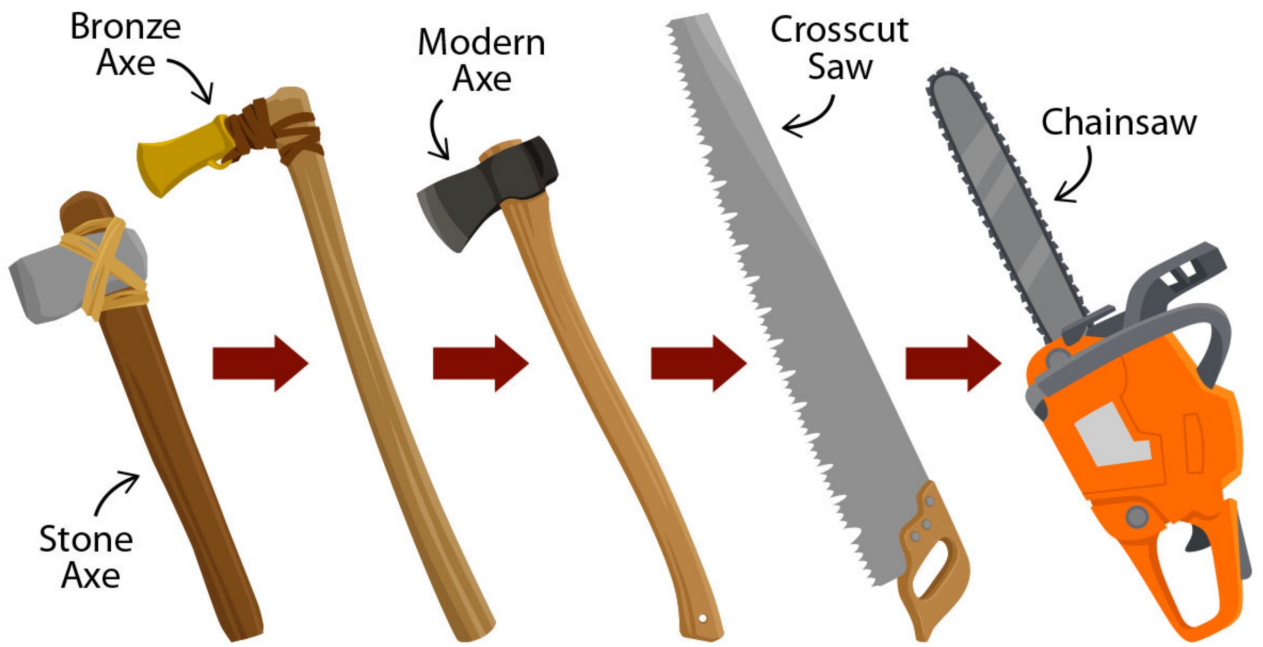
Module 1: What is AI, where did it come from, and where is it taking us?

Lecture 1: AI and The Fourth Industrial Revolution

Carnegie Mellon University
Africa

Licklider's Prediction and the Cognitive Era

Humans have always used tools to augment & amplify their physical capabilities



http://devichedesigns.com/work/tool-evolution

Licklider's Prediction and the Cognitive Era

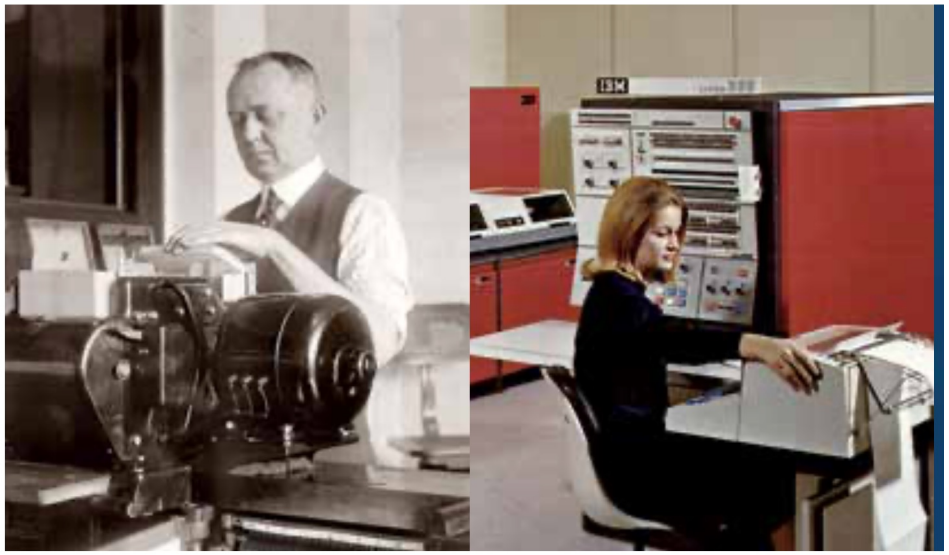
Humans have always used tools to augment & amplify their physical capabilities

https://oneacrefund.org/what-we-do/countries-we-serve/rwanda/

Photo by Sam Ngendahimana
https://www.newtimes.co.rw/news/roads-authority-under-fire-overpaying-maintenance-contractor

Licklider's Prediction and the Cognitive Era

The computer extended this to mental work …



Mainly as a tool for greatly increasing the speed of processing

The Tabulating Era
(1900s – 1940s)

The Programming Era
(1950s – present)

(Kelly, 2015)

Licklider's Prediction and the Cognitive Era

The computer extended this to mental work ...

The Tabulating Era
(1900s – 1940s)

The Programming Era
(1950s – present)

The Cognitive Era
(2011 –)

(Kelly, 2015)

Licklider's Prediction and the Cognitive Era

Cooperative "living together in intimate association, or even close union, of two dissimilar organisms"

"Man-computer symbiosis is an expected development in cooperative interaction between men and electronic computers."

(Licklider, 1960)

Unfortunately, there was little awareness of gender bias in 1960

wikipedia.org/wiki/J._C._R._Licklider

Licklider's Prediction and the Cognitive Era

"... the symbiotic partnership will perform intellectual operations much more effectively than man alone can perform them"

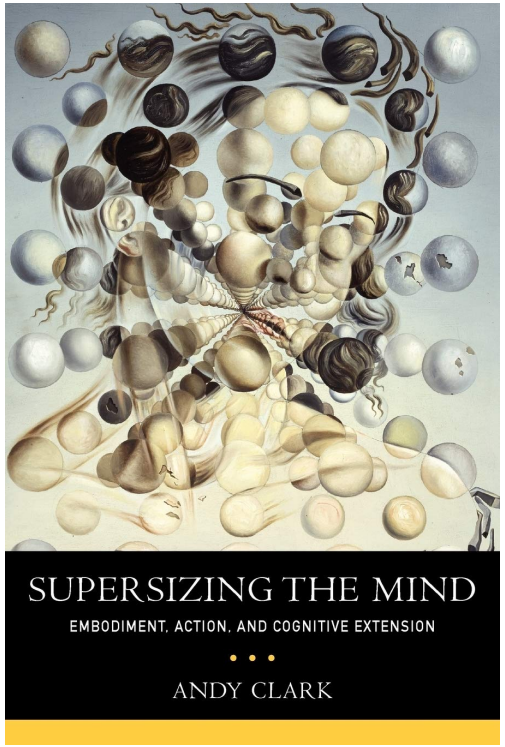
(Licklider 1960)

Licklider's Prediction and the Cognitive Era

- This symbiotic partnership is being realized today through artificial intelligence (AI)
- AI both amplifies and extends human cognitive abilities

With AI, we do what we used to do, but more quickly, more efficiently, and more effectively

With AI, we can also solve problems we weren't able to solve before



https://www.amazon.ca/Supersizing-Mind-Embodiment-Cognitive-Extension/dp/0199773688

Licklider's Prediction and the Cognitive Era

"Man-computer symbiosis is probably not the ultimate paradigm for complex technological systems.

It seems entirely possible that, in due course, electronic or chemical "machines" will outdo the human brain ..."

(Licklider 1960)

Anticipates the technological singularity:
the point in time when the autonomous capabilities of AI exceed those of humans (Shanahan, 2015)

What is Artificial Intelligence?

This definition comes from the original proposal by John McCarthy and others to study AI. We cover this in the next lecture AIML01-01-02

This definition focusses on action as the key attribute of AI

This definition focusses on the use of sensing, reasoning, learning to take action in pursuit of objectives

Definitions of artificial intelligence

The phrase "artificial intelligence" (AI) was used for the first time in a 1955 proposal for a study on using computers to "solve kinds of problems now reserved for humans."[9]

AI is that activity devoted to making machines intelligent, and intelligence is that quality that enables an entity to function appropriately and with foresight in its environment.[10]

The field that studies the synthesis and analysis of computational agents that act intelligently.[11]

A constellation of technologies, including machine learning, perception, reasoning, and natural language processing.[12]

A collective term for computer systems that can sense their environment, think, learn, and take action in response to what they're sensing and their objectives.[13]

Building machines that are intelligent, that can do things that humans can do, and for doing that it needs to have knowledge about the world and then be able to use that knowledge to do useful things.[14]

This definition focusses on prospection, i.e., the ability to anticipate the the future, as the key attribute of intelligence, artificial or otherwise

This definition notes that there are many elements in AI, one of which is machine learning. Others are perception, reasoning, and natural language processing

This definition emphasizes the human-level nature of AI and the need to acquire and use knowledge

(Smith & Neupane, 2018)

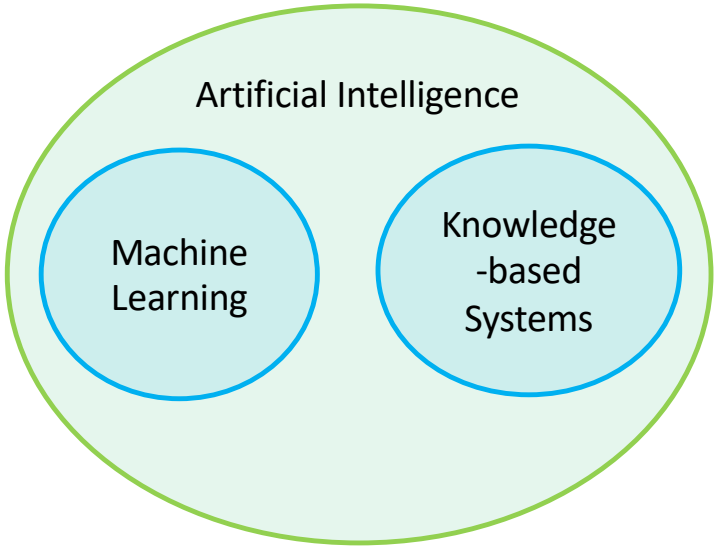
What is Artificial Intelligence?

It helps to distinguish between what AI can do: the behaviors an AI system can engage in and how it does it: the underlying techniques.

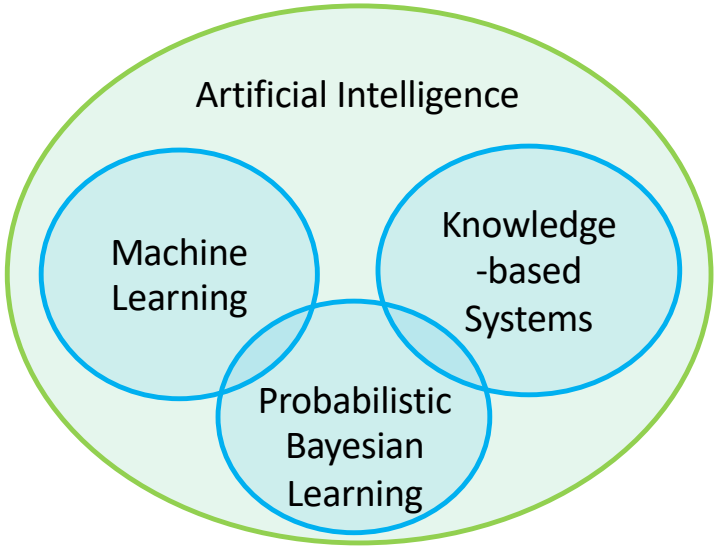
Intelligent behaviour	**Optimization**
Application	Supply chains, logistical pathways, pricing
Intelligent behaviour	**Pattern recognition/detection**
Application	Face recognition, medical diagnostics, fraud detection
Intelligent behaviour	**Prediction/hypothesis testing**
Application	Flood prediction, disaster prediction, disease outbreak, recidivism
Intelligent behaviour	**Natural language processing**[16]
Application	Voice recognition
Intelligent behaviour	**Machine translation**[17]
Application	Translation of text or speech from one language to another

(Smith & Neupane, 2018)

What is Artificial Intelligence?



What is Artificial Intelligence?



The Fourth Industrial Revolution

AI forms the foundation of the Fourth Industrial Revolution

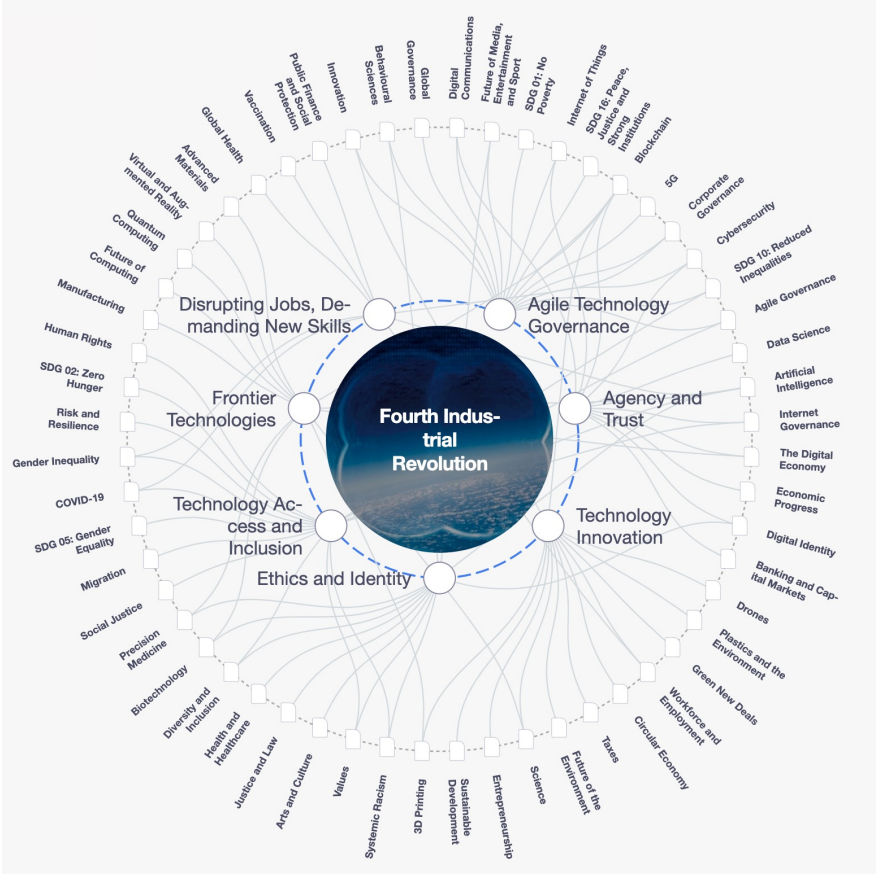
- The fusion of physical, digital, and biological technologies in cyber-physical systems
- Powered by AI and machine learning
- Enabled by ubiquitous communication and near-universal access to information
- Also known as 4IR and Industry 4.0

The Fourth Industrial Revolution

"The Fourth Industrial Revolution represents a fundamental change in the ways that we live and work

It is a new chapter in human development, … merging the physical, digital, and biological worlds and fusing technologies in ways that create both promise and peril"

World Economic Forum, 2022



https://intelligence.weforum.org/topics/a1Gb0000001RIhBEAW?tab=publications

Centre for the Fourth Industrial Revolution

C4IR Rwanda

The Centre for the Fourth Industrial Revolution Rwanda (C4IR Rwanda) brings together government, industry, civil society, and academia to co-design, test and refine policy frameworks and governance protocols that maximize the benefits and minimize the risks of 4IR technologies. The Centre is primarily focusing on artificial intelligence and data policy, and seeks to develop multi-stakeholder partnerships to drive innovation and adoption at scale for the benefit of society.

https://www.weforum.org/centre-for-the-fourth-industrial-revolution/c4ir-rwanda

C4IR South Africa

The Centre for the Fourth Industrial Revolution South Africa (C4IR South Africa) supports industry transformation across various sectors, supports government transformation to maintain robust and resilient technology governance protocols and develops and deploys frameworks to support awareness and development of frontier technologies.

https://www.weforum.org/centre-for-the-fourth-industrial-revolution/c4ir-south-africa

The Fourth Industrial Revolution

The challenge is to harness AI within an ethical framework

- that achieves economic benefits and
- social development

for everyone, everywhere

"in ways that create a more inclusive, human-centred global economy."

https://intelligence.weforum.org/topics/a1Gb0000001RIhBEAW?tab=publications

The Fourth Industrial Revolution

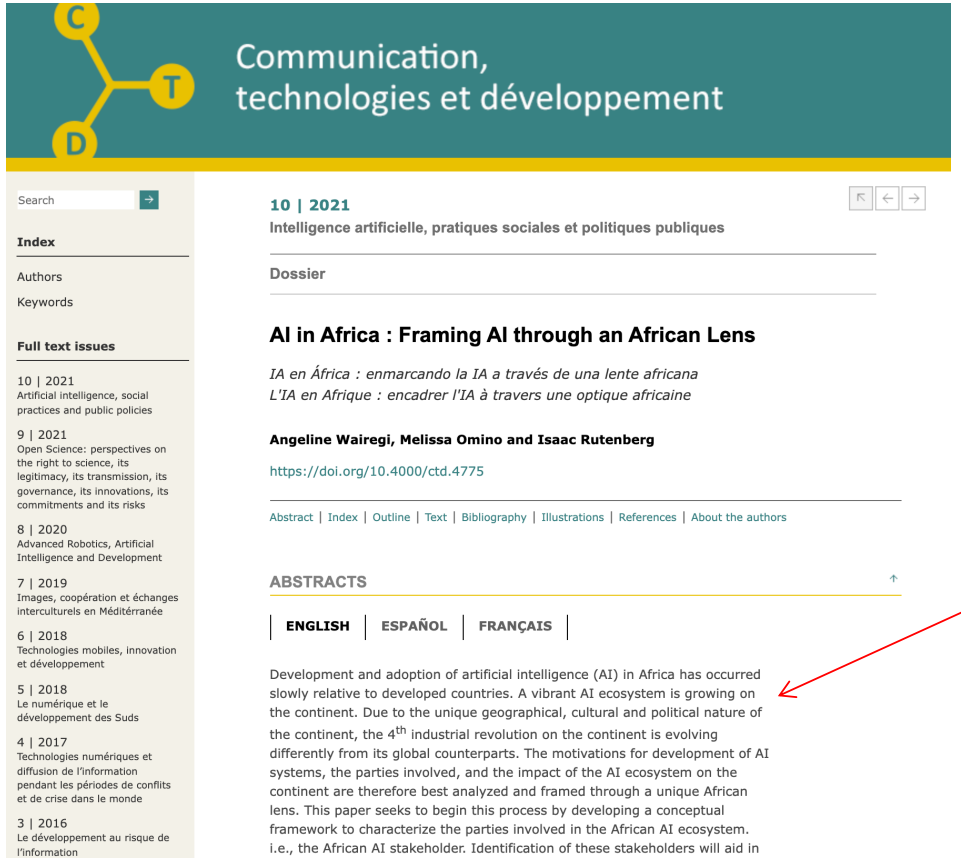
REPORT

The Fourth Industrial Revolution and digitization will transform Africa into a global powerhouse

Njuguna Ndung'u and **Landry Signé** · Wednesday, January 8, 2020

https://www.brookings.edu/research/the-fourth-industrial-revolution-and-digitization-will-transform-africa-into-a-global-powerhouse/

AI in Africa



Communication, technologies et développement

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Images, coopération et échanges interculturels en Méditérranée

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Le numérique et le développement des Suds

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Technologies numériques et diffusion de l'information pendant les périodes de conflits et de crise dans le monde

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Le développement au risque de l'information

10 | 2021
Intelligence artificielle, pratiques sociales et politiques publiques

Dossier

AI in Africa : Framing AI through an African Lens

IA en África : enmarcando la IA a través de una lente africana
L'IA en Afrique : encadrer l'IA à travers une optique africaine

Angeline Wairegi, Melissa Omino and Isaac Rutenberg

https://doi.org/10.4000/ctd.4775

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ABSTRACTS

ENGLISH | **ESPAÑOL** | **FRANÇAIS**

Development and adoption of artificial intelligence (AI) in Africa has occurred slowly relative to developed countries. A vibrant AI ecosystem is growing on the continent. Due to the unique geographical, cultural and political nature of the continent, the 4th industrial revolution on the continent is evolving differently from its global counterparts. The motivations for development of AI systems, the parties involved, and the impact of the AI ecosystem on the continent are therefore best analyzed and framed through a unique African lens. This paper seeks to begin this process by developing a conceptual framework to characterize the parties involved in the African AI ecosystem. i.e., the African AI stakeholder. Identification of these stakeholders will aid in

https://journals.openedition.org/ctd/4775?lang=en

"A vibrant AI ecosystem is growing on the continent. Due to the unique geographical, cultural and political nature of the continent, the 4th industrial revolution on the continent is evolving differently from its global counterparts. "

AI in Africa

https://www.brookings.edu/blog/africa-in-focus/2020/01/13/the-future-is-intelligent-harnessing-the-potential-of-artificial-intelligence-in-africa/

AI in Africa

Stanford SOCIAL INNOVATION Review
Informing and inspiring leaders of social change

SOCIAL ISSUES SECTORS SOLUTIONS | MAGAZINE MORE

Technology

The AI Invasion is Coming to Africa (and It's a Good Thing)

Before Africa can reap the benefits of artificial intelligence, African governments, investors, and NGOs must train workers for complex tasks, and reform laws and education to meet the demands of tomorrow's economy.

SHARE COMMENT PRINT ORDER REPRINTS

By Lexi Novitske | Feb. 12, 2018

For many countries, the prospects of artificial intelligence (AI) are thrilling. They conjure up the kinds of innovations we see in science fiction. In Africa, however, the dawn of AI carries with it a fear of falling further behind more-developed economies, rather than the eager anticipation of new technology—the World Economic Forum predicts a net loss of five million jobs to AI worldwide by 2020.

But Africa need not dread the age of robotics and automation. Across the continent, from Ghana to Zimbabwe, this technology has the potential to bring myriad positive changes in sectors such as health care and finance, bridging the gap between physical infrastructure inadequacies and consumer demands, while freeing up more time for skilled labor and increased labor productivity. For Africans to reap these benefits, African governments, investors, and NGOs must prepare for the fourth industrial revolution's transformation of the modern workplace by training workers for complex tasks, and reforming laws and education to meet the demands of tomorrow.

Leveraging AI to Africa's advantage

But despite the pervasive narrative that AI spells doom for Africa's development, thoughtful planning can leverage it as a tool to help grow the country's economies. Economic development depends on increasing worker productivity. For too long, African markets have been stagnant in that capacity, but AI is well poised to change that. In countries like Nigeria and Kenya, where capital is scarce but ideas are abundant, process automation can enable businesses to run on leaner models. Moreover, rather than displacing employees, machines can empower low-skilled workers and equip them to take on more-complex responsibilities. This, in turn, can help meet an urgent need for countries lacking widespread access to education and skills training.

https://ssir.org/articles/entry/the_ai_invasion_is_coming_to_africa_and_its_a_good_thing#

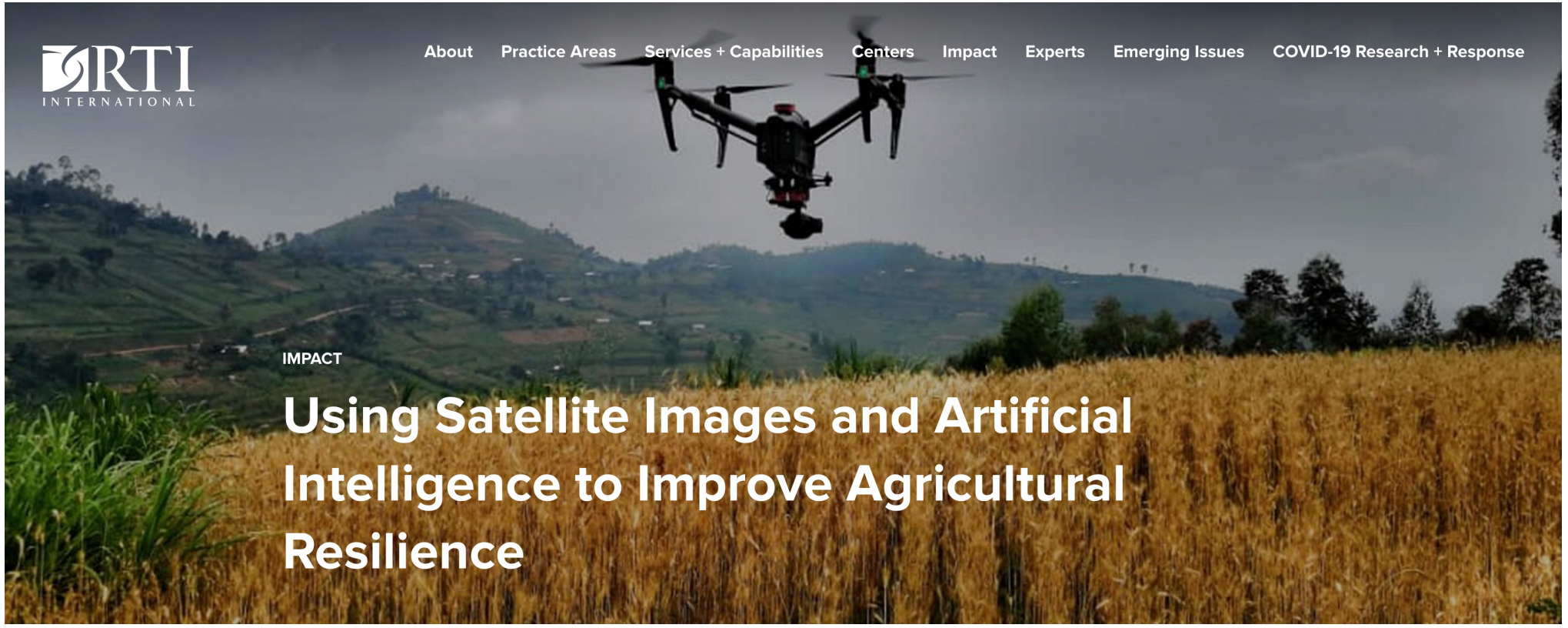
AI in Africa

AI has the potential to overcome some of the most pressing challenges facing Africa and drive growth and development in core sectors:

Agriculture
Healthcare
Public services
Financial services
...

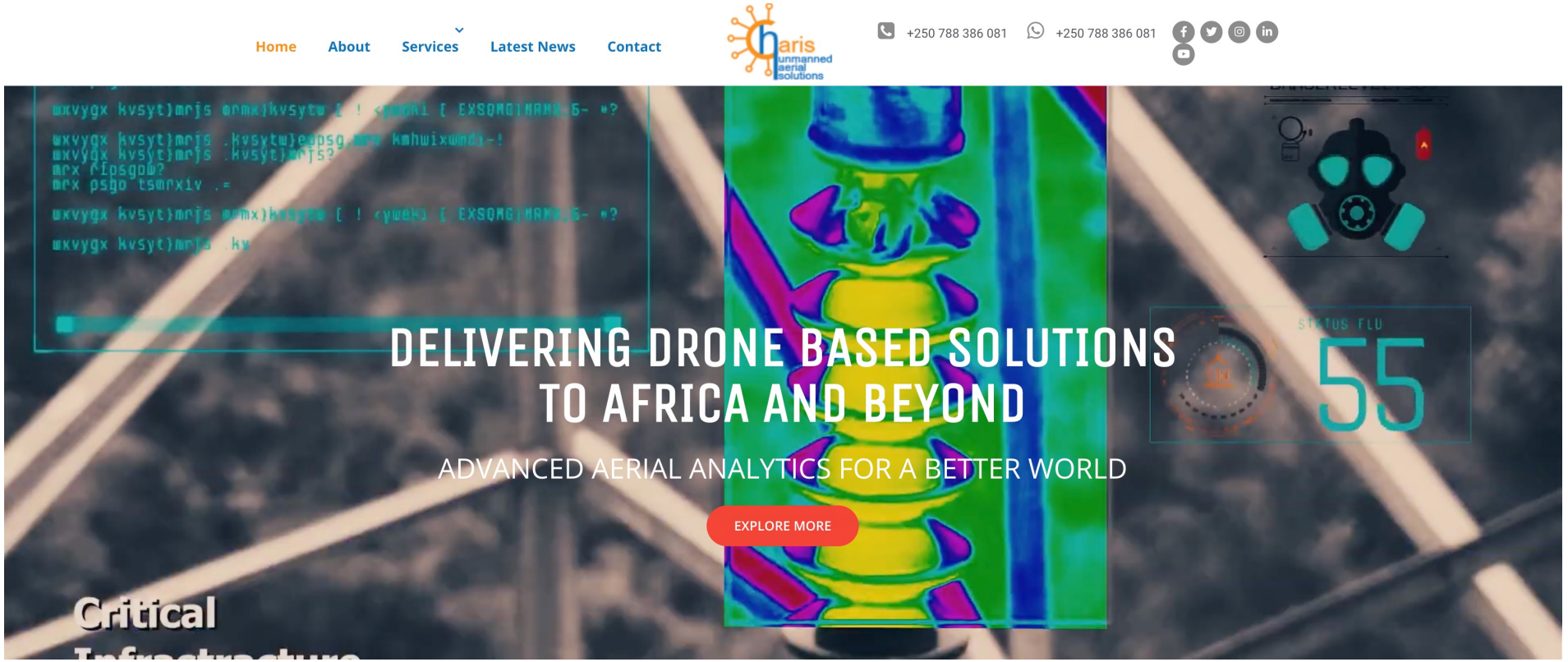
https://www.mamopanel.org/resources/reports-and-briefings/byte-byte-policy-innovation-transforming-africas-f/

AI in Africa



https://www.rti.org/impact/using-satellite-images-and-artificial-intelligence-improve-agricultural-resilience

AI in Africa



https://charisuas.com/

AI in Africa

PRECISIONAg | In-Field Technologies | Digital Farming | Farm to Fork | Market Watch

GLOBAL TECH INSIGHT TO DRIVE AGRIBUSINESS

Market Watch May 8, 2019

Kenya: Microsoft Brings FarmBeats, AI, Edge Computing, Drones to Africa

By Microsoft Care GH

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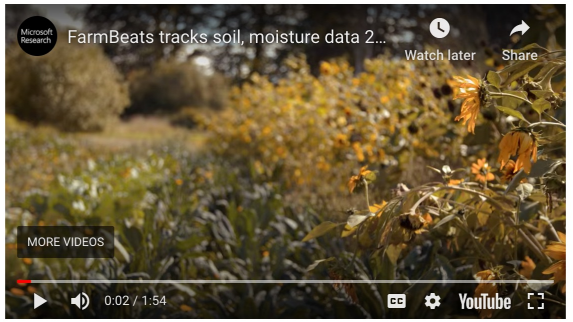


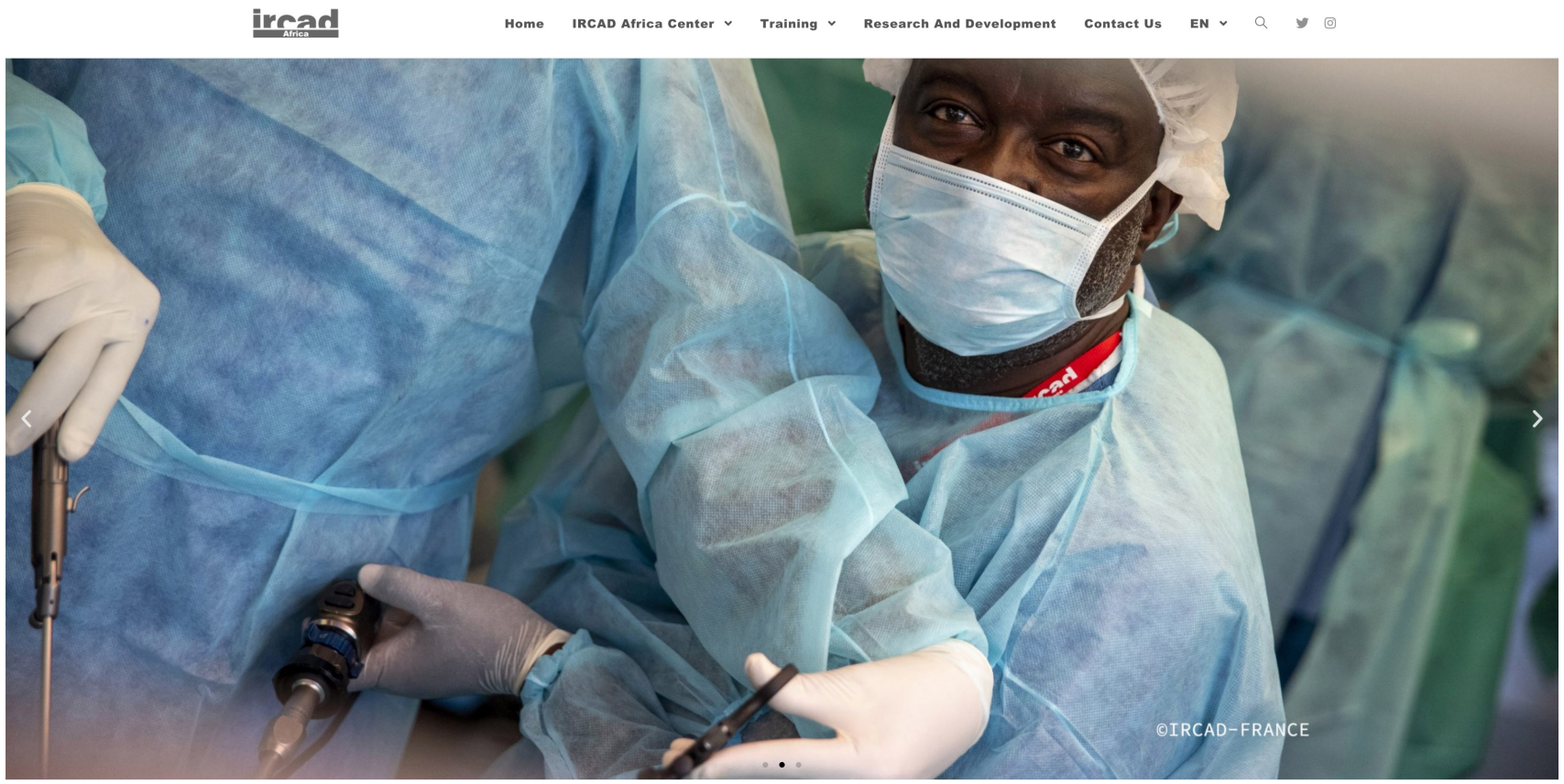
Microsoft is expanding the pilot program of FarmBeats to Africa, starting in Kenya, reports Microsoft Cares GH. The program in Nairobi will reportedly be focused on addressing the specific challenges of farming in Africa with the intent of expanding to other African countries.

https://www.precisionag.com/market-watch/kenya-microsoft-brings-farmbeats-ai-edge-computing-drones-to-africa/

AI in Africa

Institut de Recherche contre les Cancers de l'Appareil Digestif
Research Institute against Digestive Cancer

AI in Africa



rwanda.ircad.fr/

AI in Africa

https://rwanda.ircad.fr/

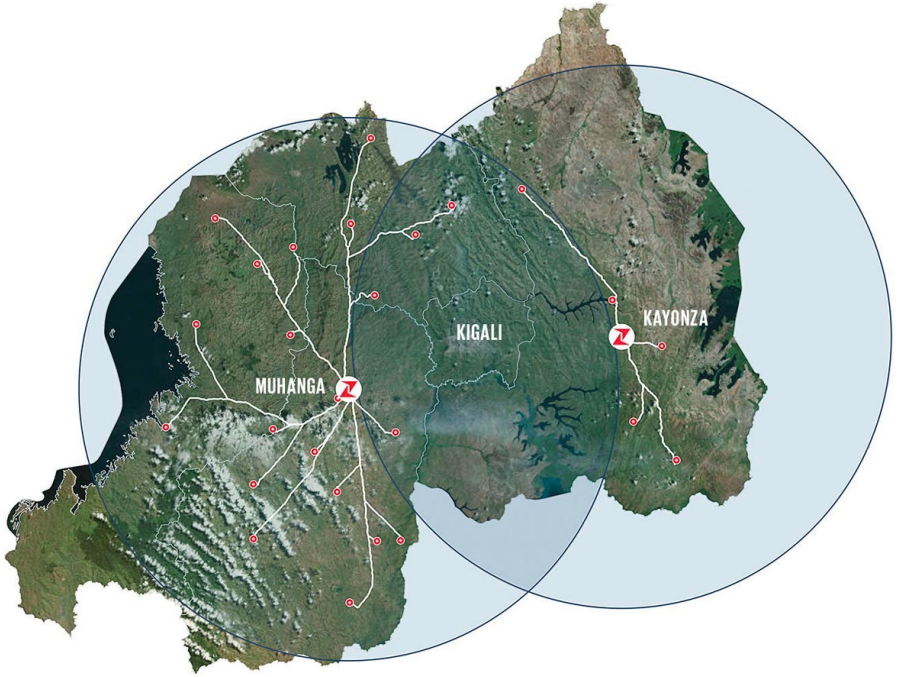
AI in Africa

Zipline Medical Delivery Drones

https://spectrum.ieee.org/robotics/drones/in-the-air-with-ziplines-medical-delivery-drones

AI in Africa

Zipline Medical Delivery Drones



https://spectrum.ieee.org/robotics/drones/in-the-air-with-ziplines-medical-delivery-drones

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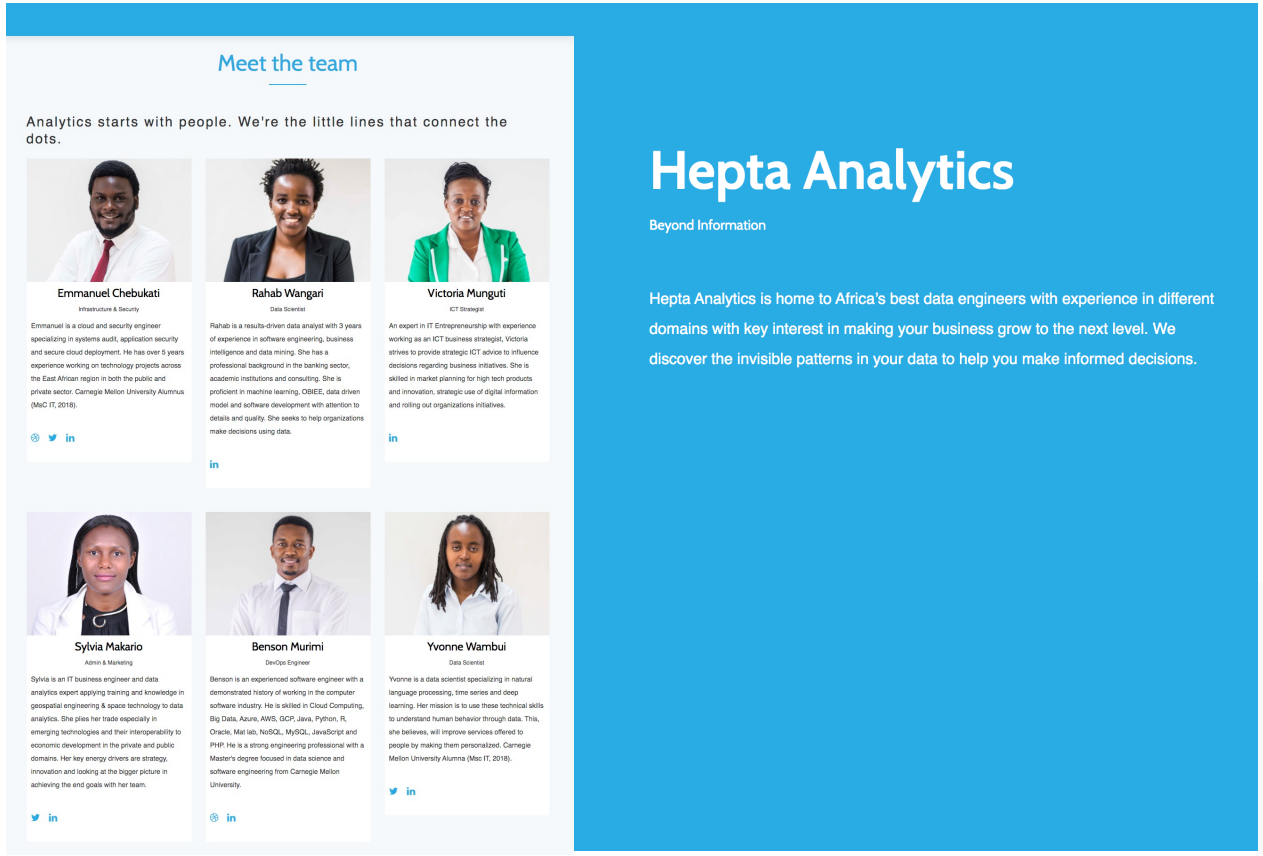
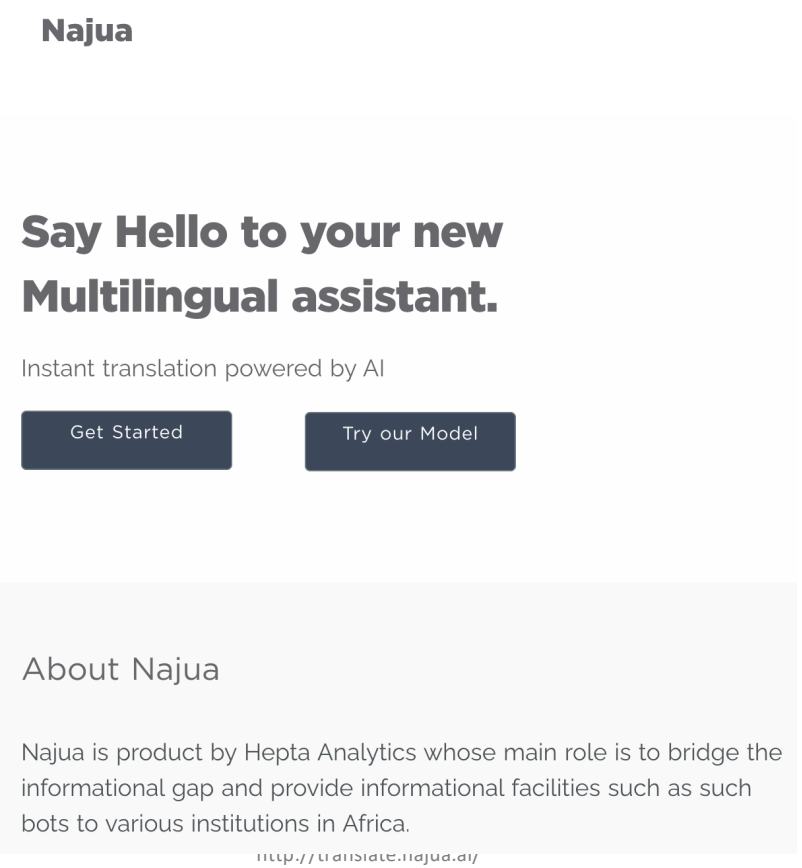


www.heptanalytics.com/



http://translate.najua.ai/

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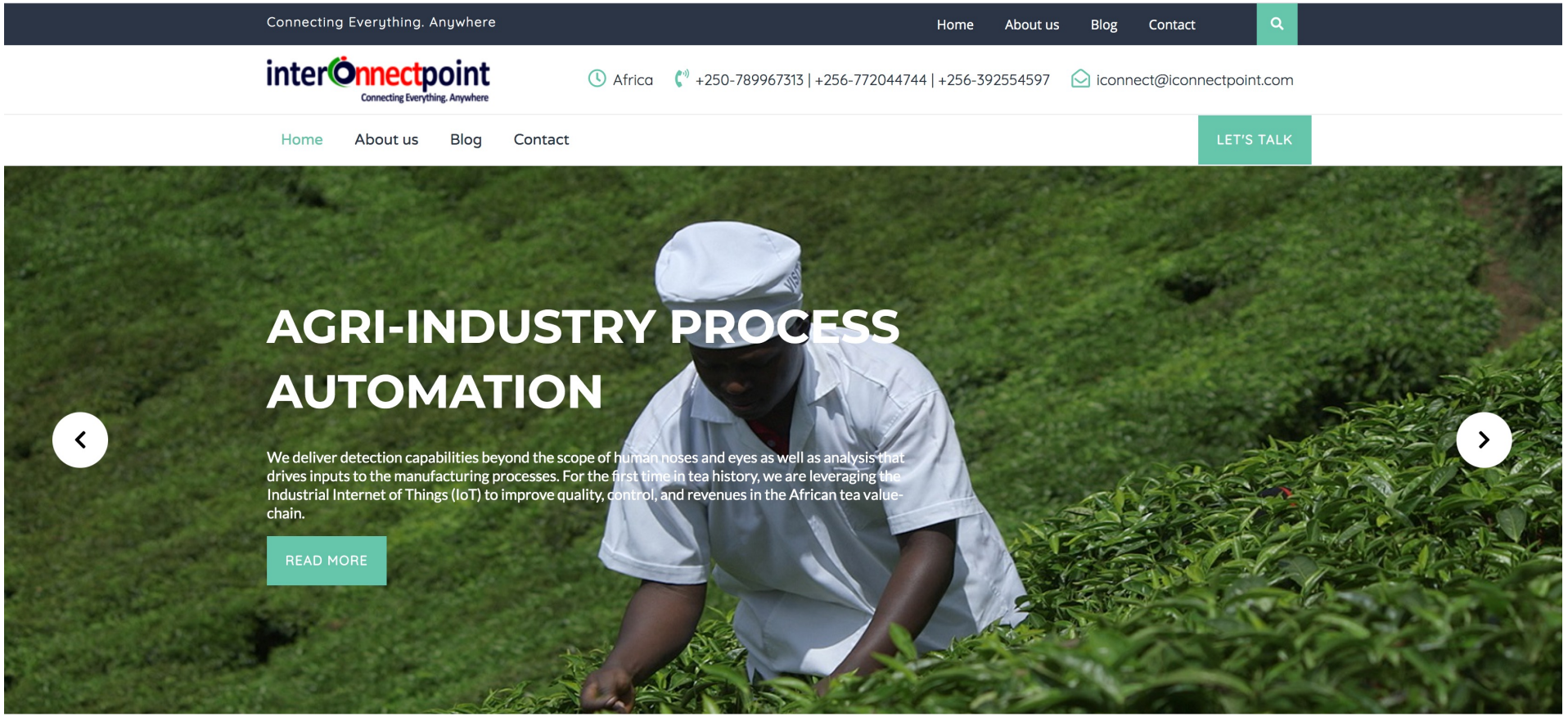

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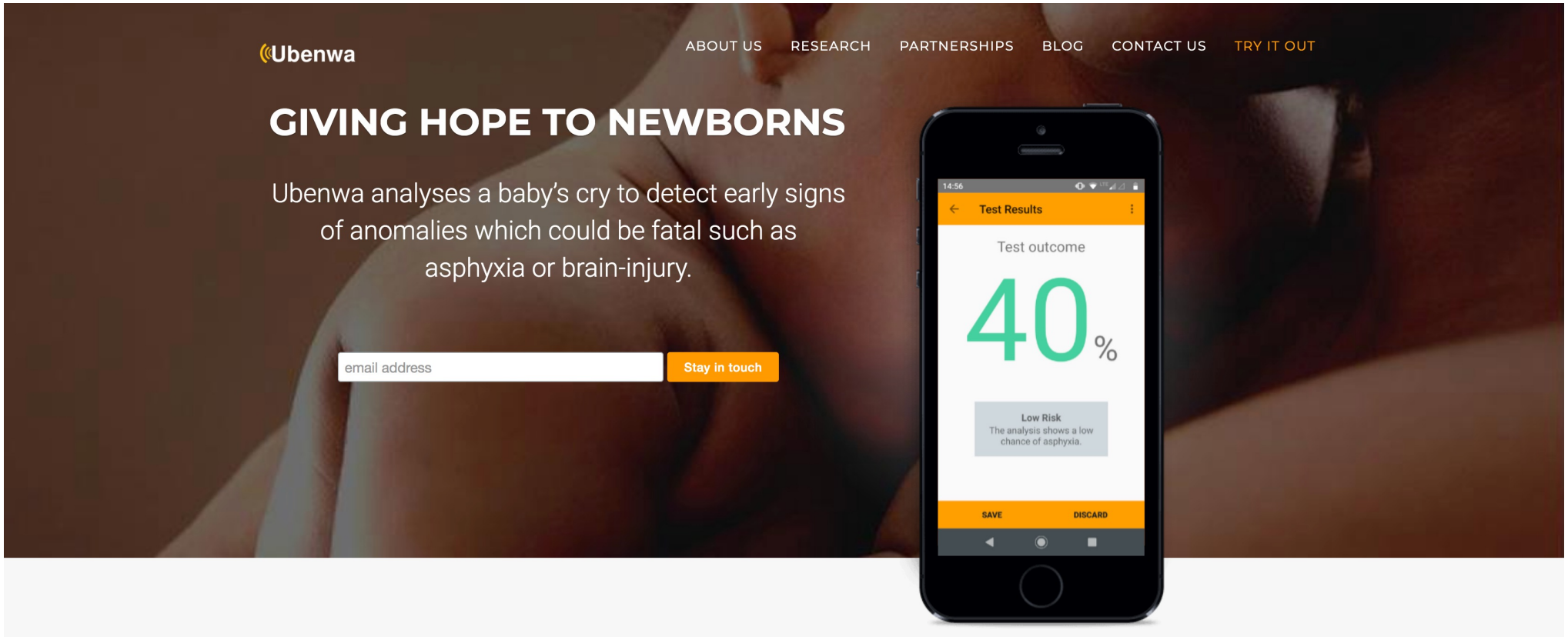

www.ubenwa.ai

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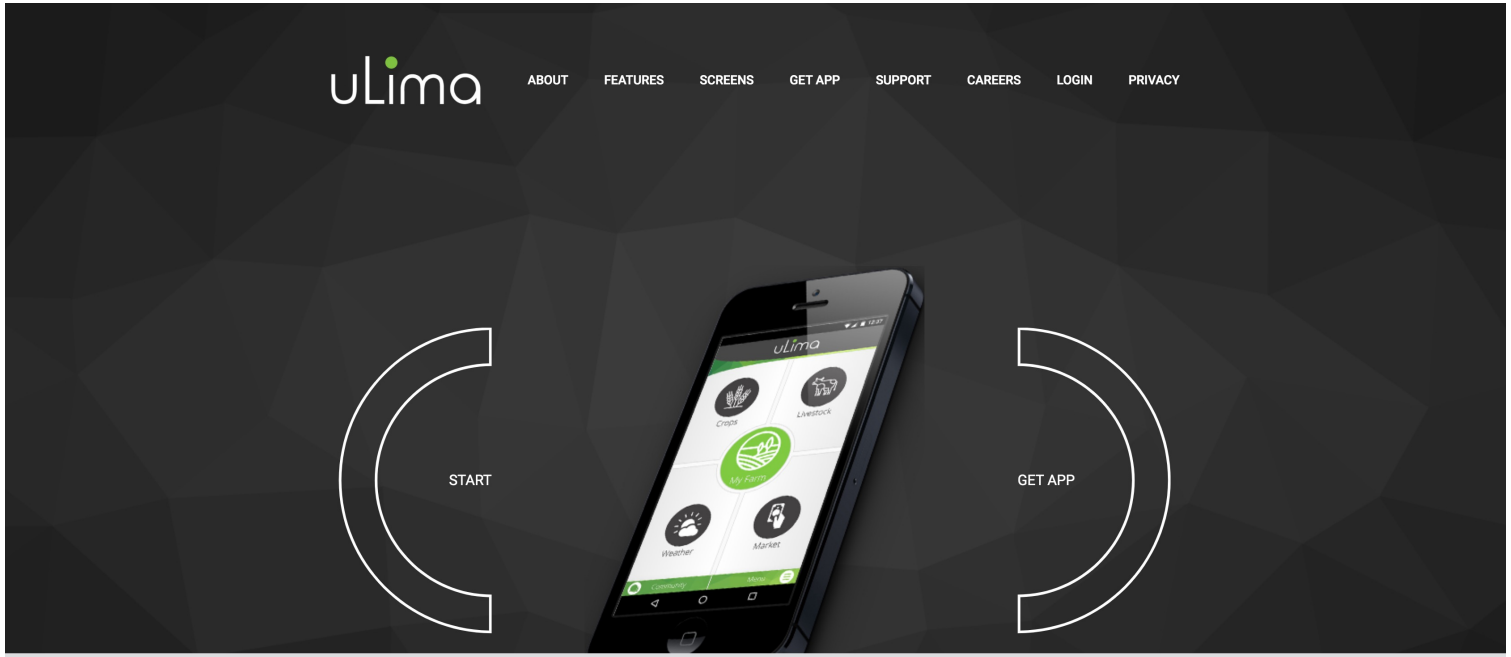

http://ulima.co/

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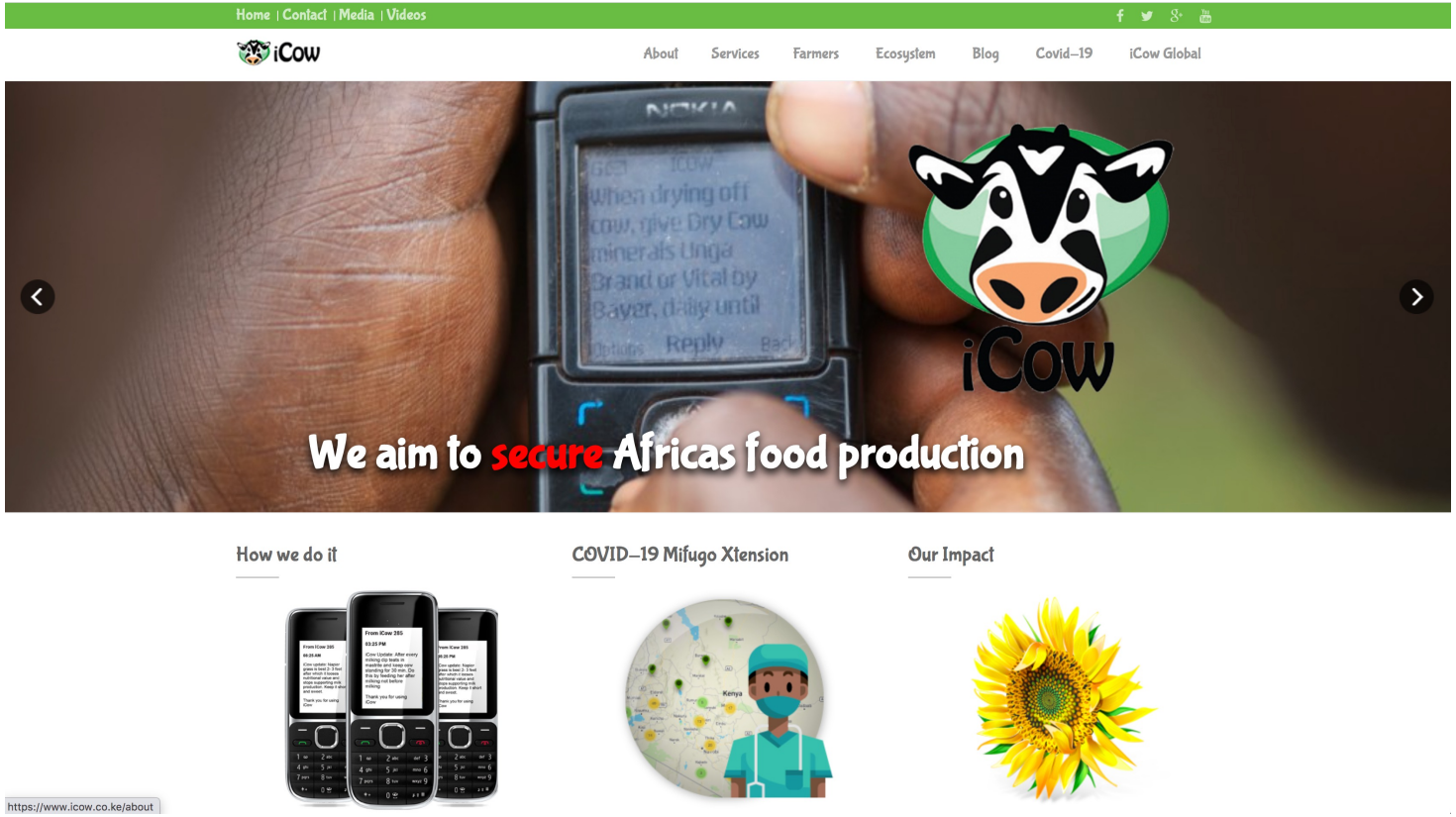

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