

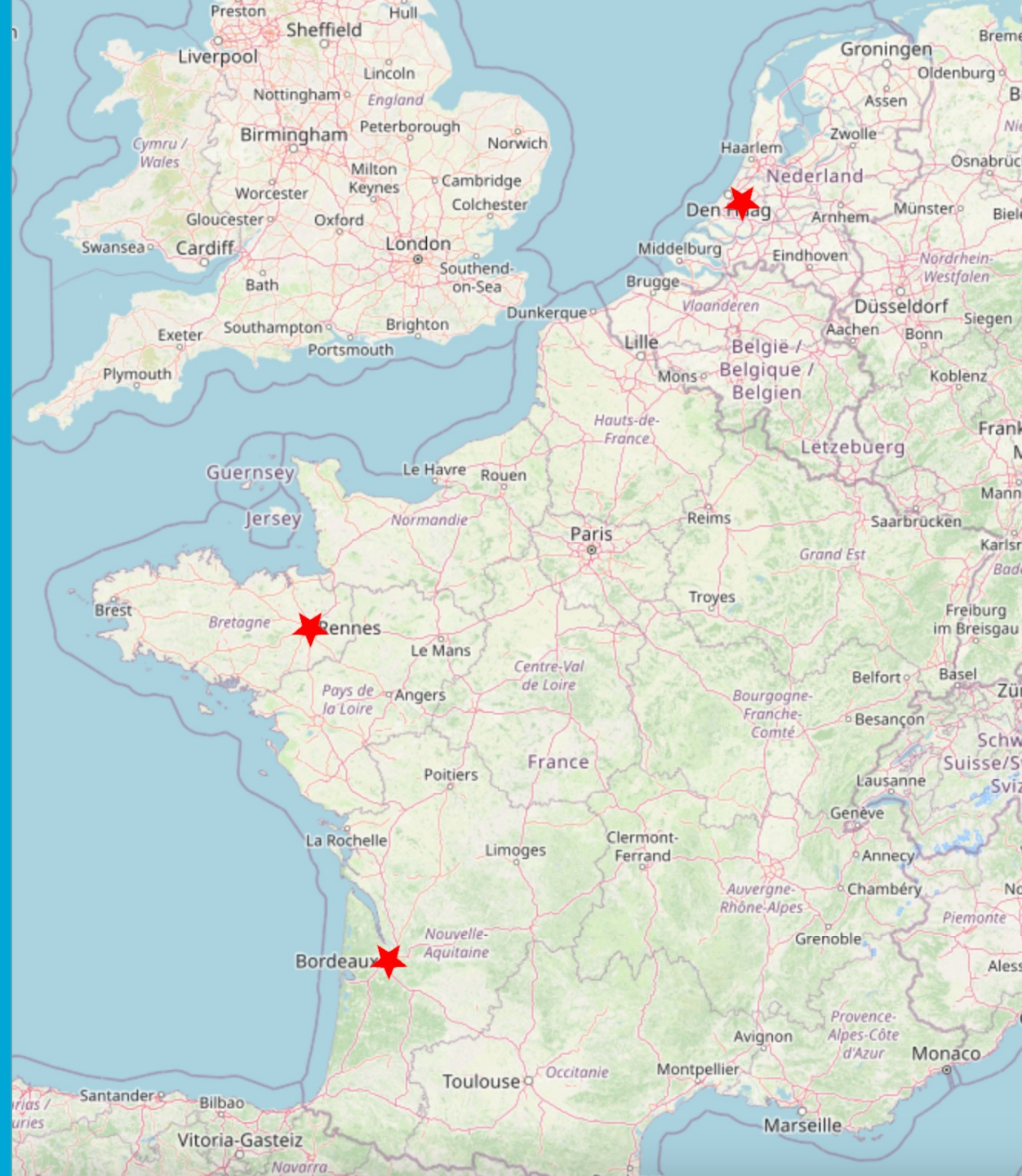
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Green AI: Thinking first before using Artificial Intelligence

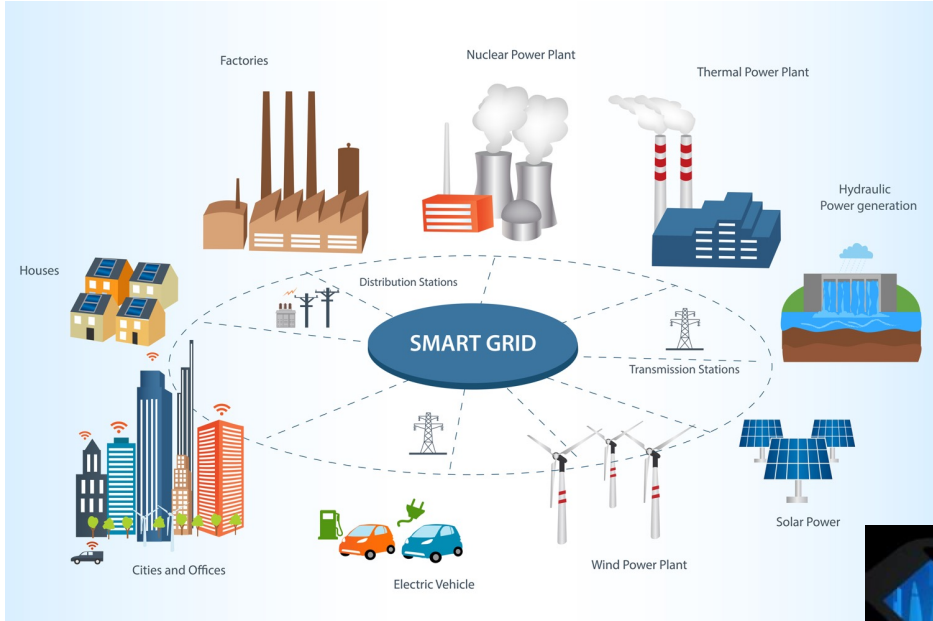
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My Background

- MEng in Agronomy / Environmental Science
- MSc in Software Engineering
- PhD in Software Engineering
- Postdoc in (Sustainable) Software Engineering
 - TU Delft, SERG



AI: A key enabler of new possibilities



At what cost?

- **284,019 kg of CO₂e** for training **1** NLP model [Strubell et al. 2019]
 - 5x lifetime emissions of a car
- AI training computations: up by 300000x for 2012-2018 [Amodei and Hernandez 2019]

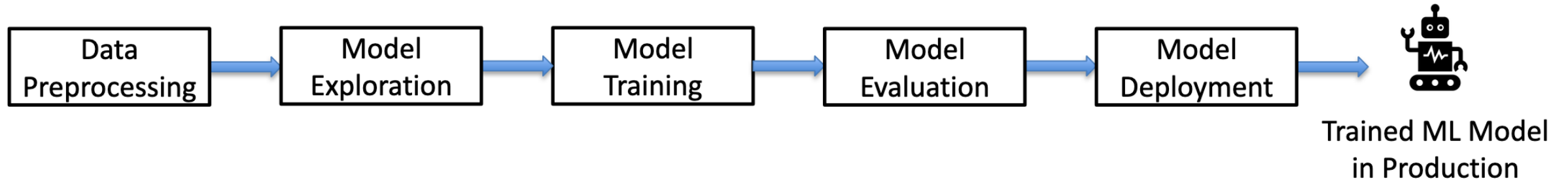


[Duranton 2023]

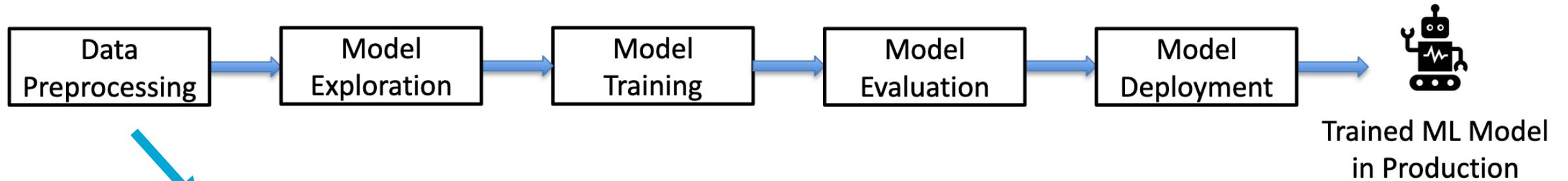
What can be done?

- energy efficiencies in ICT can reduce ICT's carbon footprint [Malmodin et al. 2018, Masanet et al. 2020, Freitag et al. 2021]
- **Green AI** [Schwartz et al. 2019]
 - increasing efficiencies of AI computations > accurate AI computations without consideration of resource costs or efficiencies
- “**Green AI** regards practices aimed at utilizing AI to mitigate the impact that humans have on the natural environment in terms of natural resources utilized, and/or **mitigating the impact that AI itself can have on the natural environment.**” [Verdecchia et al 2023]

What can be done?



What can be done?



Data-Centric Green AI An Exploratory Empirical Study

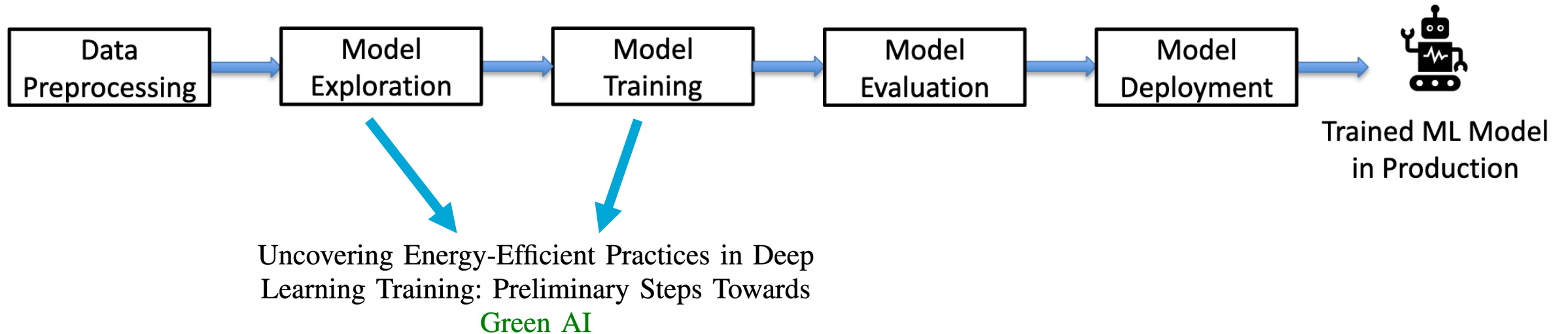
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What can be done?

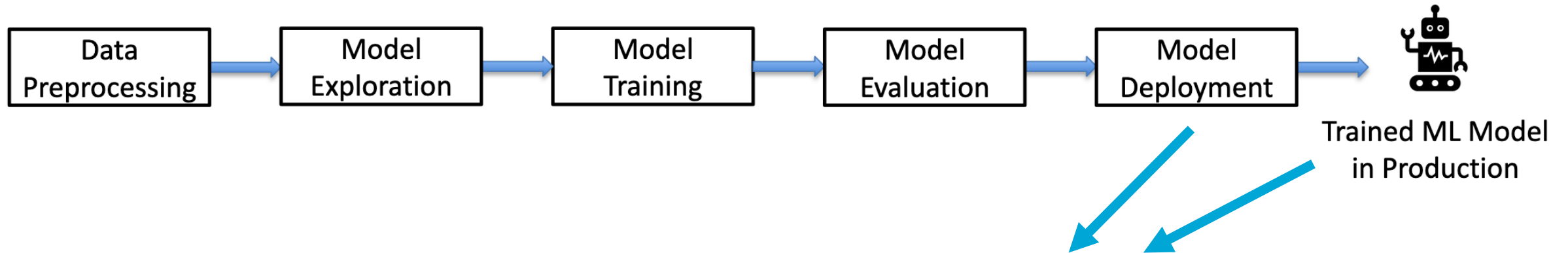


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What can be done?



Retrain AI Systems Responsibly! Use Sustainable
Concept Drift Adaptation Techniques

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Is it enough?

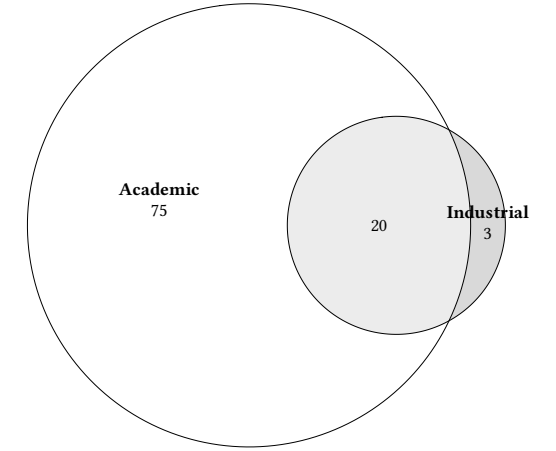
Rebound Effect!!!



Decreasing the energy consumption can lead to increasing the overall usage

Is it enough?

- Transfer research knowledge and findings to practices in industry
- Regulations ?
 - Can we forbid some AI applications?



[Verdecchia 2023]

Conclusion

- Reducing the environmental impact of AI is possible
 - Can be quite simple and with great results!
 - Across the AI pipeline
- Ensuring to tackle rebound effects
- Regulating the use cases of AI?
 - Other dimensions of sustainability
- Smart usage of (Green) AI : Thinking first before using it!

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Thank you for your attention

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