UNIVERSITÉ MOULAY ISMAÏL
جامعة مولاي إسماعيل

كلية العلوم والتقنيات
FACULTÉ DES SCIENCES ET TECHNIQUES

Precision Agriculture in Morocco
CHALLENGES AND PERSPECTIVES

HESSANE Abdelaaziz[1], EL YOUSSEFI Ahmed[2],
FARHAOUI Yousef[3], AGHOUTANE Badraddine[4]

[1,2,3] STI Laboratory, IDM, T-IDMS Faculty of Sciences and
Techniques, Moulay Ismail University

[4] IA Laboratory, Department of Computer Science,
Faculty of Sciences, Moulay Ismail University

May 27th, 2021   FST Errachidia (Morocco)

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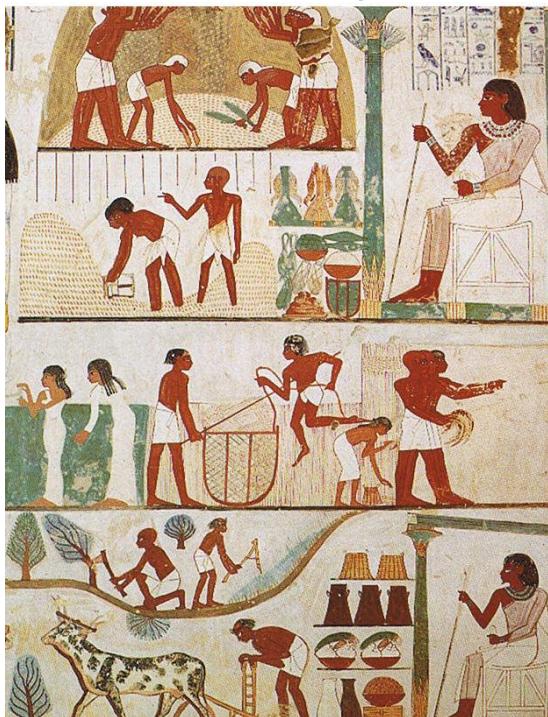
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- Definition

- PA Technologies

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Motivation

15th century BC.

21th century

DIFFERENT Tools, SAME Objectives

Norman de Garis Davies, Nina Davies (2-dimensional 1 to 1 Copy of an 15th century BC Picture) - Matthias Seidel, Abdel Ghaffar Shedid: Das Grab des Nacht. Kunst und Geschichte eines Beamtengrabes der 18. Dynastie in Theben-West, von Zabern, Mainz 1991 ISBN 3805313322

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Motivations

WORLD POPULATION
is expected to reach

9.7 billion in 2050

Source : United Nations Official website

52%

WORLD POPULATION
To be affected by

Water STRESS
by 2050

Source : waterfootprint.org

- **Maximize Food Production**
- **Minimize Environmental Damage**
- **Increase Productivity**
- **Reduce Costs**

www.farmmanagement.pro/4-reasons-to-create-a-precision-agriculture-strategy

Precision Agriculture

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Definition

"Precision farming is generally defined as doing the **right practice** at the **right location** and **time** at the **right intensity**"

(Mulla and Khosla 2016)

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Definition

RIGHT PRACTICE

What crop to cultivate ?
What fertilizers/Pesticides to use ?

RIGHT LOCATION

What land for a specific crop ?
Where to apply fertilizers/pesticides

RIGHT TIME

When to harvest?
When to irrigate ?
When to use fertilizers/pesticides ?

RIGHT INTENSITY
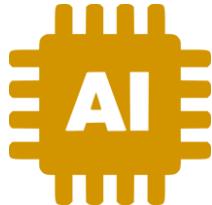
How much fertilizers/pesticides we need for a specific area ?

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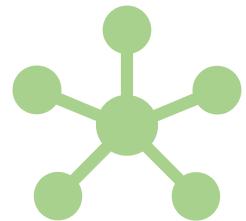
PA Technologies

Internet of things (IoT)

Wireless Sensors Networks (WSNs)

Precision Agriculture

Machine learning (ML)

Unmanned Aerial Vehicles (UAV)

(Bhakta et al. 2019)

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PA Technologies

- Internet of things (IoT)

  The Internet of Things (IoT) is a network of interconnected intelligent devices that can communicate with one another and generate relevant data about the environment in which they operate.

  (Madakam et al. 2015)

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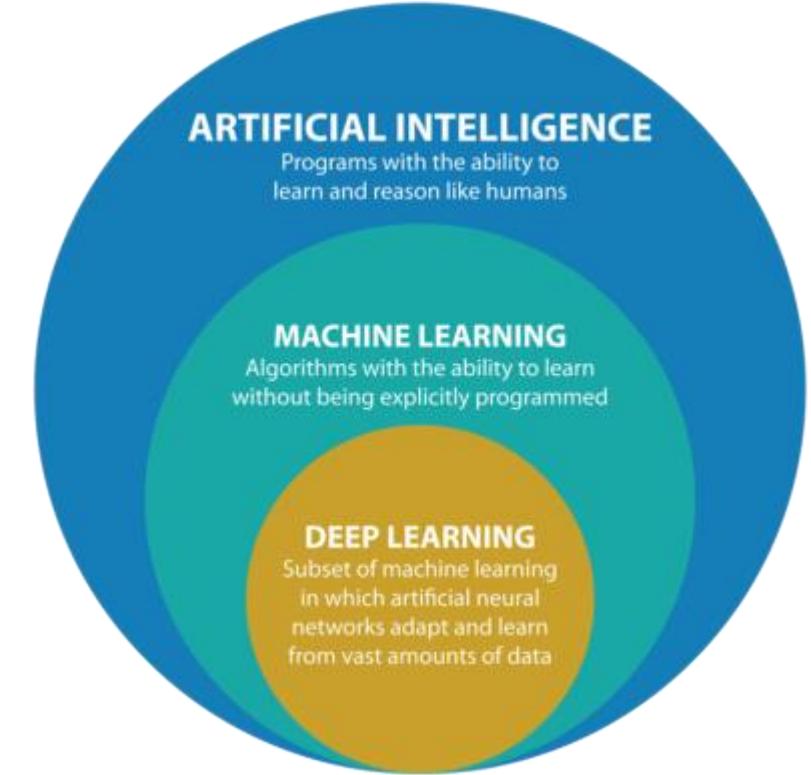
PA Technologies

- Machine learning

Machine learning (ML) is a scientific area that enables machines to learn without being explicitly programmed.

(Samuel, 1959)

ARTIFICIAL INTELLIGENCE
Programs with the ability to learn and reason like humans

MACHINE LEARNING
Algorithms with the ability to learn without being explicitly programmed

DEEP LEARNING
Subset of machine learning in which artificial neural networks adapt and learn from vast amounts of data

Source : www.qubole.com/blog/deep-learning-the-latest-trend-in-ai-and-ml/

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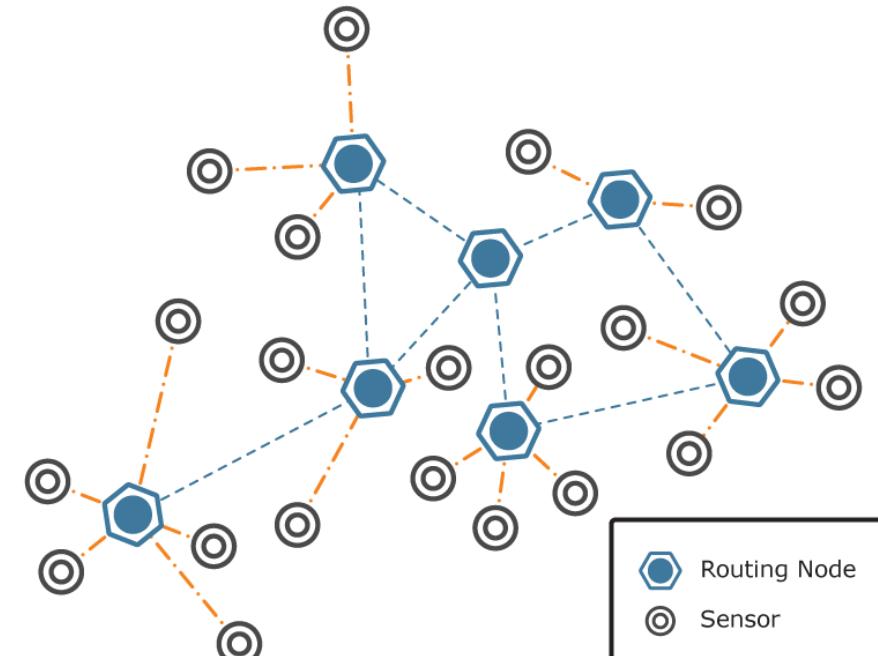
PA Technologies

- Wireless Sensor Networks

WSNs are networks that are made up of sensor nodes. These sensor nodes assist in sensing, collecting, and measuring data from the environment in which they are installed, as well as transmitting the data to users.

(Thakur1 et al. 2019)


Source : www.technosinc.files.wordpress.com

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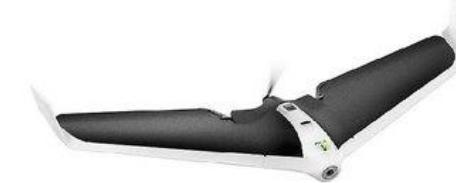
- ## Unmanned Areal Vehicles

UAV-based IoT technology is considered as the future of remote sensing in Precision Agriculture. UAVs' ability to fly at a low altitude results in ultra-high spatial resolution images of the crops (i.e., a few centimeters).

(Tsouros et al. 2019)

Multirotor Drone
(a)

The Parrot Disco
(b)

Yamaha RMA X
(c)

Source : Finding Security Vulnerabilities in Unmanned Aerial Vehicles Using Software Verification - Mustafa A. Mustafa
www.researchgate.net/profile/Mustafa-A-Mustafa/publication/334082182/figure/fig1/

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PA Applications

Chemical control
(e.g., pesticides and fertilizers).

Crop monitoring

Disease prevention

Irrigation control

Soil management

Vehicles and machinery control

(Navarro et al. 2020)

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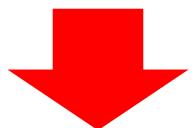
PA in Morocco - Status

- Actual level is "Presence" (No adoption YET!).

- Soil testing is limitedly adopted by farmers.

- Because of water scarcity, Precision Irrigation (Also known as smart irrigation) has known particular expansion in Morocco.

- Sensing-based assessment of soil properties, Crop Monitoring and Grazing behavior analysis are recently introduced by limited farmers because of its very high Cost..

(Bouabid et al. 2020), (Chebli et al – 2020)

Embryonic stage

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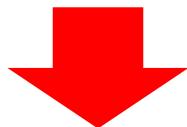
PA in Morocco - Challenges

- Lack of awareness and information;

- Farm structure (**65%** are smallholder farmers);

- Level of farmer's education;

- High Cost of equipment & of PA services;

- Constraints on the use of flying objects (drones);

- Lack of well-trained personnel;

- Limited government support.

(Bouabid et al. 2020), (Jabir et Falih - 2020)

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PA in Morocco – Prospects & Future

Soft PA
For small farms

HARD PA
For Medium and large commercial farms

- Simple soil and crop tests
- Free available remote sensing information
- low-cost tools and low cost adapted equipment for GNSS and VRA
- Easy-to-use smartphone apps and DSS;

- Soil fertility mapping
- Remote sensing (free or via service provider)
- Yield monitoring system,
- GNSS and VRA equipment,
- Advanced smartphone apps and DSS

(Bouabid et al. 2020)

GNSS : Global Navigation Satellite System
VRA : Variable Rate Application
DSS : Decision Support Systems

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