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WAIT4: un projet collaboratif sur l'évaluation en dynamique du bien-être des animaux d'élevage - de la captation de la donnée à la découverte de motifs significants et de seuils d'alertes spécifiques

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➤ **WAIT4: un projet collaboratif sur l'évaluation en dynamique du bien-être des animaux d'élevage – de la captation de la donnée à la découverte de motifs signifiants et de seuils d'alertes spécifiques**

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WAIT4: Welfare: Artificial Intelligence and new Technologies for Tracking key indicator Traits in animals facing challenges of the agroecological Transition



Flagship project in the PEPR Agroecology and ICT (oct 2022 – oct 2027)



Agroecological (AE) transition of livestock systems

Positive effects ?

(more freedoms, socialization, self-medication,...)



Dynamic phenotype

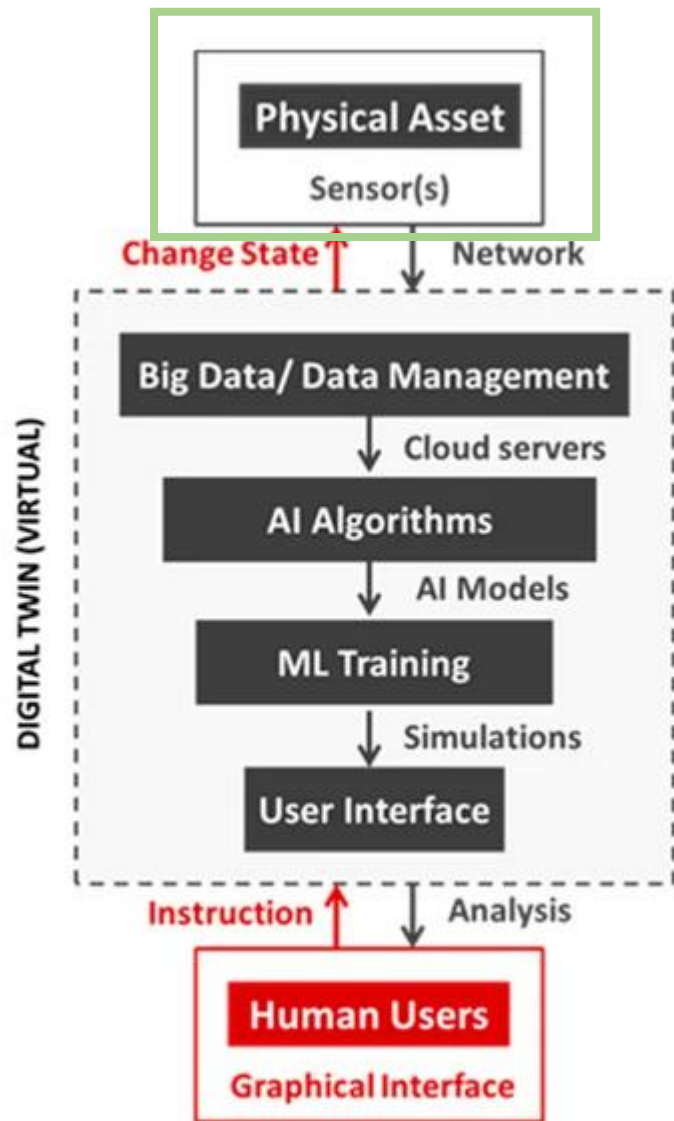
Negative effects ?

(climate hazards, heat stress, feeds, pathogens,...)

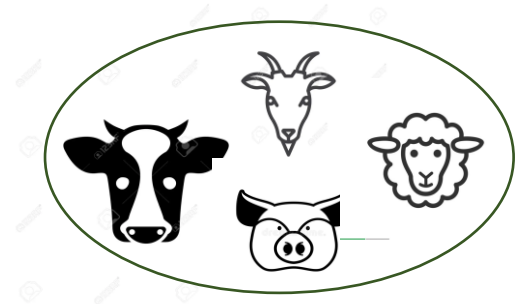
Global warming

Objectives of the WAIT4 project:

- ☑ Real-time analysis of AW indicators under different environments (indoor, outdoor, grazing, loose, organic farming) and climates (continental, harsh, tropical), in response to AE practices
- ☑ Defining early alerts for deteriorated AW and evaluation of improved welfare



1. Testing/developing tools to send and receive continuously-transmitted data



Mental state
(How the animal perceives the environment)

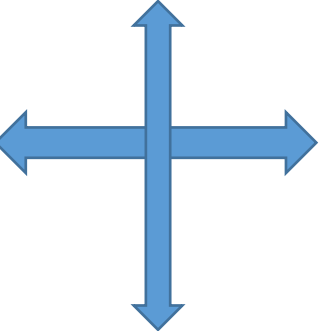
Positive/negative emotions
⇒ Sounds/calls (audio)
⇒ Cameras

Physiology

Homeostasis
Stressors
⇒ Thermal probes
⇒ Chemical sensors
⇒ Fluids (milk)

Behavior

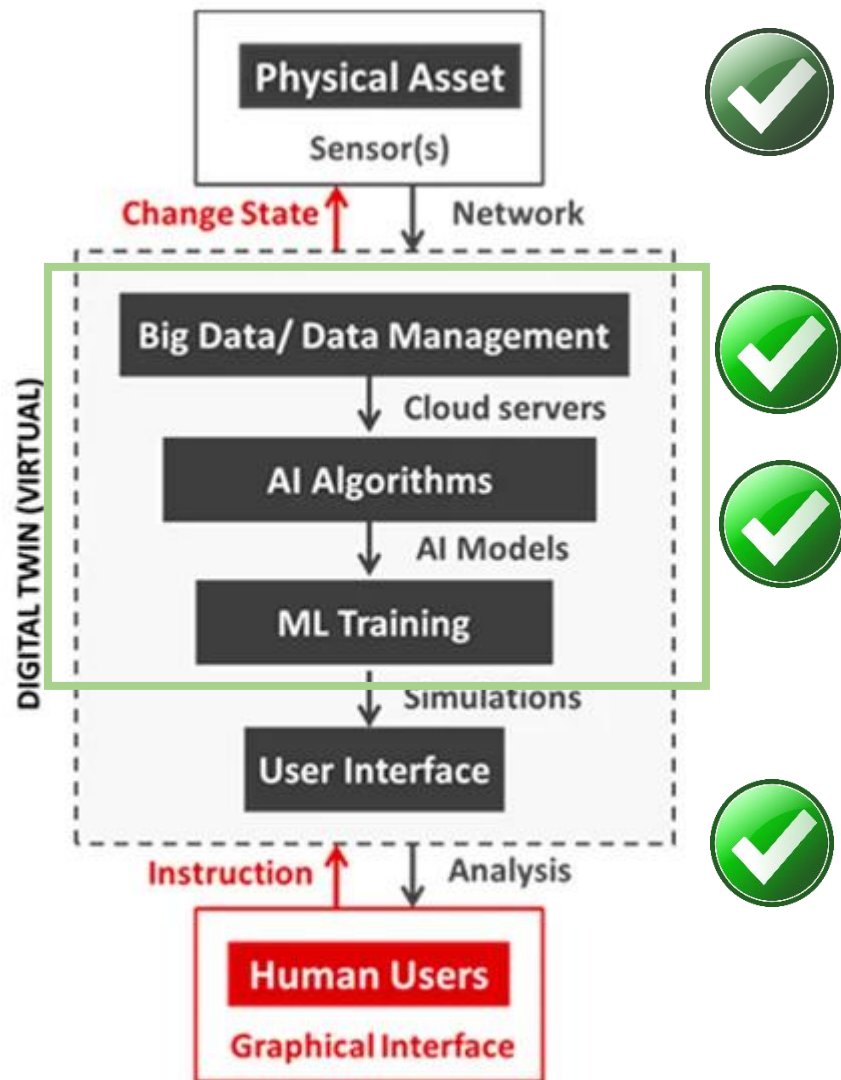
Positions
Activities
Relations
⇒ Accelerometers, GPS
⇒ Thermal imaging
⇒ Videos



Animal choices

⇒ Automates (drinking, feeding)
⇒ Social interactions
⇒ Shadow sensors

Digital twins in Livestock farming,
Neethirajan et al. 2021. *Animals*
(Basel). 1(4):1008.
doi: 10.3390/ani11041008.



2. Store, process and extract information

3. Using algorithms to suggest recommendations

Coupling massive heterogeneous information (symbolic + numerical data; different times)

- ⇒ **Holistic view**
- ⇒ **Deviations from baseline**

AI to identify new patterns

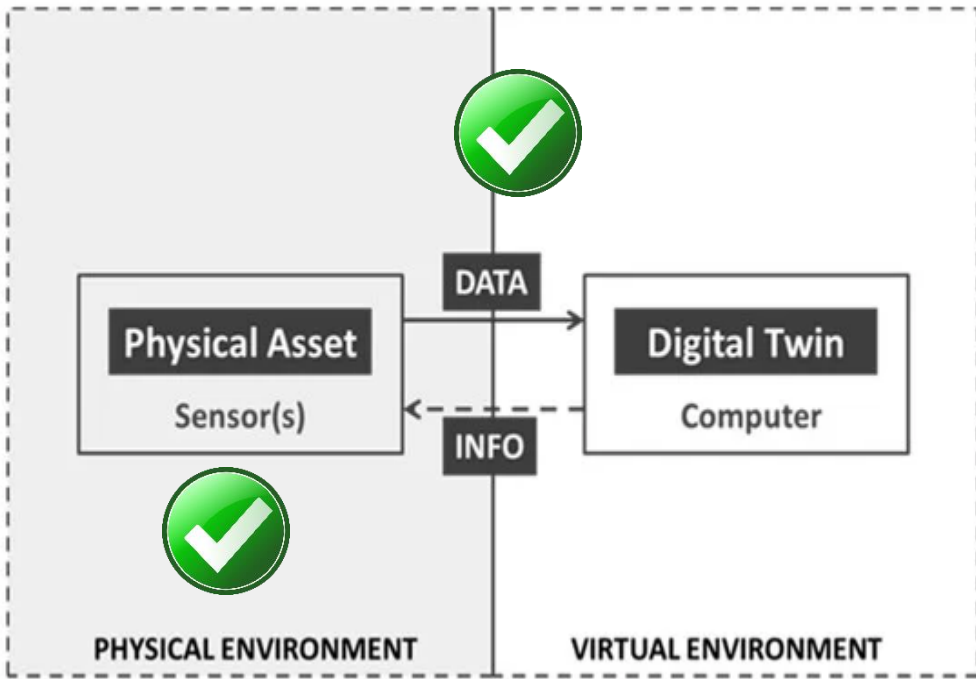
- ⇒ **Iceberg signals of AW**
- ⇒ **Thresholds : warning signals**
- ⇒ **Predictive responses**

- Time series
- Machine Learning and Deep Learning
- Graph modeling
- Interactive model mining
- Pattern mining

Model selection techniques

Hybrid models

WAIT4 is an exploratory project using stored data (and not data transmitted in real-time) to develop and train the algorithms



The retro-action loop in real time is not in the immediate ambition of the WAIT4 project, which primarily addresses:

- ☑ What are the relevant frequencies to assess AW traits ?
=> More frugal sensors can be then developed
- ☑ What are the relative importance between AW traits ?
=> Accentuate the phenotyping efforts on some traits
- ☑ Give messages to stakeholders that are objectified by scientific bases to recommend AE practices
=> Define thresholds for animal resistance
- ☑ Encourage the change of paradigm in AW
=> From obligation of means to obligation of results*

X 4. Interactive digital user interface to apply the learning to improve the performance of the physical asset is not available in real-time

- *1. Algorithms will analyze the data and define alerts (for health and welfare)
- *2. Feedback will be obtained to anticipate the responses of the animals when facing challenges (heat stress, water or feed restriction, improved AE practices ..)
=> Part of a digital twin ...