

Certificate I: Understanding AI and Machine Learning in Africa

Course AIMLO1: Artificial Intelligence – Past, Present, and Future

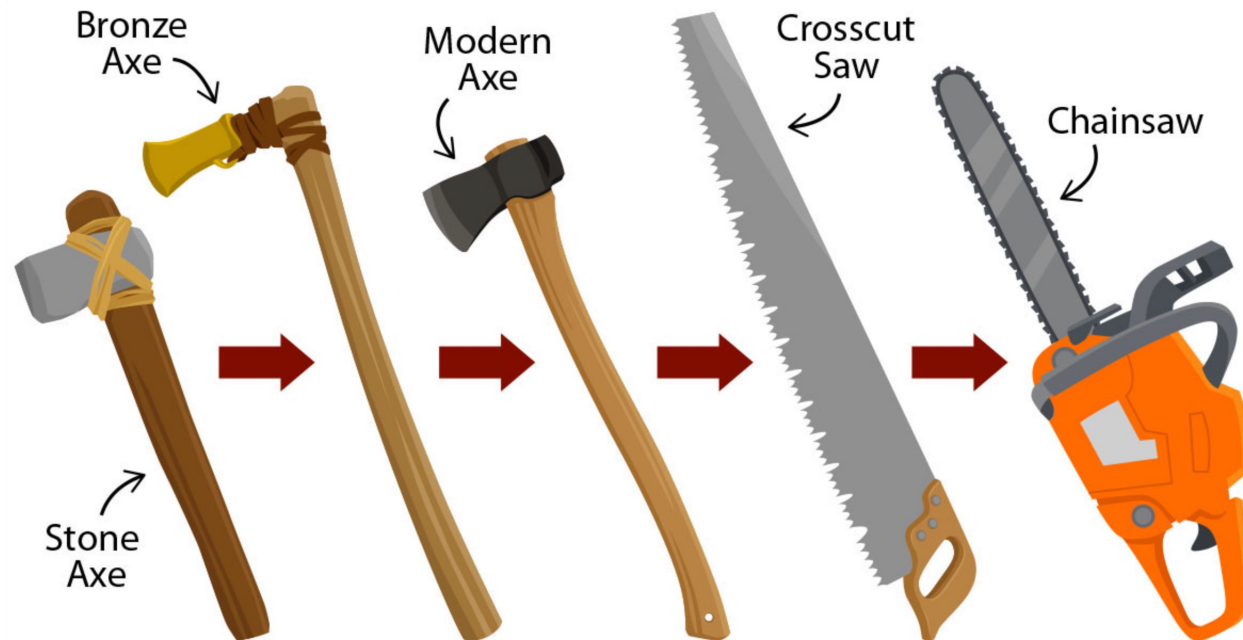
Module 1: What is AI, where did it come from, and where is it taking us?

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/>

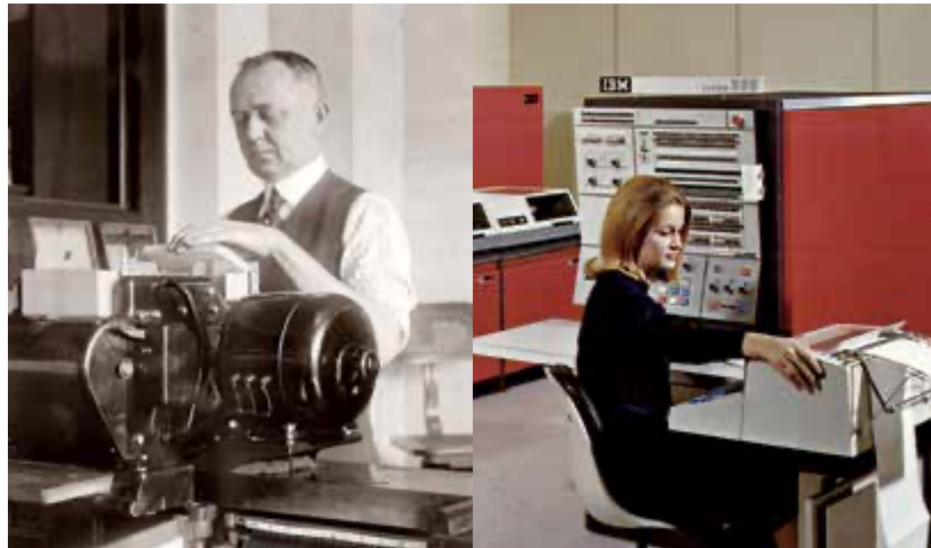


Photo by Sam Ngendahimana

<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

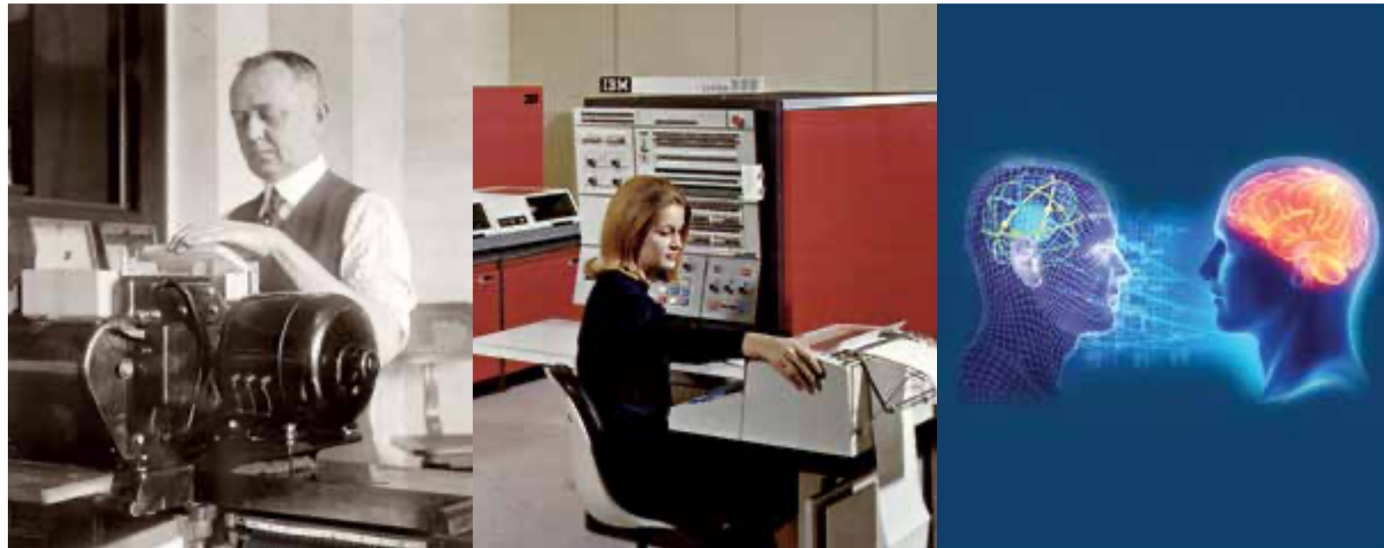
The Tabulating Era
(1900s–1940s)

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)

(Kelly, 2015)

The Cognitive Era
(2011–)

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"

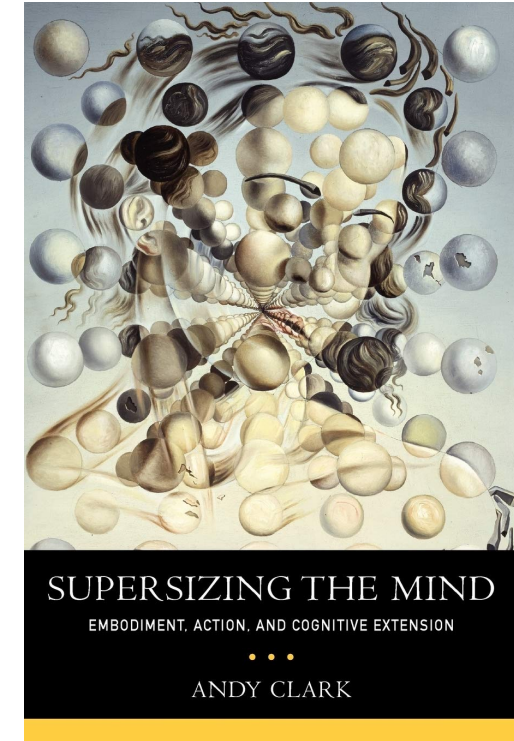
(Licklider 1960)

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?

Definitions of 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



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



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

This definition focusses on action as the key attribute of AI



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



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



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

(Smith & Neupane, 2018)

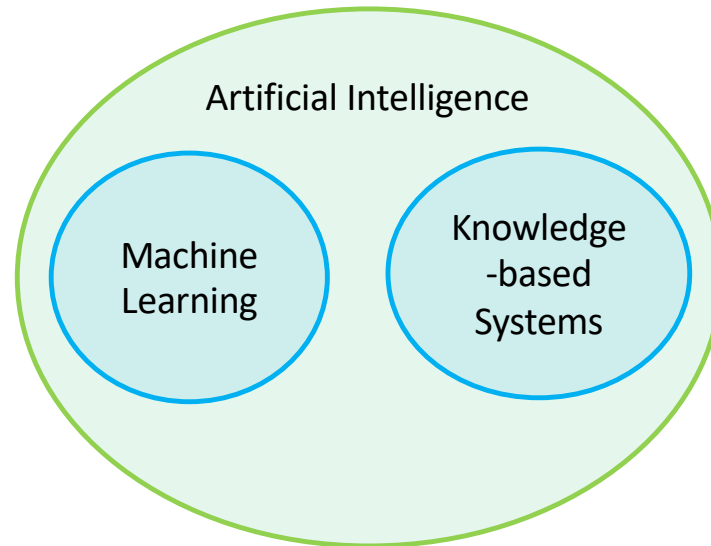
What is Artificial Intelligence?

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**.

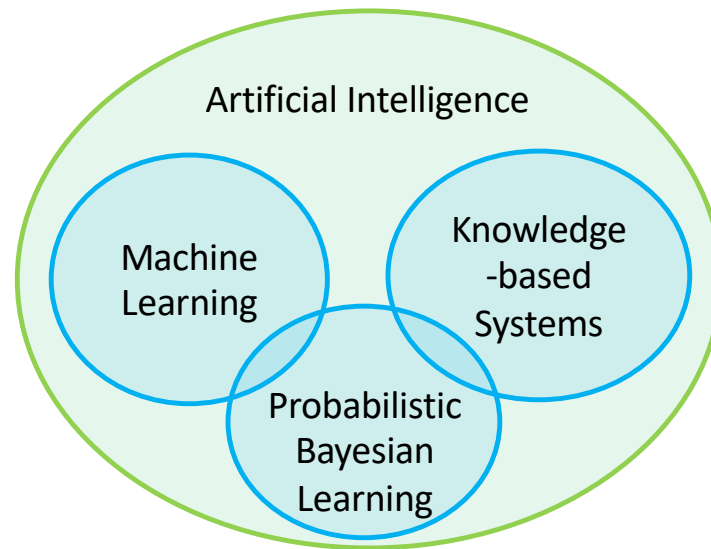
Intelligent behaviour	Optimization
Application	Supply chains, logistical pathways, pricing
Intelligent behaviour	Pattern recognition/detection
Application	Face recognition, medical diagnostics, fraud detection
Intelligent behaviour	Prediction/hypothesis testing
Application	Flood prediction, disaster prediction, disease outbreak, recidivism
Intelligent behaviour	Natural language processing¹⁶
Application	Voice recognition
Intelligent behaviour	Machine translation¹⁷
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

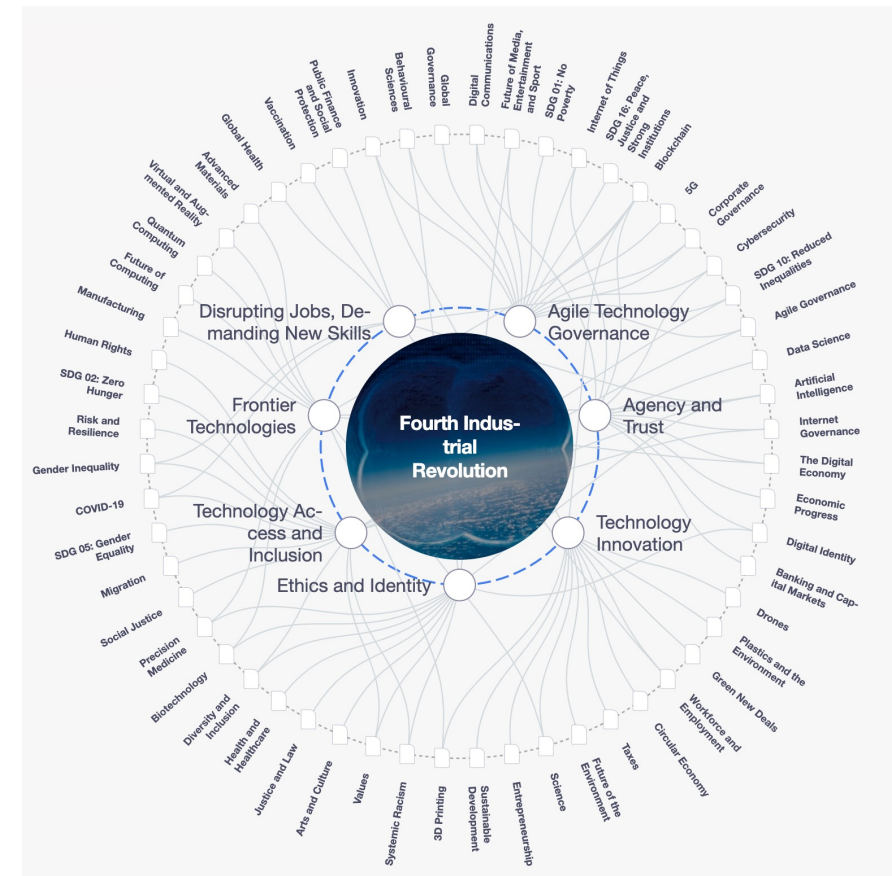
- The fusion of **physical**, **digital**, and **biological** technologies in **cyber-physical systems**
- Powered by **AI** and **machine learning**
- Enabled by ubiquitous communication and near-universal access to information
- Also known as **4IR** and **Industry 4.0**

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

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Communication,
technologies et développement

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Advanced Robotics, Artificial Intelligence and Development

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Technologies mobiles, innovation et développement

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4 | 2017
Technologies numériques et diffusion de l'information pendant les périodes de conflits et de crise dans le monde

3 | 2016
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

"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. "

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

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/>

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.

AI in Africa

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

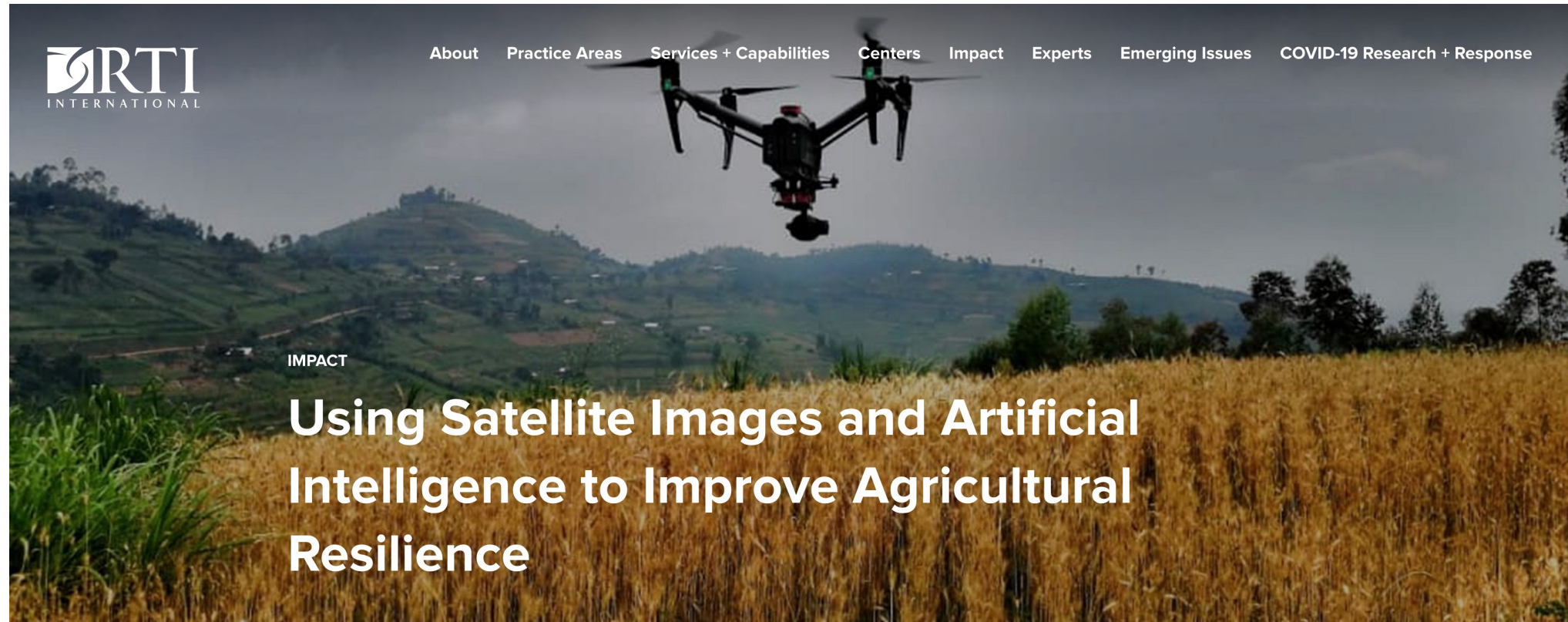
Financial services

...



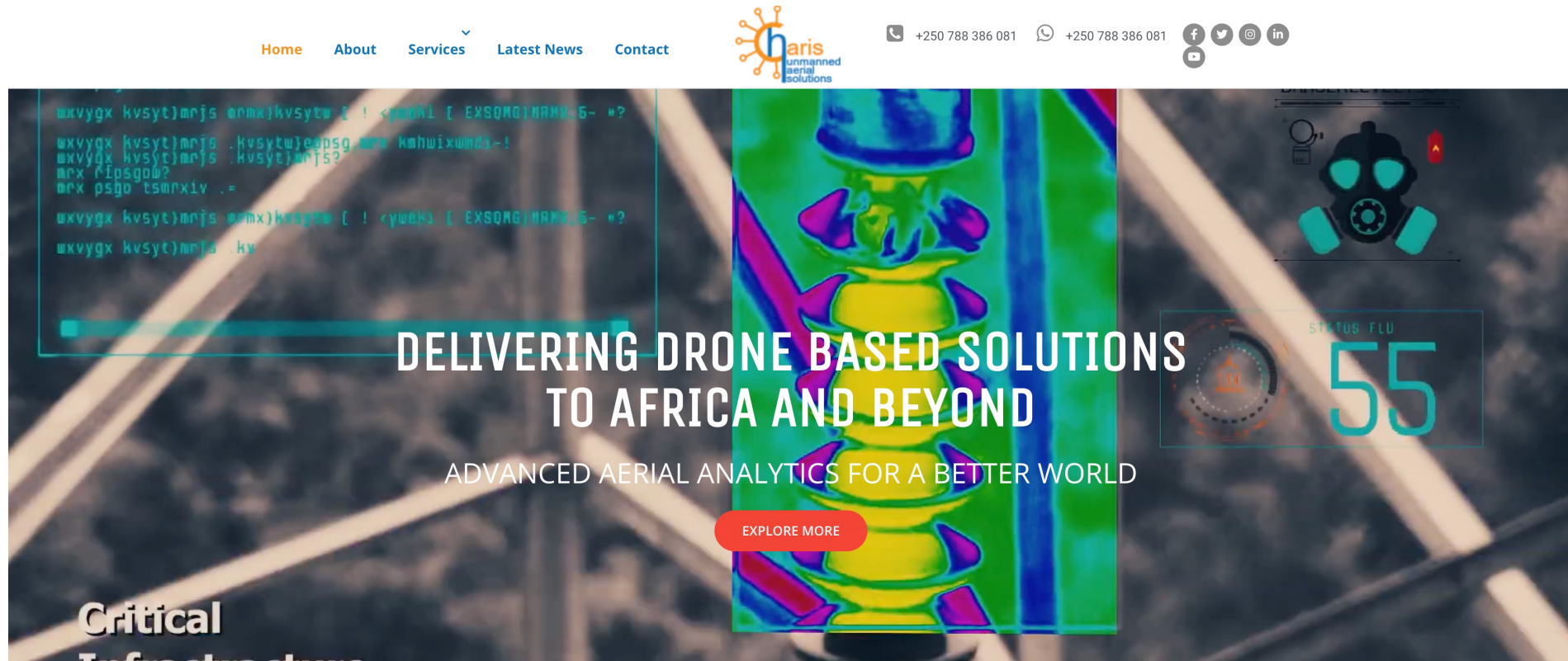
<https://www.mamopanel.org/resources/reports-and-briefings/byte-byte-policy-innovation-transforming-africas-f/>

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

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GLOBAL TECH INSIGHT TO DRIVE AGRIBUSINESS

Market WatchMay 8, 2019

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

By [Microsoft Care GH](#)

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Microsoft Research

FarmBeats tracks soil, moisture data 2...

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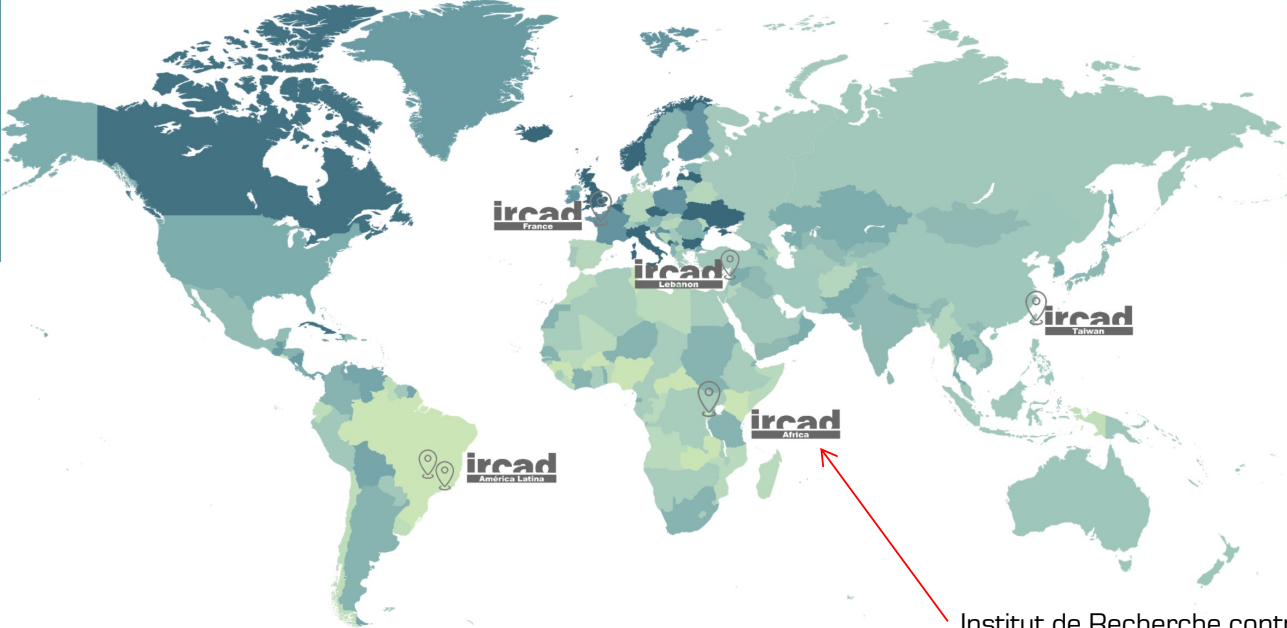
Microsoft is expanding the pilot program of FarmBeats to Africa, starting in Kenya, [reports Microsoft Cares GH](#). The program in Nairobi will reportedly be focused on addressing the specific challenges of farming in Africa with the intent of expanding to other African countries.

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

AI in Africa

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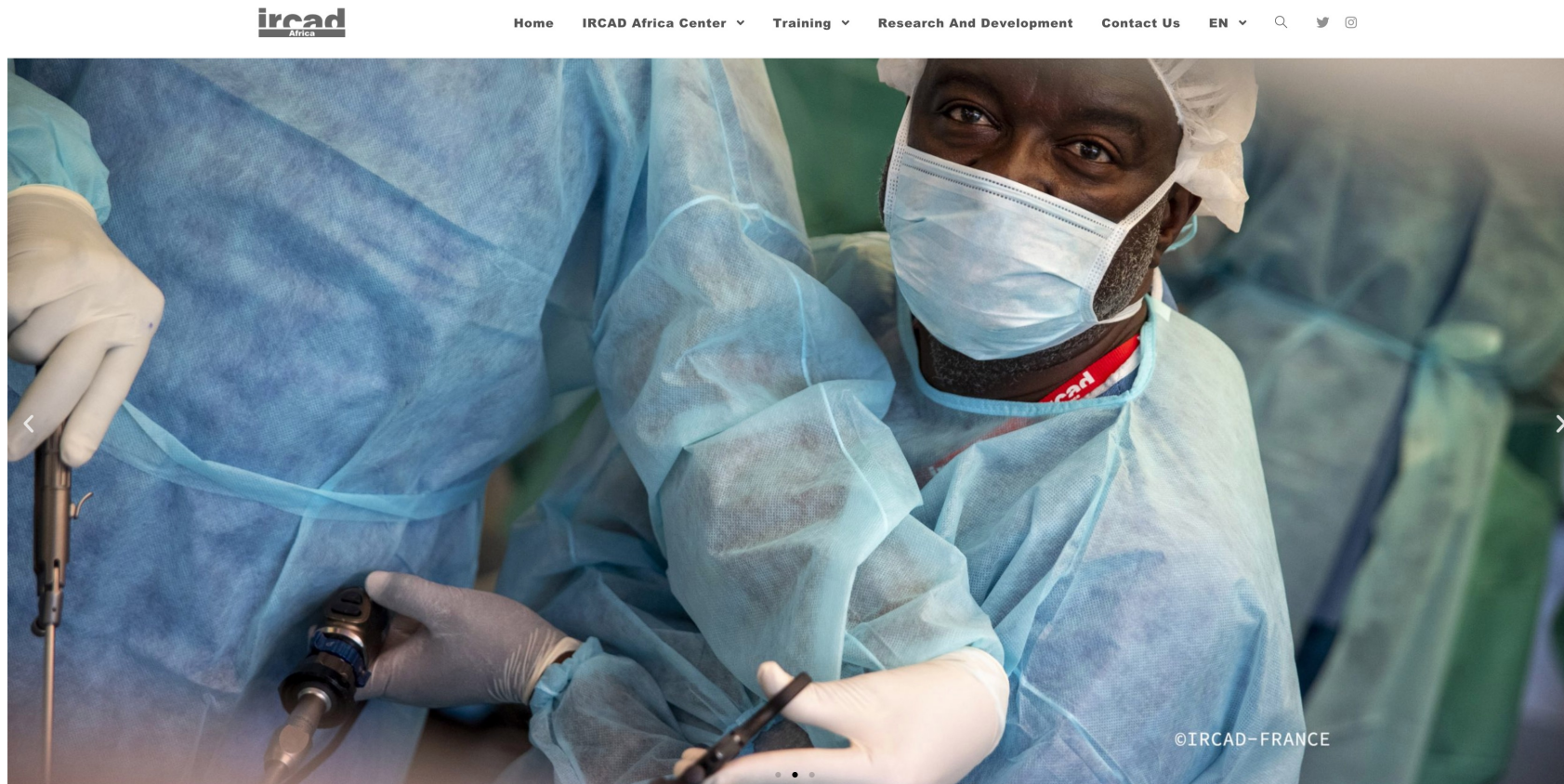


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Institut de Recherche contre les Cancers de l'Appareil Digestif
Research Institute against Digestive Cancer

AI in Africa



rwanda.ircad.fr/

Certificate I: Understanding AI and Machine Learning in Africa
Course AIMLO1: Artificial Intelligence – Past, Present, and Future

Carnegie Mellon University
Africa

Module 1: What is AI?
Lecture 1: AI and the Fourth Industrial Revolution; Slide 27

AI in Africa



<https://rwanda.ircad.fr/>

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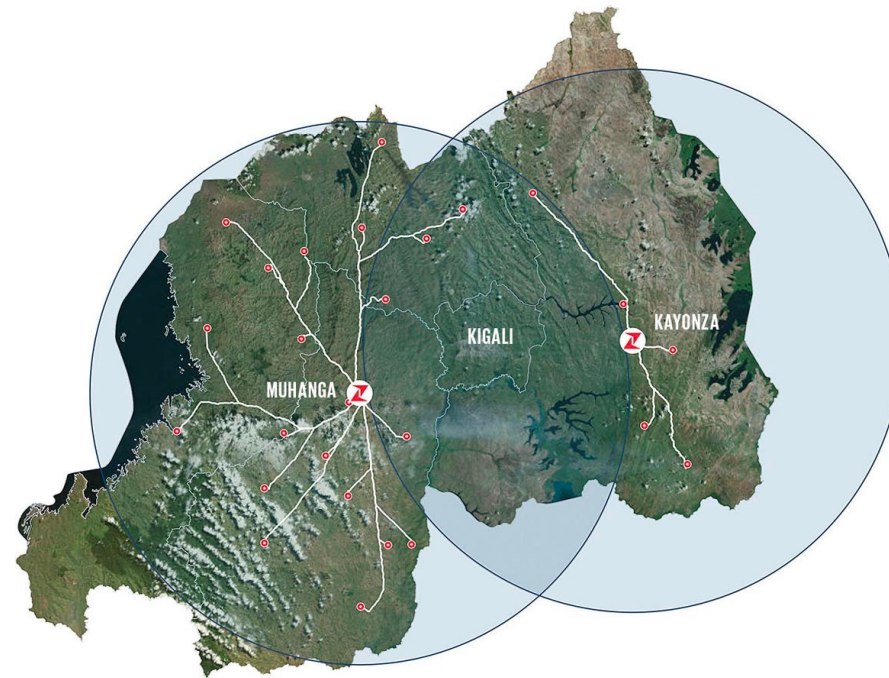
Zipline Medical Delivery Drones



<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>

AI in Africa

Meet the team


Analytics starts with people. We're the little lines that connect the dots.



Emmanuel Chebukati
Infrastructure & Security

Emmanuel is a cloud and security engineer specializing in systems audit, application security and secure cloud deployment. He has over 5 years experience working on technology projects across the East African region in both the public and private sector. Carnegie Mellon University Alumnus (MSc IT, 2018).


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Rahab Wangari
Data Scientist

Rahab is a results-driven data analyst with 3 years of experience in software engineering, business intelligence and data mining. She has a professional background in the banking sector, academic institutions and consulting. She is proficient in machine learning, OBIEE, data driven model and software development with attention to details and quality. She seeks to help organizations make decisions using data.


[in](#)



Victoria Munguti
ICT Strategist

An expert in IT Entrepreneurship with experience working as an ICT business strategist, Victoria strives to provide strategic ICT advice to influence decisions regarding business initiatives. She is skilled in market planning for high tech products and innovation, strategic use of digital information and rolling out organizations initiatives.


[in](#)



Sylvia Makario
Admin & Marketing

Sylvia is an IT business engineer and data analytics expert applying training and knowledge in geospatial engineering & space technology to data analytics. She possesses her trade especially in emerging technologies and their interoperability to economic development in the private and public domains. Her key energy drivers are strategy, innovation and looking at the bigger picture in achieving the end goals with her team.


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Benson Murimi
DevOps Engineer

Benson is an experienced software engineer with a demonstrated history of working in the computer software industry. He is skilled in Cloud Computing, Big Data, Azure, AWS, GCP, Java, Python, R, Oracle, Matlab, NoSQL, MySQL, JavaScript and PHP. He is a strong engineering professional with a Master's degree focused in data science and software engineering from Carnegie Mellon University.

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Yvonne Wambui
Data Scientist

Yvonne is a data scientist specializing in natural language processing, time series and deep learning. Her mission is to use these technical skills to understand human behavior through data. This, she believes, will improve services offered to people by making them personalized. Carnegie Mellon University Alumna (Msc IT, 2018).

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Hepta Analytics

Beyond Information

Hepta Analytics is home to Africa's best data engineers with experience in different domains with key interest in making your business grow to the next level. We discover the invisible patterns in your data to help you make informed decisions.

www.heptanalytics.com/

Najua

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Instant translation powered by AI

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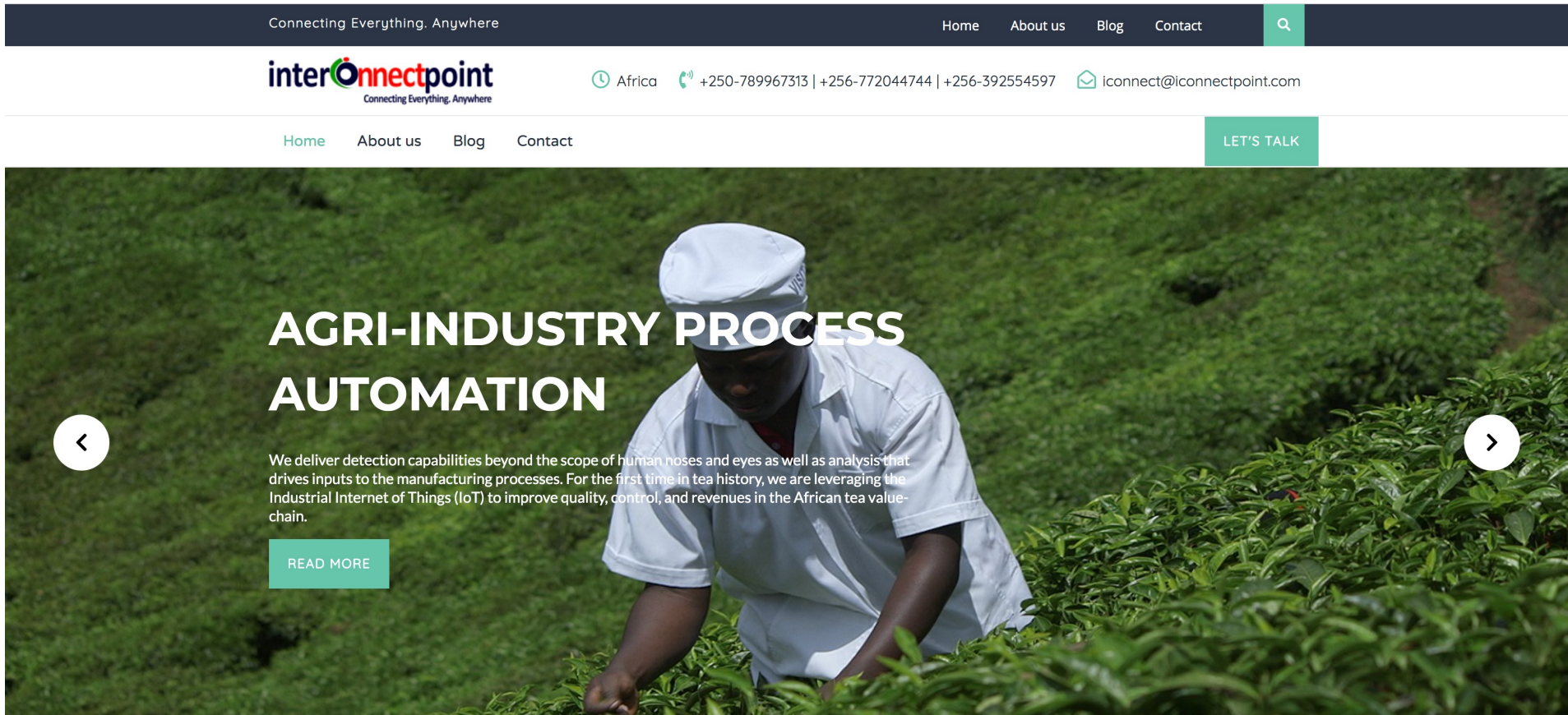
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About Najua

Najua is product by Hepta Analytics whose main role is to bridge the informational gap and provide informational facilities such as such bots to various institutions in Africa.

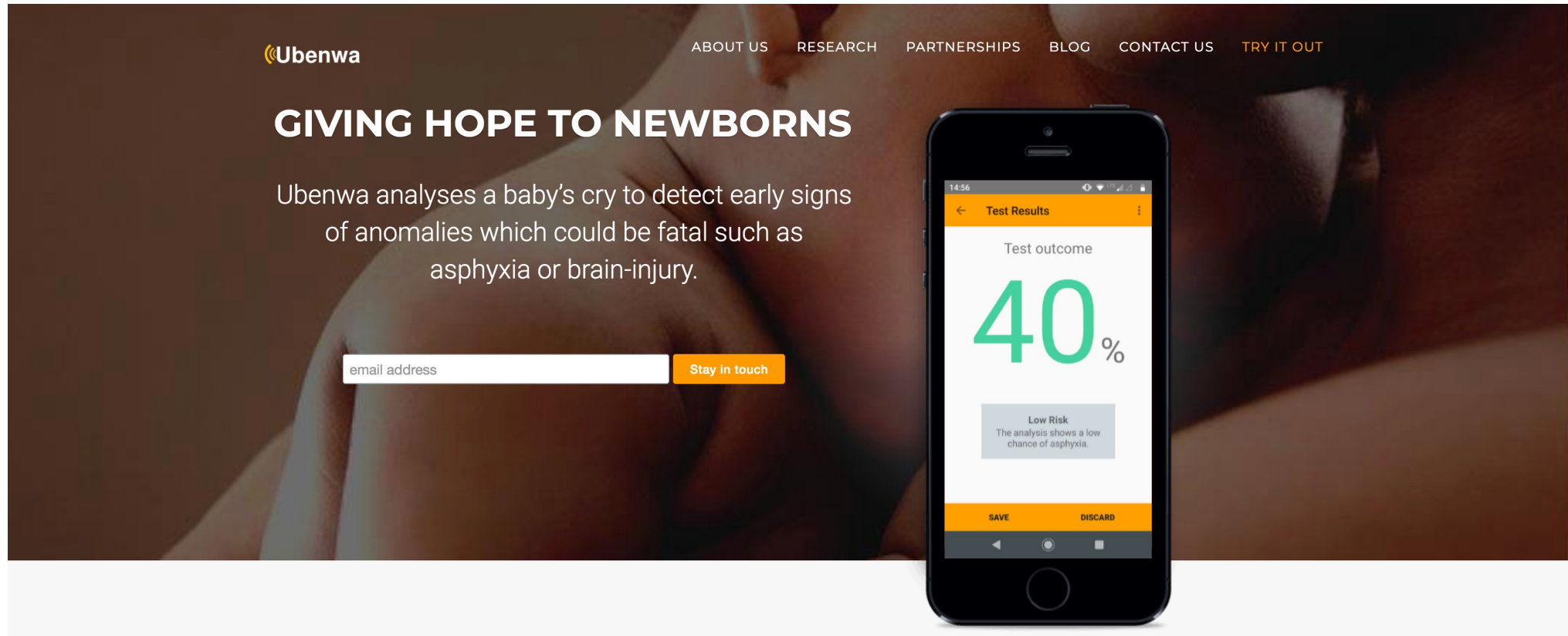
<http://translate.najua.ai/>

AI in Africa



<https://iconnectpoint.com/>

AI in Africa



www.ubenwa.ai

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<http://ulima.co/>

AI in Africa

