

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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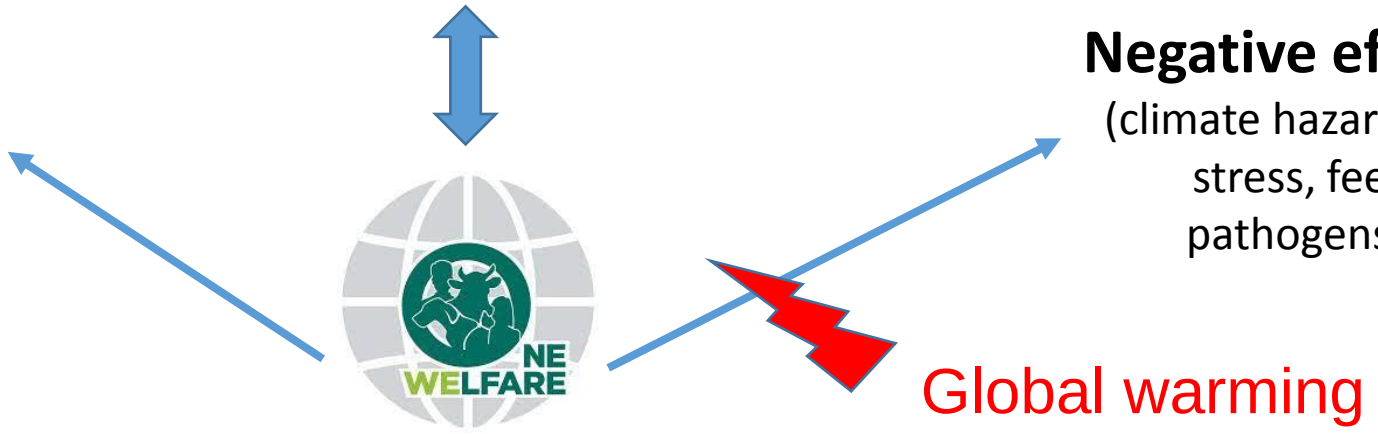
WAIT4: ***W****elfare:* ***A****rtificial* ***I****ntelligence and new* ***T****echnologies for* ***T****racking key indicator* ***T****raits in animals facing challenges of the agroecological* ***T****ransition*

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,…)

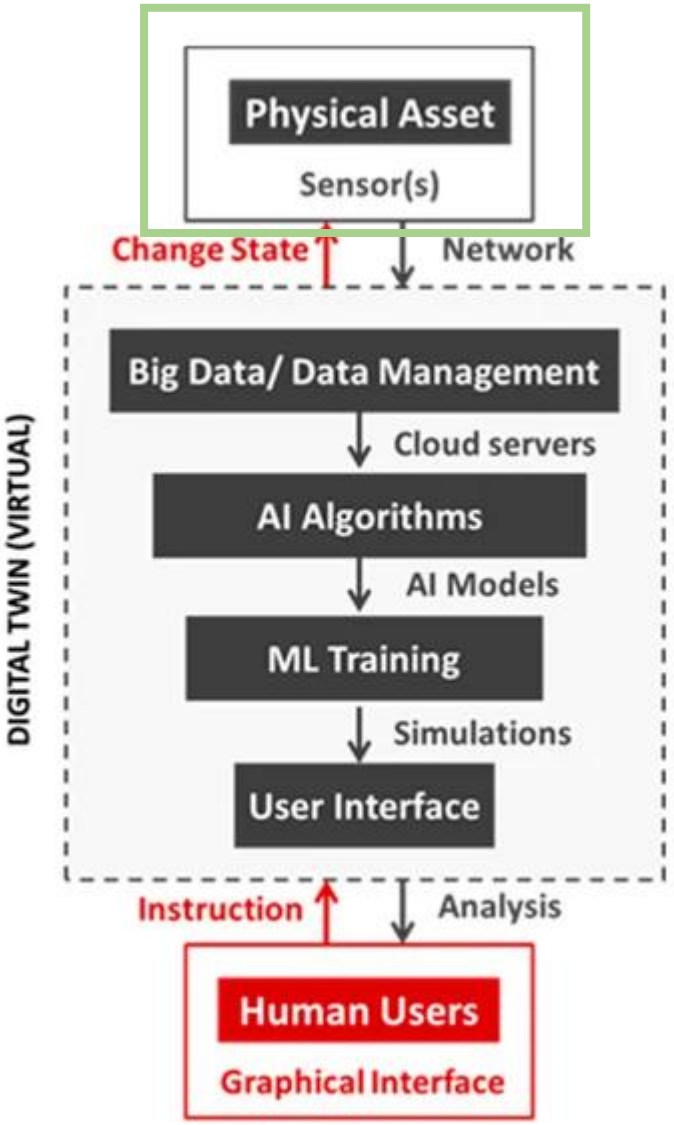
Negative effects ?
(climate hazards, heat stress, feeds, pathogens,…)



Dynamic phenotype

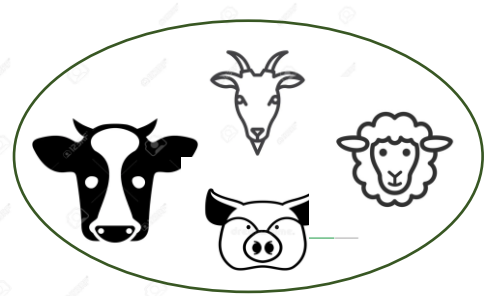
Objectives of the WAIT4 project:

- ☑ 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



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

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

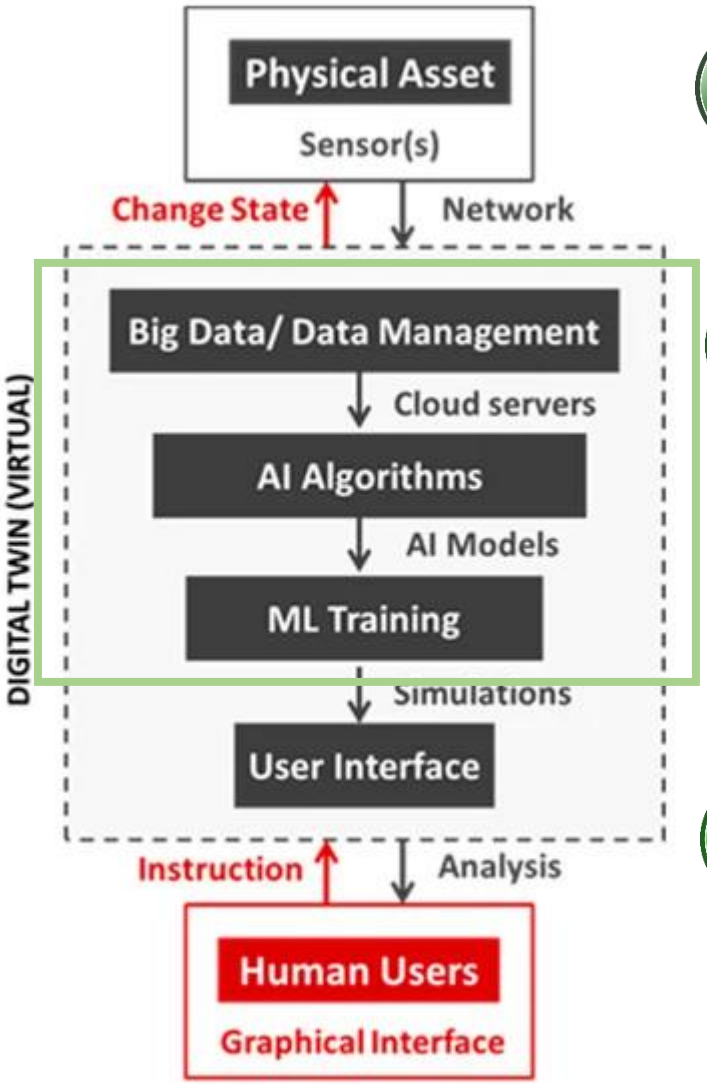
Homeostasis
Stressors
⇒ Thermal probes
⇒ Chemical sensors
⇒ *Fluids (milk)*

Behavior

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

Animal choices

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



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**

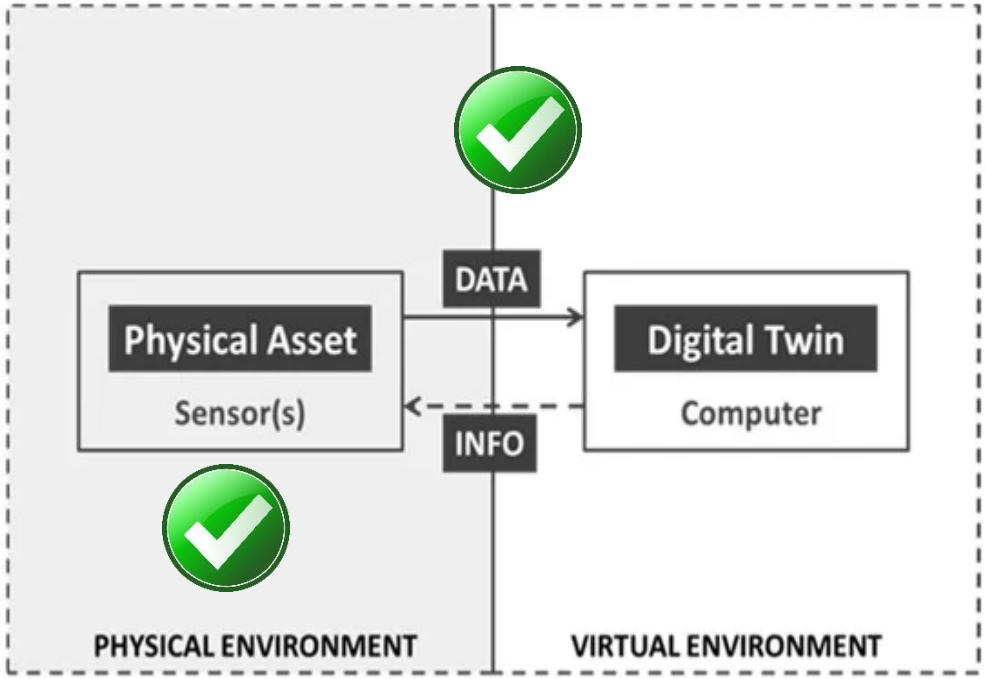
⇒ **Thresholds : warning signals**

⇒ **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*

✗ 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 …