

**4th International Workshop on
Cognition: Interdisciplinary Foundations, Models and Applications
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Markov Blankets for sustainability

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MARIA RAFFA

PhD Student IULM – Milan
maria.raffa@studenti.iulm.it



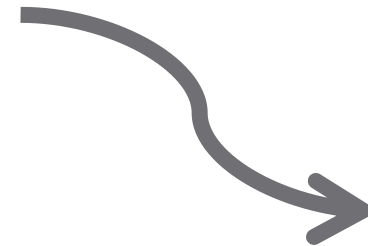
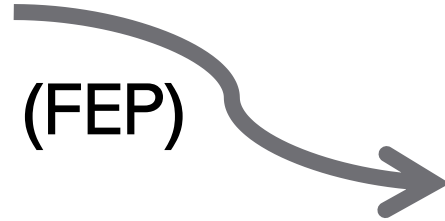
Markov Blankets (MB)

Free Energy Principle (FEP)

Active Inference

AI

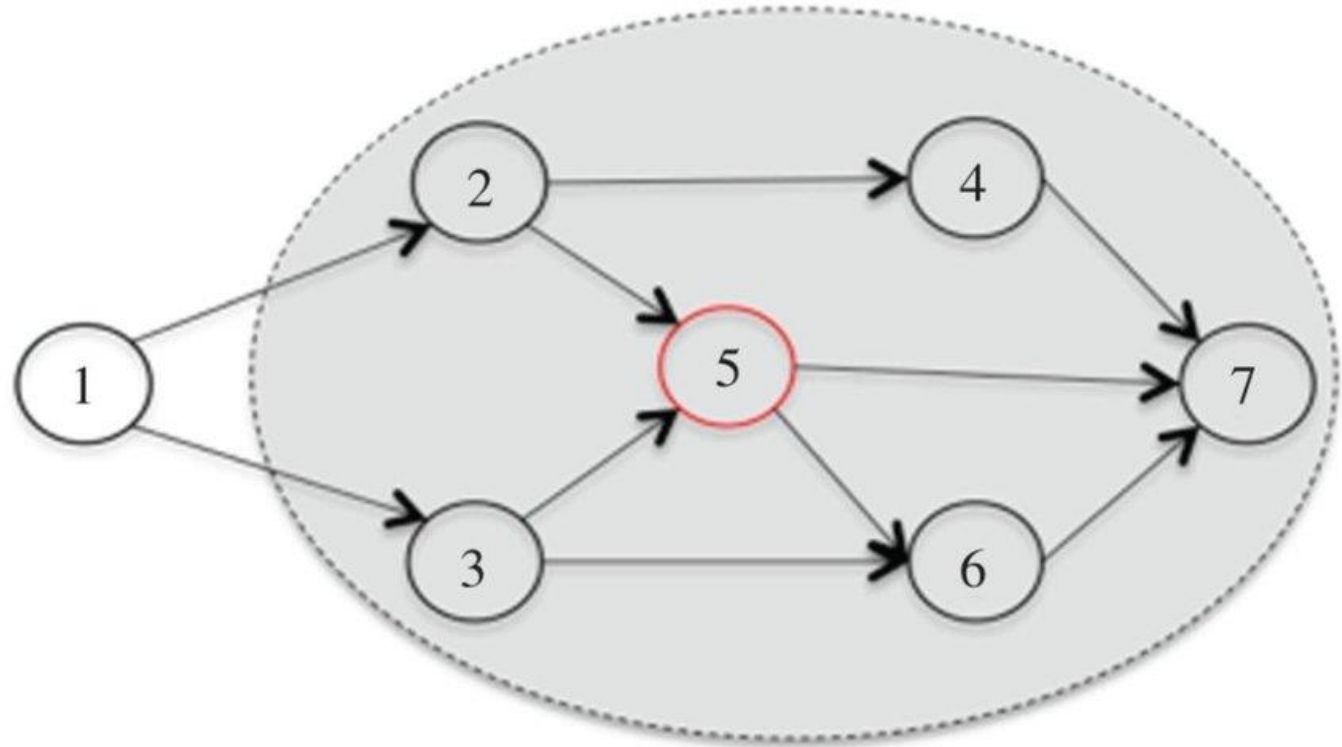
Sustainability



Statistics

Judea Pearl

«the Markov blanket of a variable X is the set consisting of the parents of X , the children of X , and the variables sharing a child with X » (1988)



The MB of a random variable is the only knowledge one may need to predict the behavior of that variable.

Philosophy of cognition

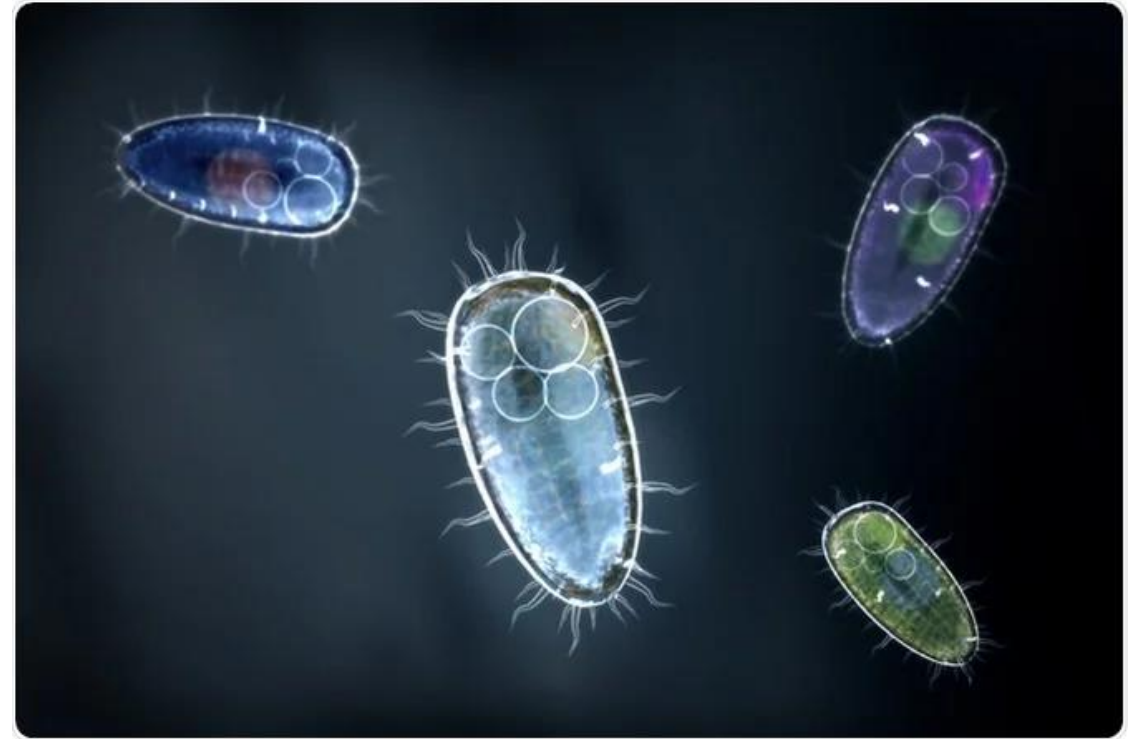
Karl Friston (2003)

MB as

- tool to draw conditional independence between a dynamical system and its environment
- real boundaries of living systems

Criticisms:

Jelle Bruineberg «reification fallacy» (2021)



Free Energy Principle (FEP)

Agents that exist do so because they can persist, maintaining their equilibrium through free energy minimization.



Active Inference

Change of status and suppression of prediction errors known history of the interactions with the environment.

«Feeling our way in darkness: we anticipate what we might touch next and then try to confirm those expectations» (Friston, 2013)

Thermodynamics

$$F = E - TS$$



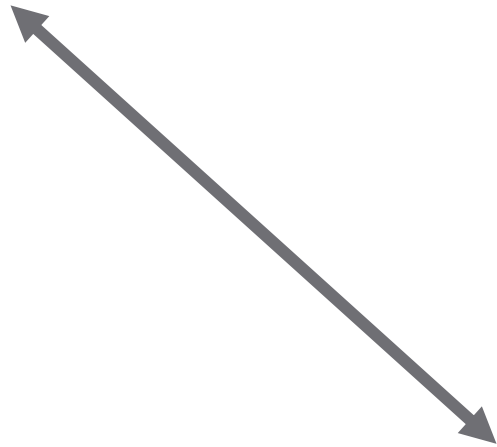
Social systems



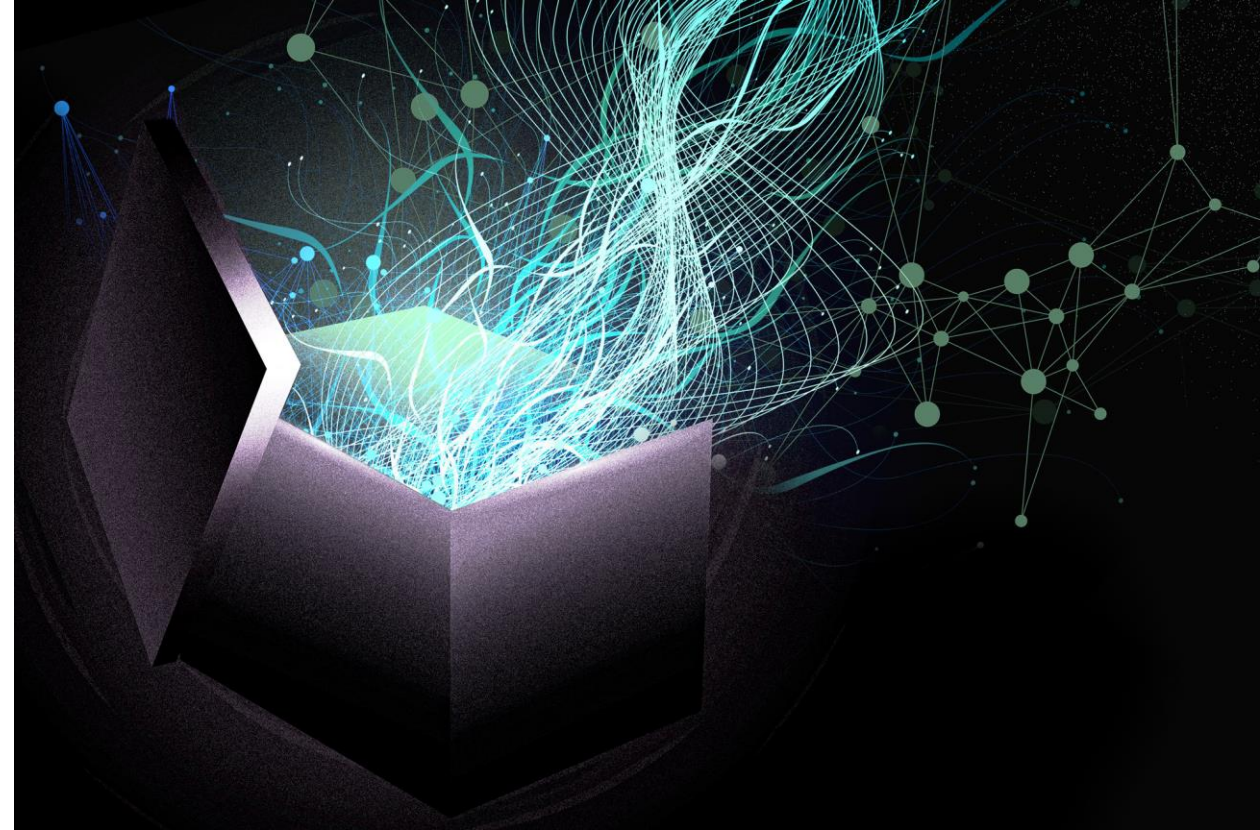
Jing Chen, 2009

AI

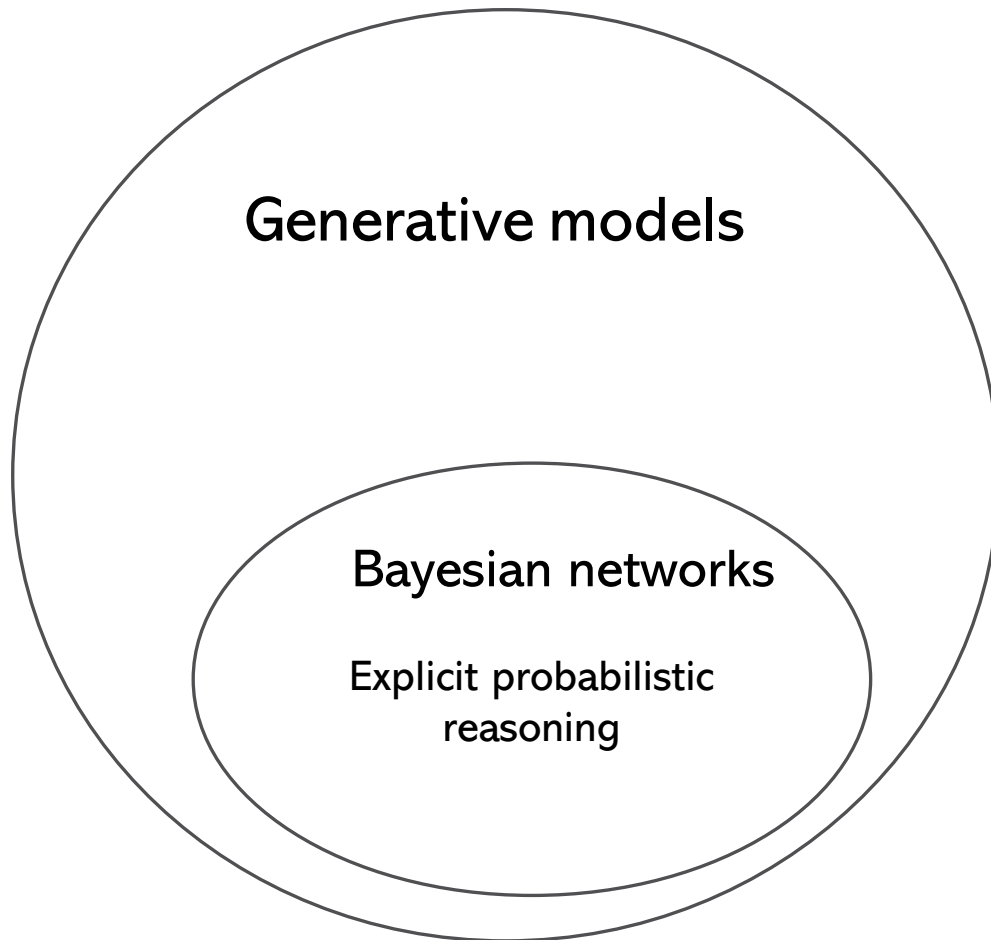
Neural models based on
feedforward architectures



Black box

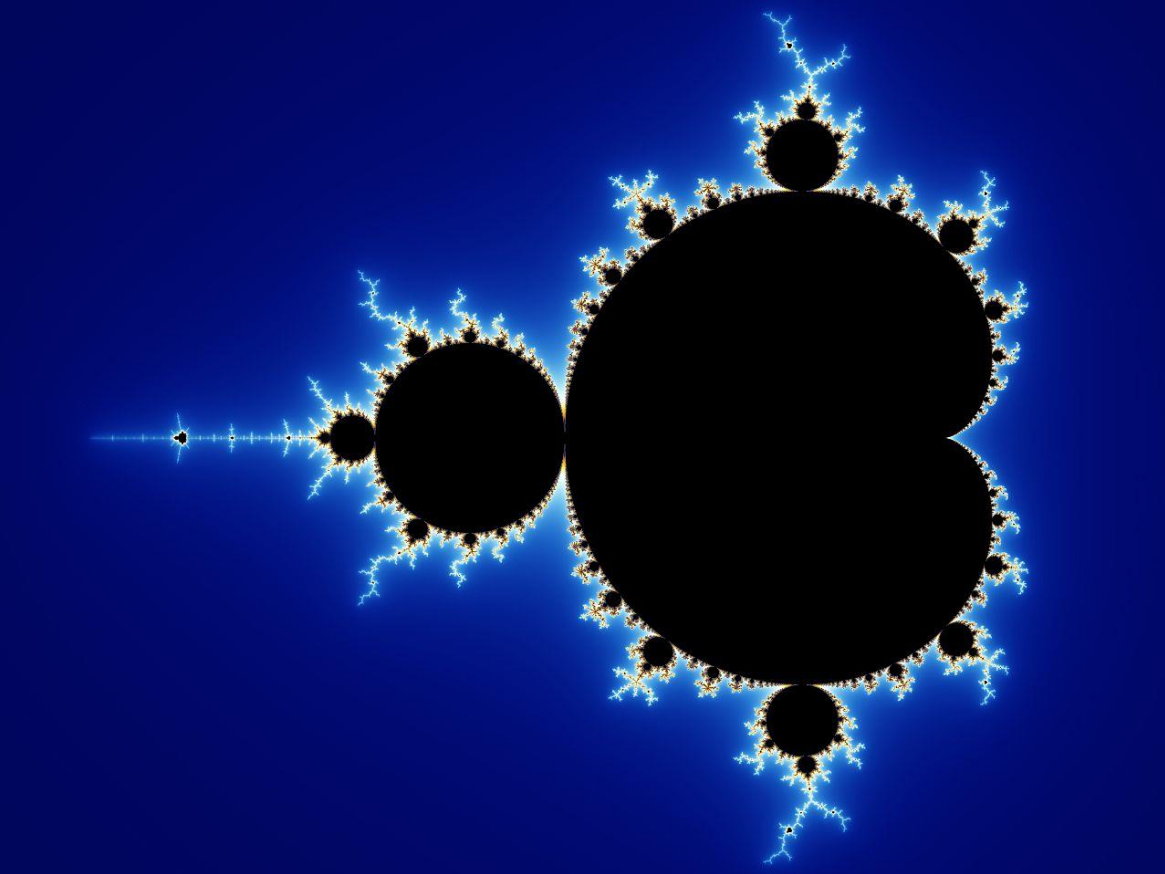


LeCun et al., 2015



- More reliable in terms of explainability
- Minimization through errors: learning from small quantities of data and generalization to new situations

Derks & de Waal, 2020



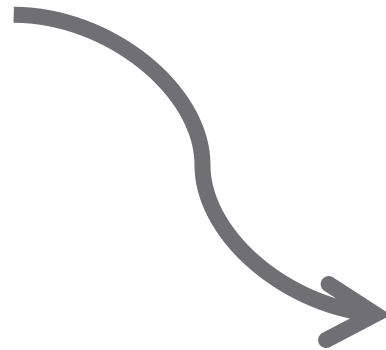
Generative Models

- Image generation
- Text prediction
- Video modeling
- Predicting system dynamics

Generative Models on MBs

- Robotics

Active inference



Active vision



Toon Van De Maele, 2021

Sustainable employment

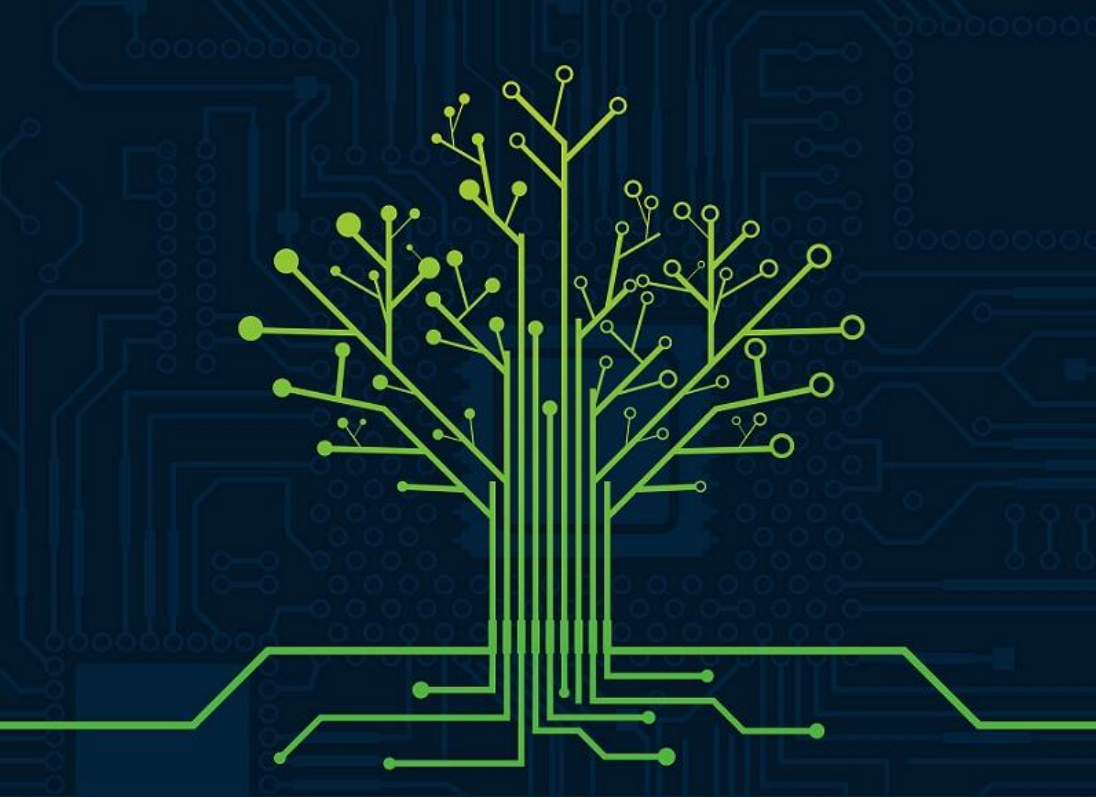
General uses of AI for Sustainable Development Goals (SDGs), United Nations Agenda 2030



A. Alsharkawi, 2021



V. Pedemonte, 2020



Bayesian network-based algorithms for sustainability

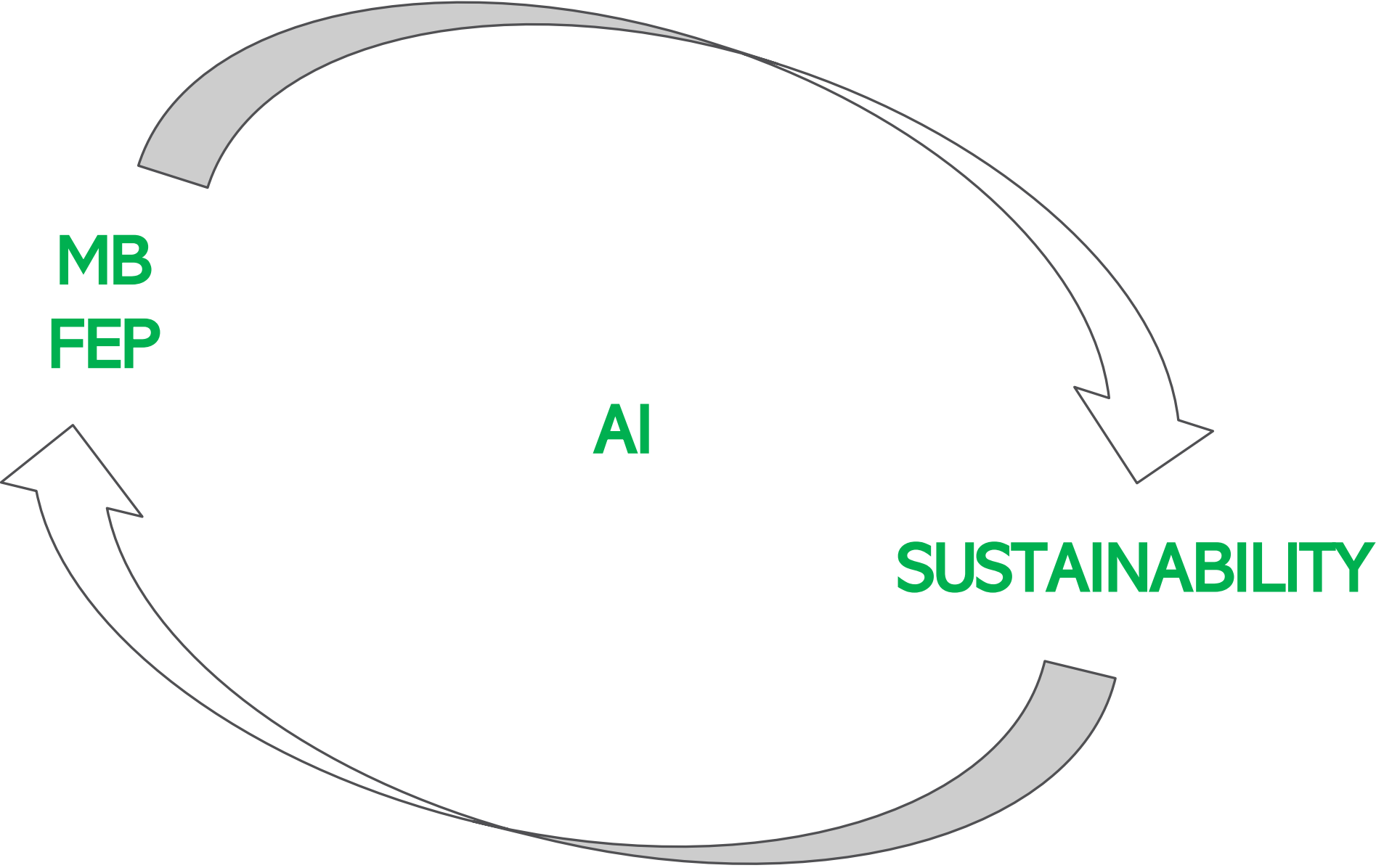
- Decision-making processes
- Handling data from different sources

MB models to measure
how an AI is sustainable

Juhwan Kim, 2018

MB based AI to address SDGs

David Requejo-Castro, 2021



Next steps

(Thanks to my reviewers)

- Better framing issues related to ontological aspects of Friston's MB
- Cons of Bayesian networks for AI
- Why are they better than other AI model for these specific purposes?
Maybe they could address some sub-problems of sustainability?

Thanks for your attention!

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