Certificate I: Understanding AI and Machine Learning in Africa

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

Module 4: Future Challenges

Lecture 3: Social and Ethical Aspects of AI

Carnegie Mellon University
Africa

Learning Objectives

1. Highlight and illustrate the relevance of AI to Africa

2. Identify the ways in which AI can have a negative impact on developing countries

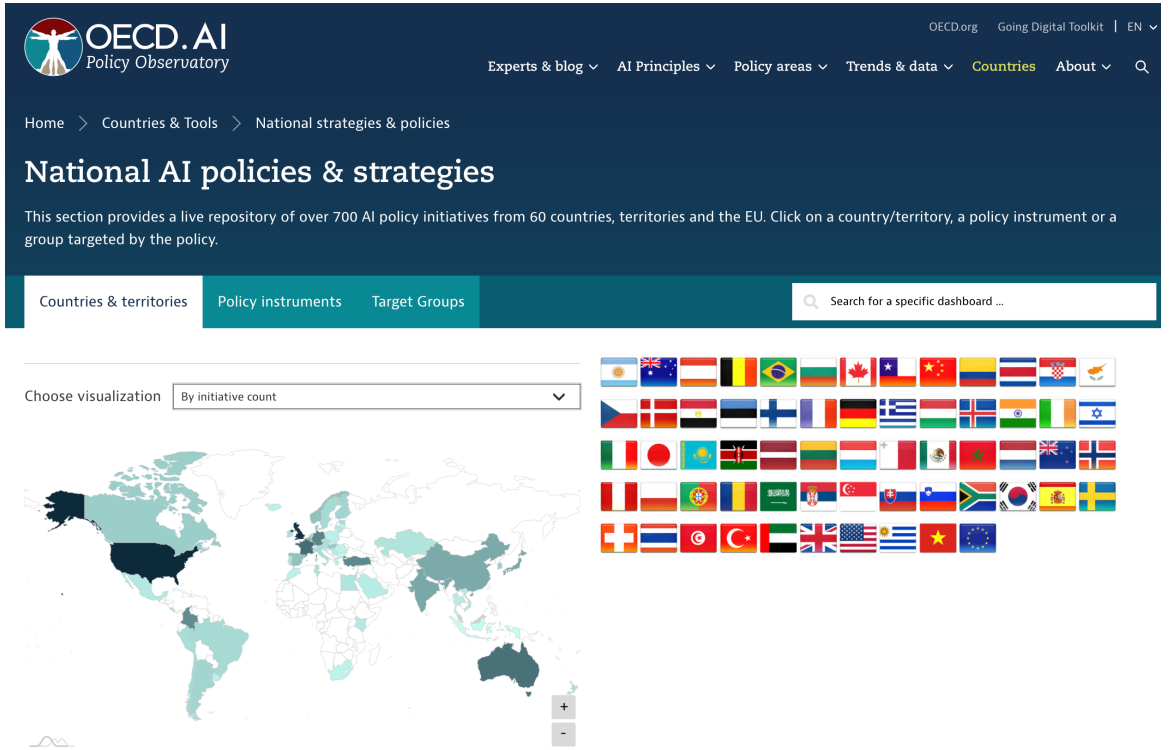
3. Discuss ethical concerns, such as the dangers of fake misinformation, the problem of gender and racial bias, and the imperative of democratization in AI

Lecture Contents

1. The positive impact of AI in Africa
2. Premature deindustrialization
3. Ethical imperatives
4. Democratization in AI
5. Lecture summary
6. Recommended reading & references

The Positive Impact of AI in Africa

- AI can benefit everyone
- The examples so far focused on applications in the developed world
- Most of the national strategies on AI have been created by governments in developed countries
- AI is just as relevant to Africa



https://oecd.ai/en/dashboards

Artificial intelligence (AI), facilitated by easier data collection and improved computing resources, is shaping the dynamics of many sectors that are closely linked with achieving the Sustainable Development Goals. Many African countries have tremendous opportunities to use AI in a number of key sectors including finance, agriculture, health, infrastructure and food security. However, the lack of expertise and capacity, as well as impacts of the current Covid19 pandemic, pose significant challenges. Despite the extensive promises of AI to transform economies and expedite development, the challenges and adverse impacts need to be studied thoroughly.

https://sites.google.com/view/aia2020/home

The Positive Impact of AI in Africa

AI is having an increasingly positive impact in Africa in sectors such as

See (Novitske, 2018; Access Partnership, 2018; Delmus Alupo et al., in press)

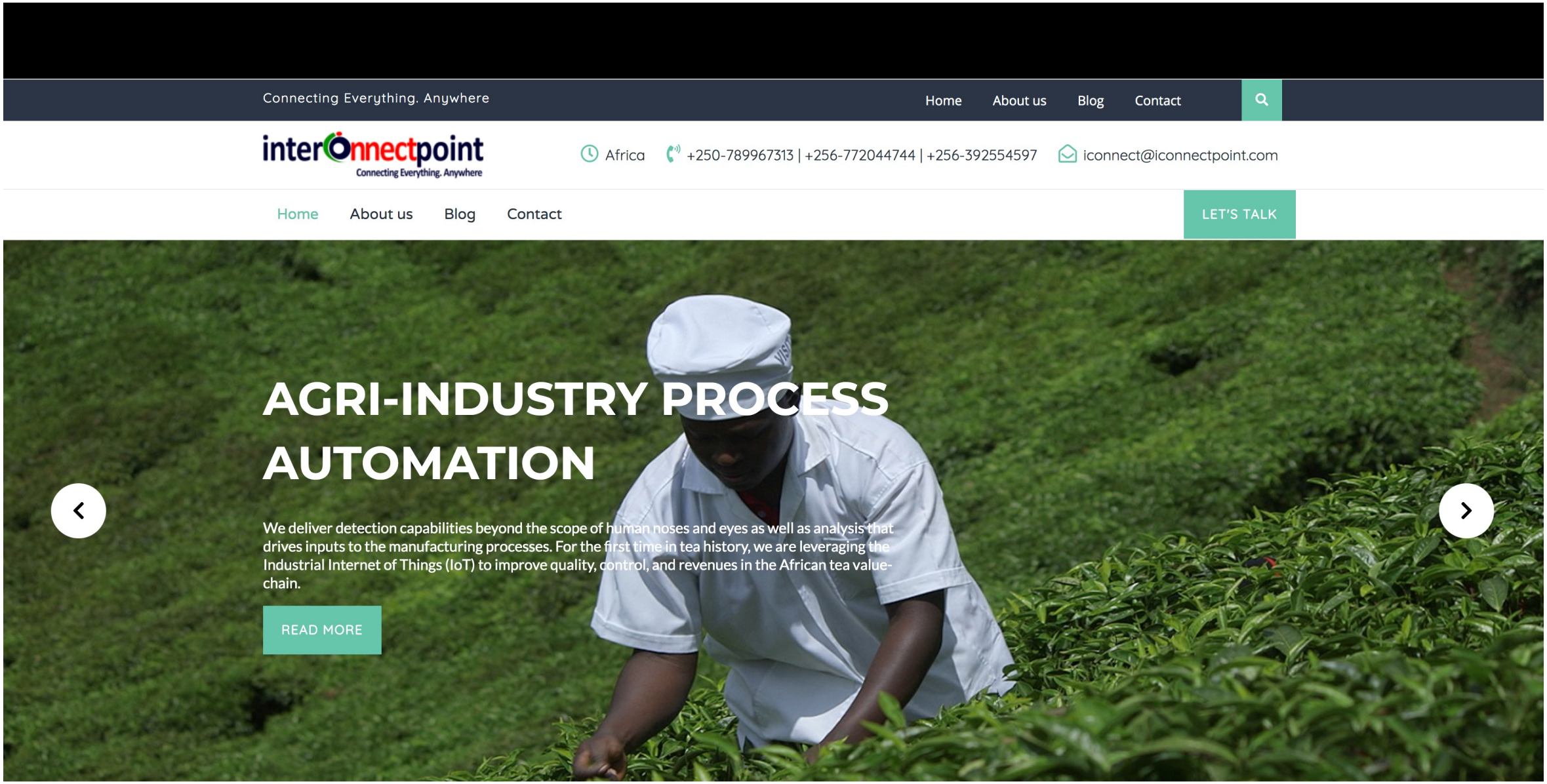
- Energy
- Healthcare
- Agriculture
- Public services
- Financial services

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

The Positive Impact of AI in Africa

It has the potential to

- Drive economic growth, development, and democratization,
- Reduce poverty
- Improve education
- Support healthcare delivery
- Increase food production
- Improve the capacity of existing road infrastructure by increasing traffic flow
- Improve public services, and
- Improve the quality of life of people with disabilities



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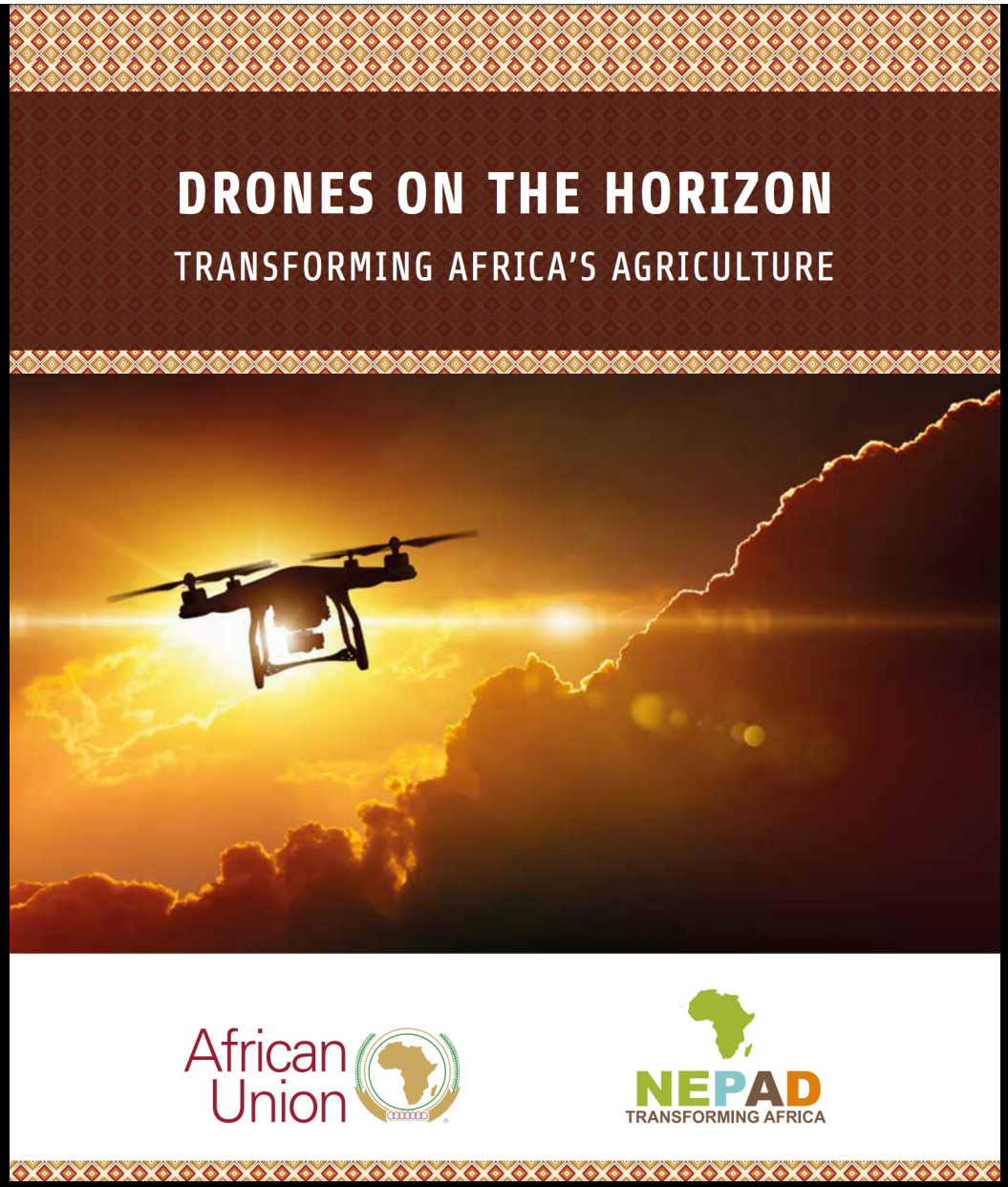
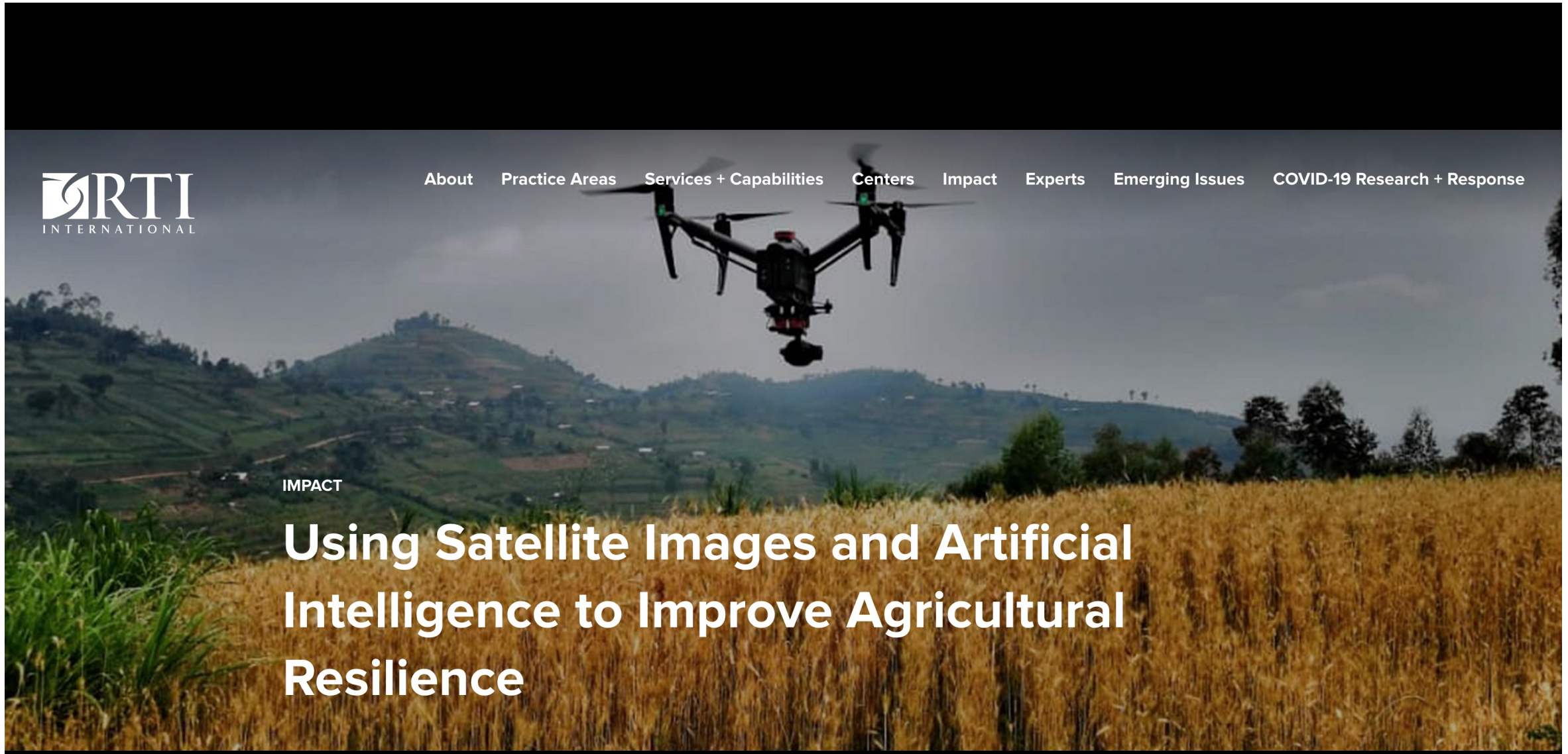


https://www.tralac.org/documents/news/1978-drones-on-the-horizon-transforming-africa-s-agriculture-nepad-2018/file.html



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

Market Watch May 8, 2019

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

By Microsoft Care GH

Share

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/

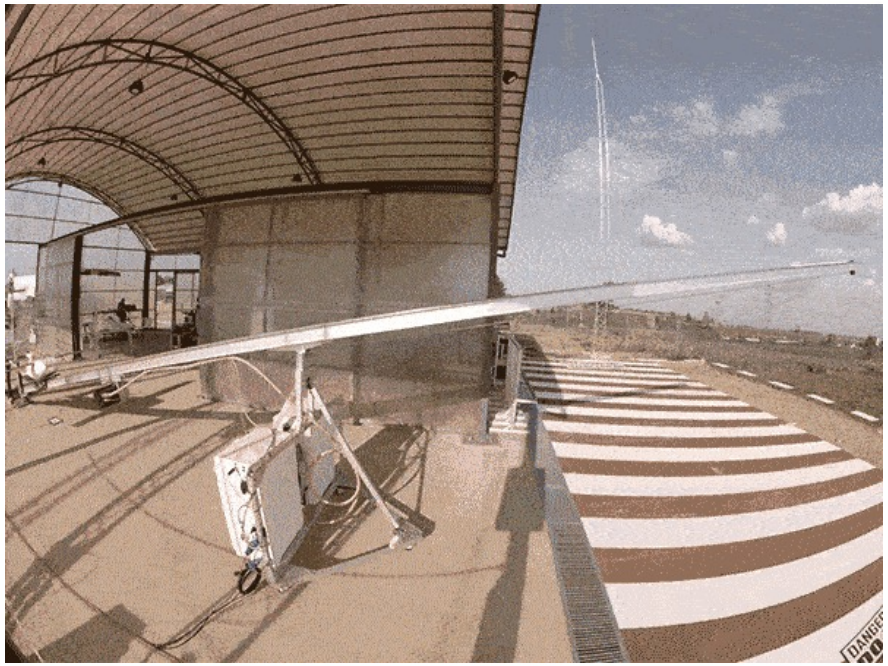
In the Air With Zipline's Medical Delivery Drones

Commercial operations in Rwanda prove the company can deliver emergency blood packs in minutes, rather than hours

By **Evan Ackerman and Michael Koziol**

TECH EXPEDITION

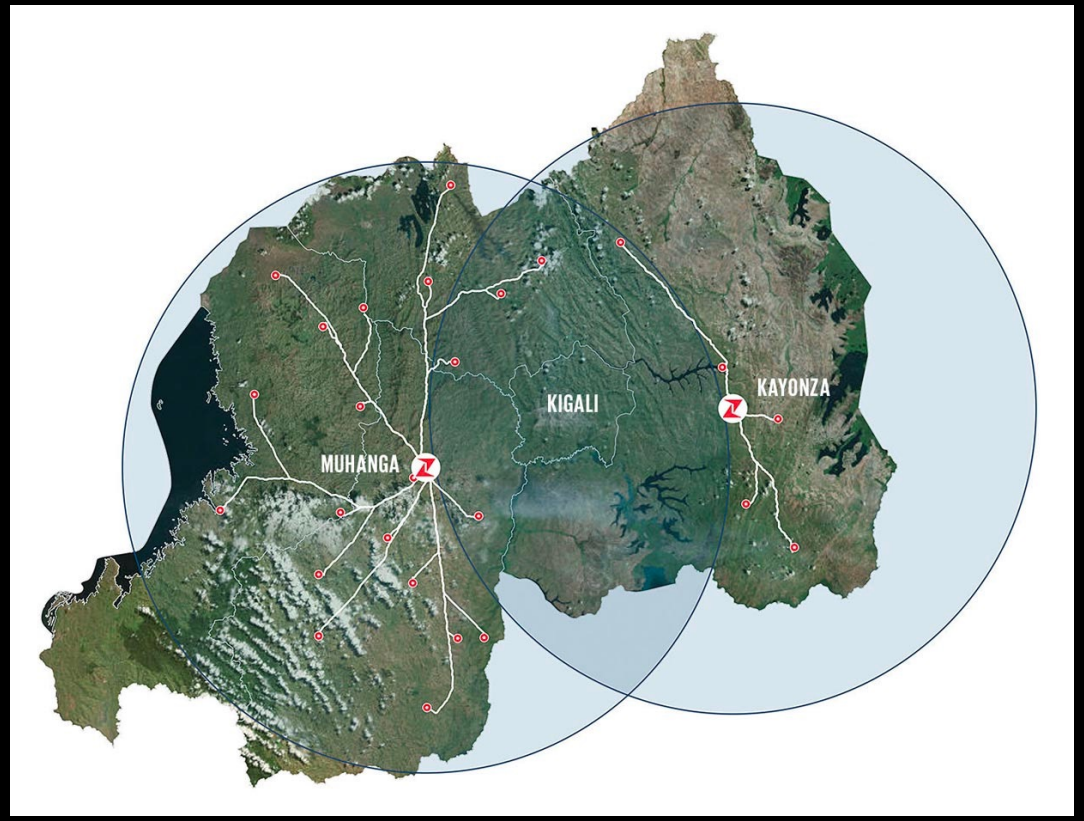
East Africa's Big Bet On Drones



Gif: IEEE Spectrum

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

Zipline Medical Delivery Drones



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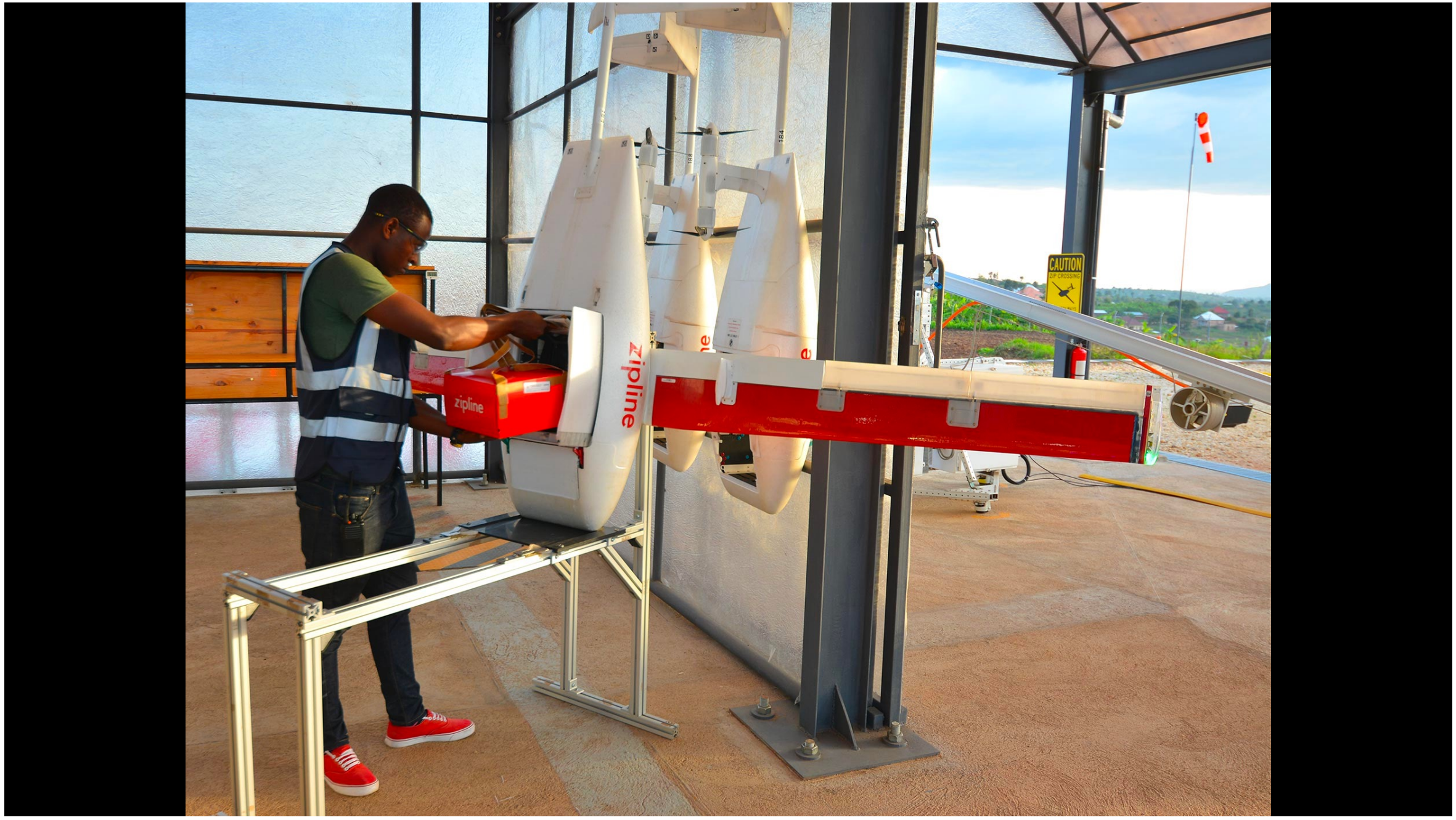
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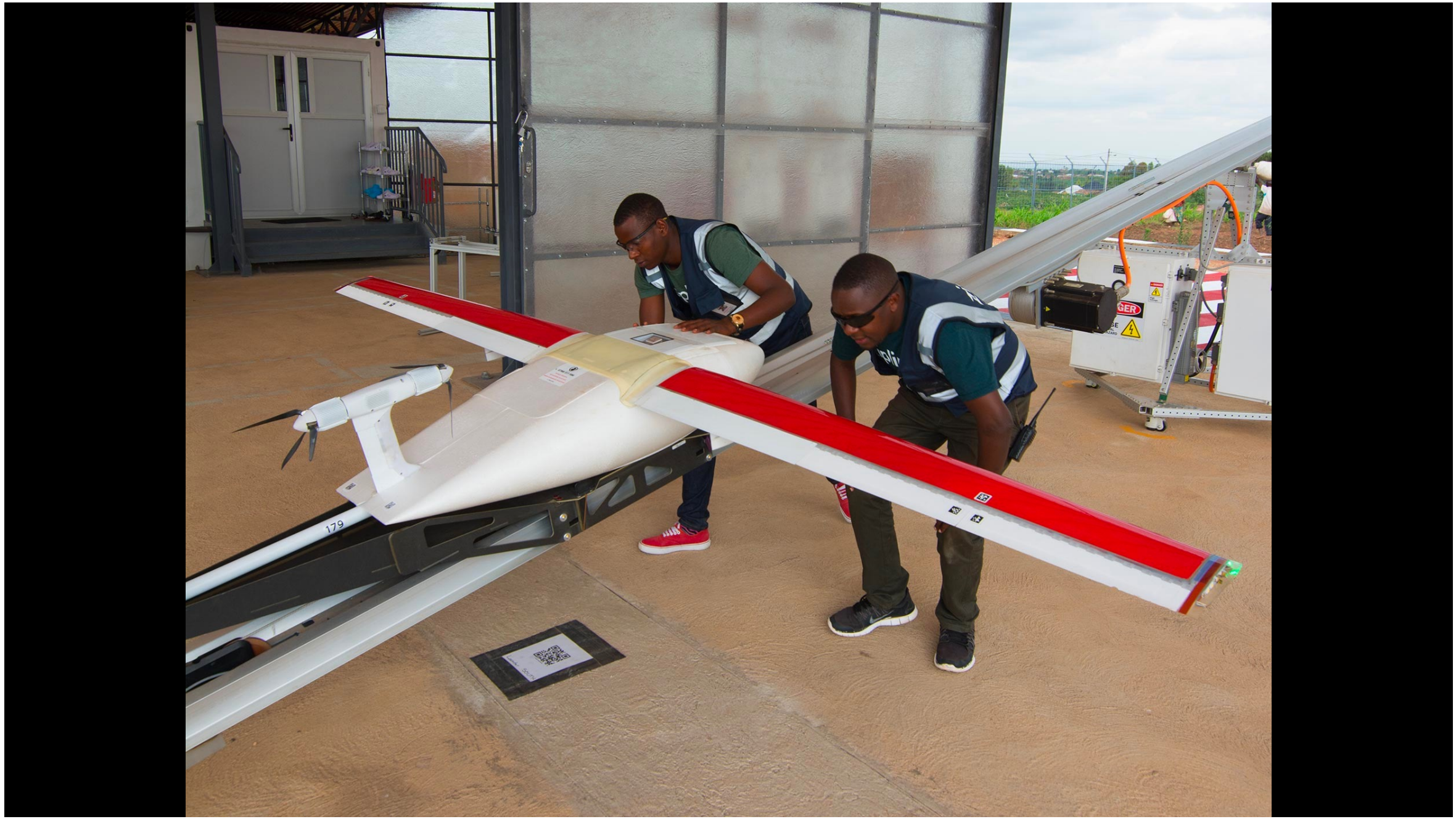
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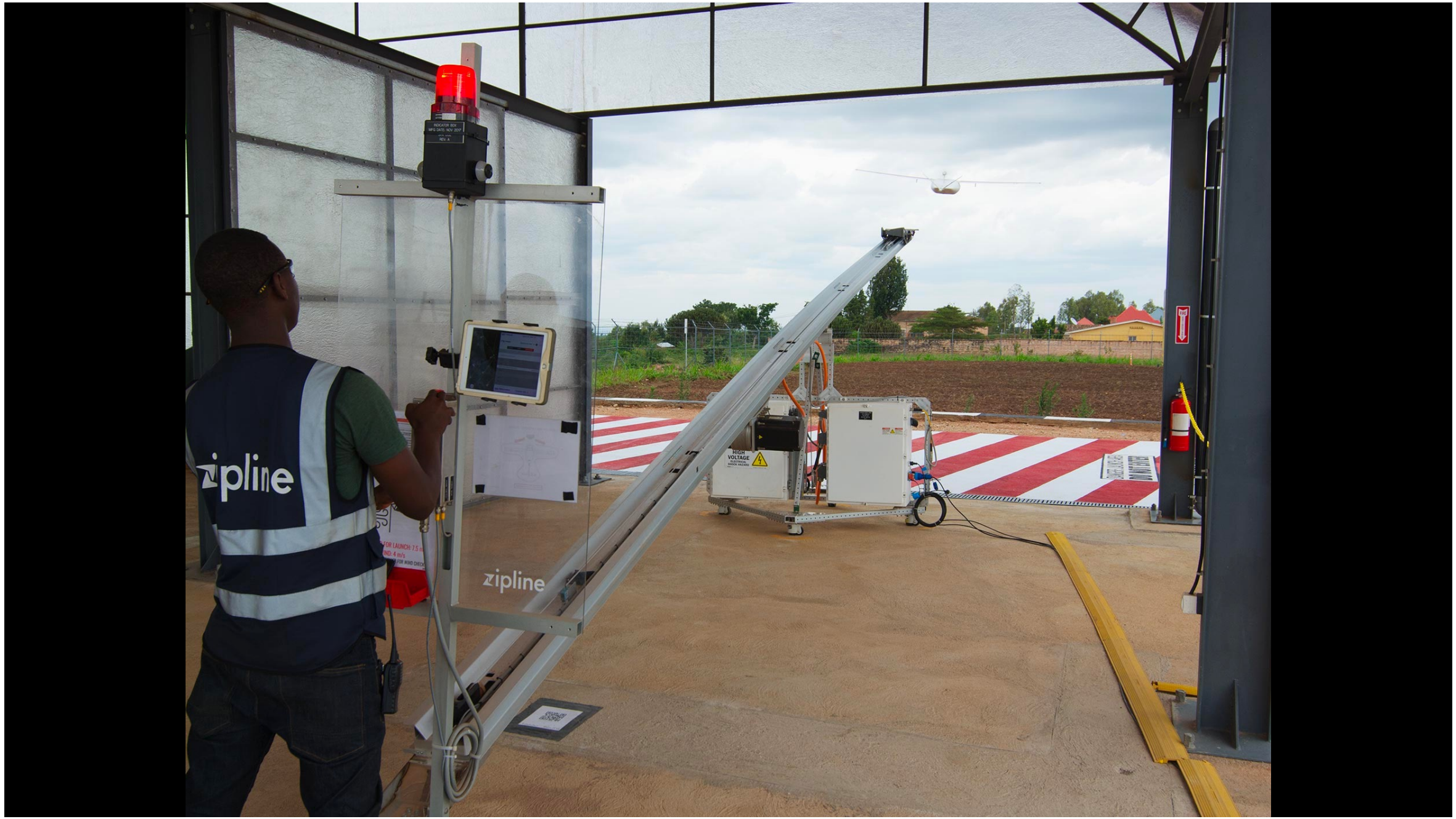
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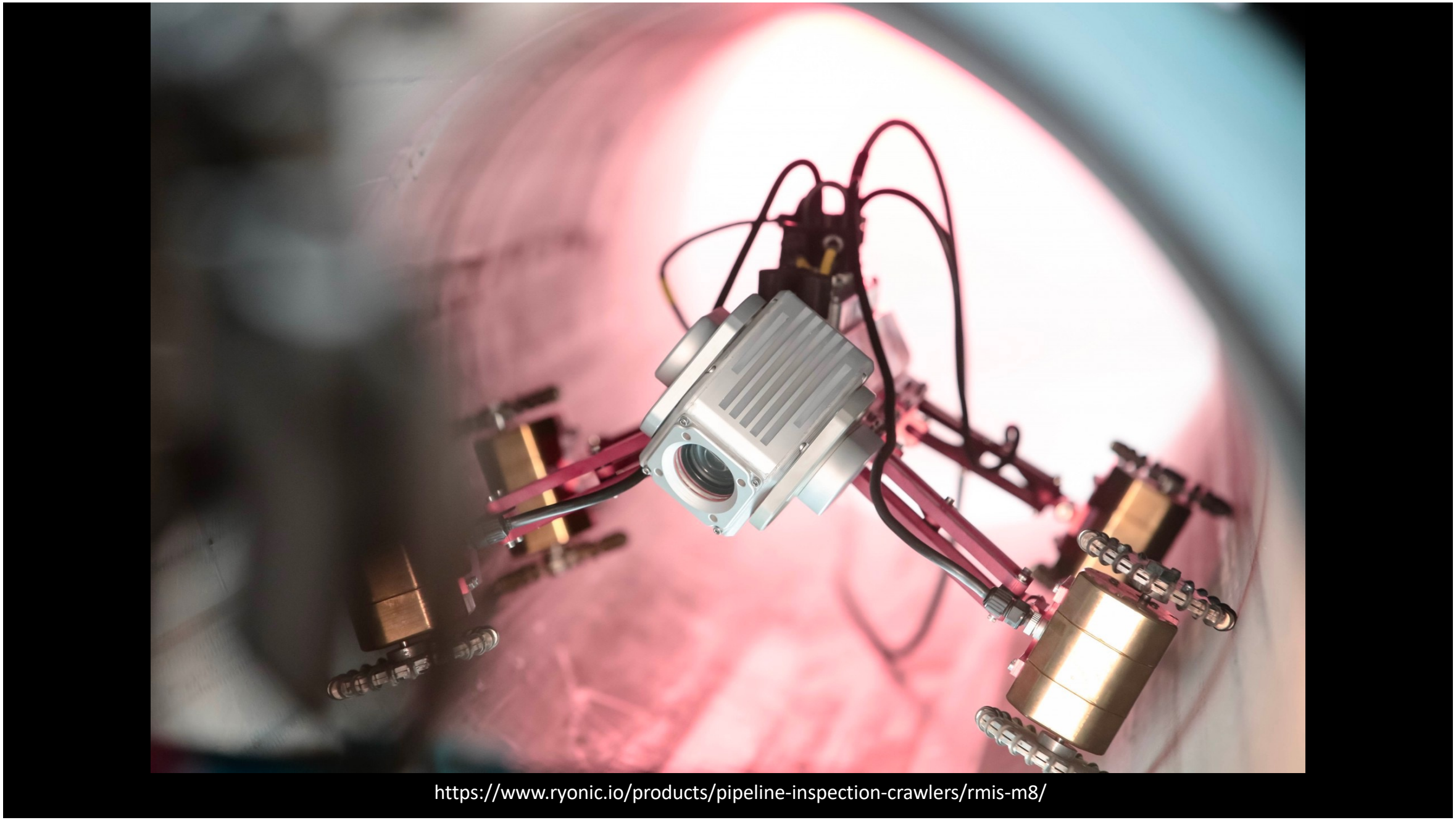
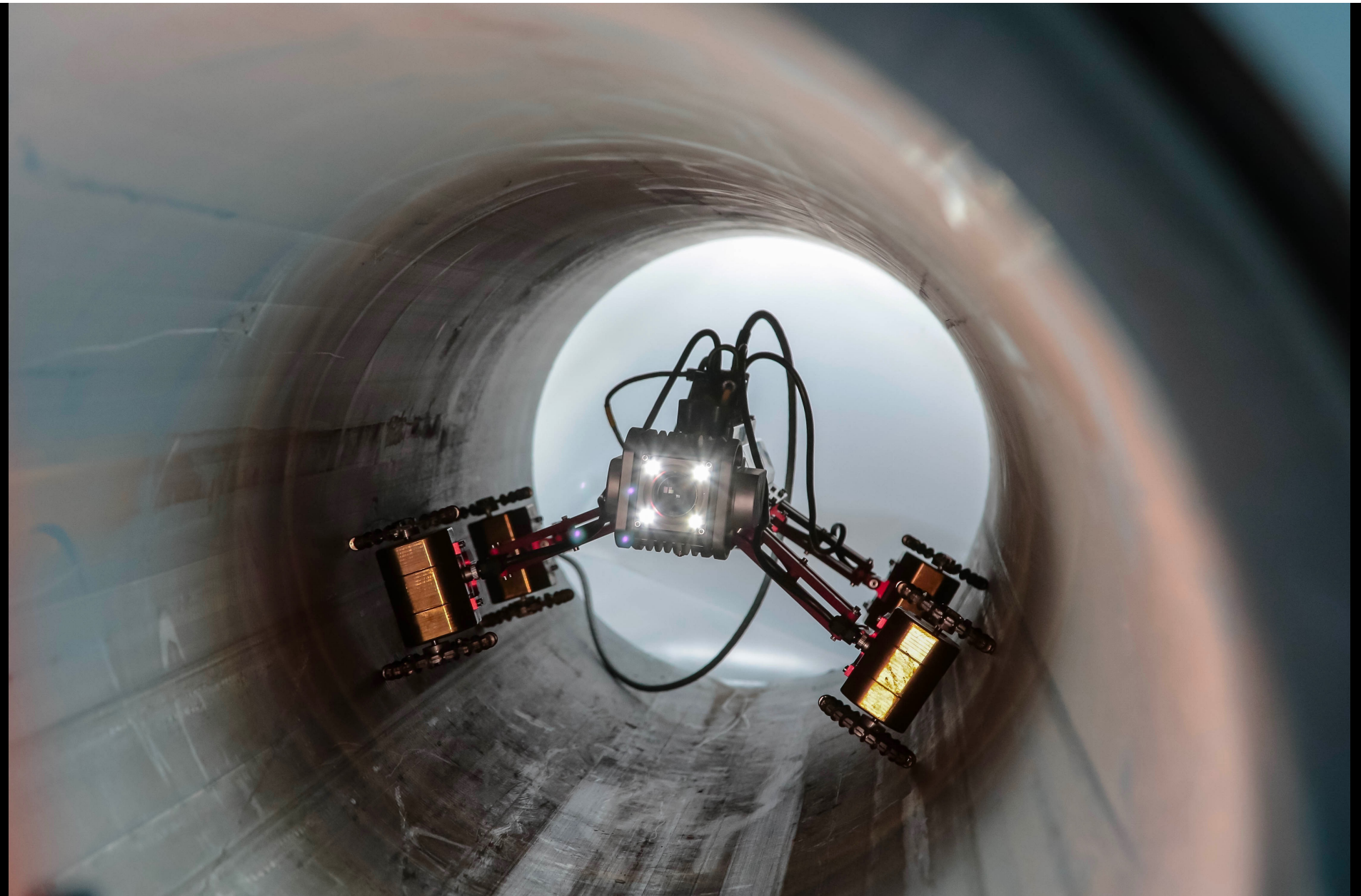


https://www.ryonic.io/products/pipeline-inspection-crawlers/rmis-m8/



https://www.ryonic.io/products/pipeline-inspection-crawlers/rmis-m8/

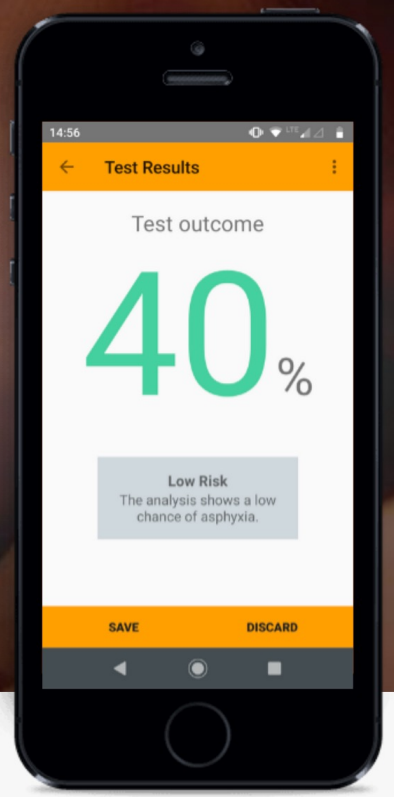
Ubenwa

ABOUT US RESEARCH PARTNERSHIPS BLOG CONTACT US TRY IT OUT

GIVING HOPE TO NEWBORNS

Ubenwa analyses a baby's cry to detect early signs of anomalies which could be fatal such as asphyxia or brain-injury.

email address Stay in touch



www.ubenwa.ai

WHAT IS UBENWA?

Ubenwa is a mobile app that analyses the cry sounds of a newborn to detect early signs of perinatal asphyxia - a leading cause of neonatal disability and death. The app uses machine learning to identify the changing acoustic patterns in the cries of newborns who are at risk of brain damage due to asphyxia. It alerts care-givers of infants at risk, allowing them to apply necessary treatment and/or make an early referral to tertiary care facilities. See our short video below to learn more.

Photos from the Ubenwa clinical study in Nigeria. Click here for more photos.

uLima

ABOUT FEATURES SCREENS GET APP SUPPORT CAREERS LOGIN PRIVACY

START

GET APP

ABOUT US

ULIMA IS A MOBILE PLATFORM DESIGNED SPECIFICALLY FOR FARMERS, AGRO-DEALERS, AND THE BROADER AGRICULTURAL COMMUNITY.

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Robotics

With our Robotics programs, your child will enjoy exciting projects that use 21st century skills.

Robotics for Kids

Age group	7 - 13 Years old
Language	English
Level	Primary education

http://creativity.rw/robotics

DIY basic robots

After this lesson, child will be able to:

- Define what a robot is
- Describe the main components of a robot
- Explain how engineers apply robotics to solve real-world problems
- Apply practical math, mechanical construction and critical thinking to make a simple robot

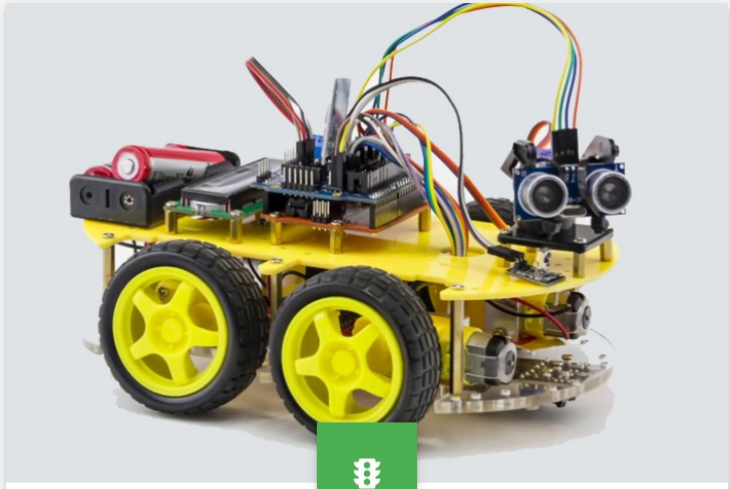
Age 9 - 13 Locked

Fischertechnik TXT Advanced

After this lesson, child will be able to:

- Describe common robot applications
- Identify the different parts of robot
- Do robots assembly and programming
- Use sensors to estimate a robot's condition and environment
- Make Soccer robot, Detection robot, Mobile robot, Camera man robot,...

Age 7 - 13 Locked



DIY programmable robots

After this lesson, child will be able to:

- Discover different categories of robots and how they interact with their surroundings
- Illustrate a robot's form based upon a specific set of function
- Program and operate a robot to address a challenge

Age 10 - 13 Locked

http://creativity.rw/robotics

Premature Deindustrialization

The deployment of AI in developed countries can have a severe negative impact on developing countries due to the phenomenon known as premature deindustrialization (Rodrik, 2016; UNCTAD, 2016)

Developing countries lose their competitive advantage in manufacturing due to the lower cost automation in developed countries

Developing countries miss out on the economic benefits that developed countries enjoyed as their workforces moved from low-value work to manufacturing before progressing to a post-industrial service economy

Premature Deindustrialization

Developing countries are increasingly likely not to have the opportunity for rapid economic growth by shifting workers from farms to factory jobs because

- Automation undermines the labor cost advantage
- Developments in robotics and additive manufacturing allow companies in advanced economies to locate production closer to domestic markets in automated factories

Ethical Imperatives

- AI can have a negative impact, intentionally or unintentionally, in many other ways
  - For example, by fomenting religious, ethnic, social, and political divisions through fake misinformation created by deep networks (Besaw and Filitz, 2019)
- Ethical imperatives
  - Eliminate bias of all types, including gender and racial bias
  - Foster trust
  - Safeguard privacy
  - Guarantee confidentiality
  - Maximize explainability

Gender and Racial Bias

- The data that are used to train the AI models can be biased
- Thereby resulting in discrimination against people on the basis of gender or race
- Examples of bias against dark-skinned people include
  - Face analysis (Buolamwini and Gebru, 2018)
  - Pedestrian detection (Wilson et al., 2019)
  - Predicting recidivism (Larson et al., 2016)

The tendency of a convicted criminal to reoffend

- AIML02 Social, Ethical, Legal, and Economic Impact of AI & ML covers these issues in more detail

Democratization in AI

- Open access to AI technology by developers everywhere
  - In both developing and developed countries
- Training deep neural networks requires access to large expensive computational resources
  - May be out of reach of some
- Training also requires very large data sets
  - These may not be available

Democratization in AI

- Using machine learning to make the web available in local African languages
  - Progress is being inhibited for so-called “low- resourced” languages
  - Because of the lack of sufficient training data (Nekoto et al., 2020)

Languages for which few digital or computational data resources exist

- This is a problem with almost all applications of machine learning in developing countries: the lack of data

Lecture Summary

1. AI has the potential to improve significantly the lives of people in Africa

2. AI can be applied in many different sectors, from agriculture, to education, to healthcare

3. The adoption of AI in developed countries can make it difficult (but not impossible) for developing countries to make the transition to an industrialized economy

4. We need to be aware of the dangers of inappropriate use of AI, for example to generate fake misinformation

5. We need to ensure that the training sets for machine learning do not have any bias, such as racial bias or gender bias

Recommended Reading

Delmus Alupo C, Omeiza D, Vernon D (in press) Realizing the potential of AI in Africa. In: Ferreira MIA (ed) Towards Trustworthy Artificial Intelligence Systems, Springer.
http://vernon.eu/publications/2023_Alupo_et_al.pdf

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https://cpr.unu.edu/ai-in-africa-is-a- doubleedged-sword.html

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https://proceedings.mlr.press/v81/buolamwini18a/buolamwini18a.pdf

Larson J, Mattu S, Kirchner L, Angwin J (2016) How we analyzed the COMPAS recidivism algorithm. ProPublica (5 2016) 9(1).
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https://aclanthology.org/2020.findings-emnlp.195.pdf

Novitske L (2018) The AI invasion is coming to Africa (and it's a good thing). Stanford Social Innovation Review
https://ssir.org/articles/entry/the_ai_invasion_is_coming_to_africa_and_its_a_good_thing#

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https://oecd.ai/dashboards

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UNCTAD (2016) Robots and industrialization in developing countries. Tech. Rep. United Nations Conference on Trade and Development (UNCTAD).
https://unctad.org/en/PublicationsLibrary/presspb2016d6_en.pdf

Wilson B, Hoffman J, Morgenstern J (2019) Predictive inequity in object detection. arXiv preprint arXiv:190211097
https://arxiv.org/pdf/1902.11097.pdf