Renault Group

AI at Renault

RENCONTRE ROBONUMERIQUE
ST QUENTIN
NOVEMBER 2024

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Introduction

What is Artificial Intelligence ?

RG

AI is another way to use computers

Implementation of reasoning (and not just computing) on computers

Specific Technics

- Symbolic AI (rule based)
- Connectionist AI (data based)

Principles as old as computers

- Need of computing power : thanks to the Moore's law
- Need of data: thanks to Internet

Unreachable applications without AI

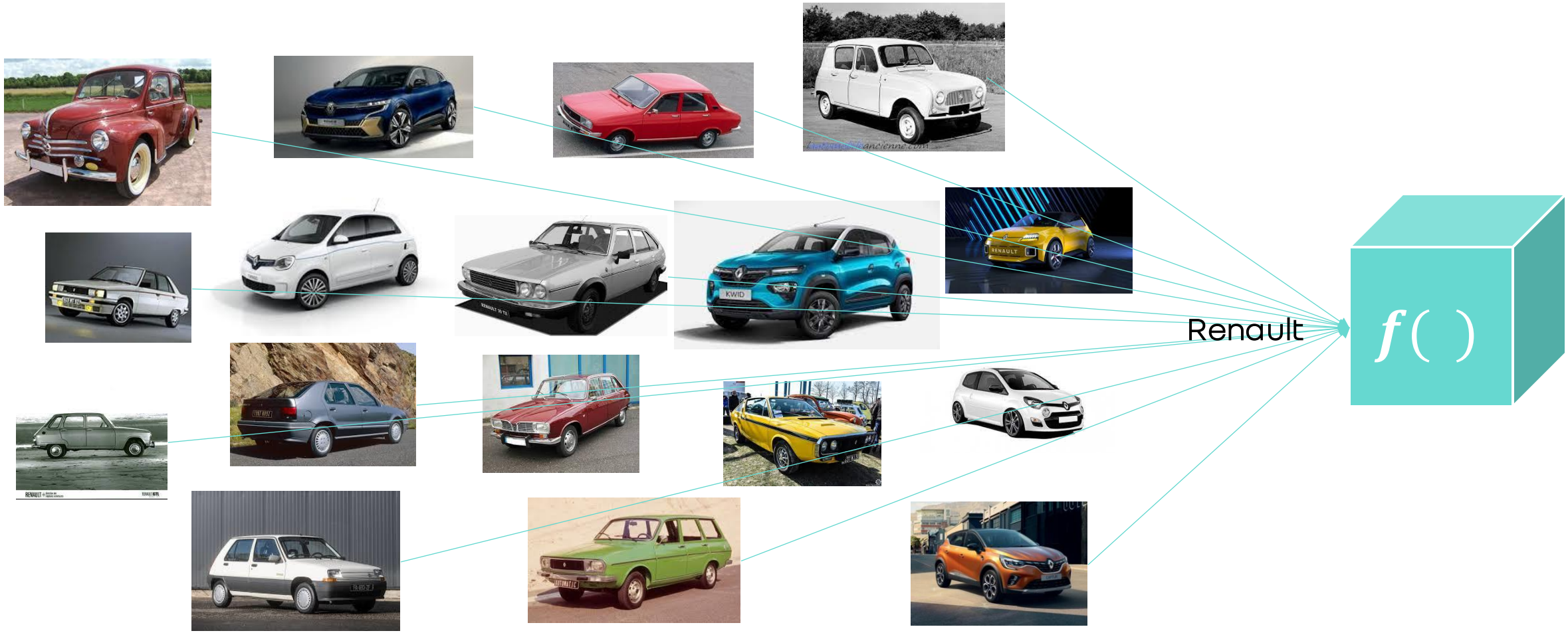
- Combinatorial explosion
- Computer vision
- Natural language processing

A powerful tool to solve well-posed problems without algorithmic solution

Connectionist AI

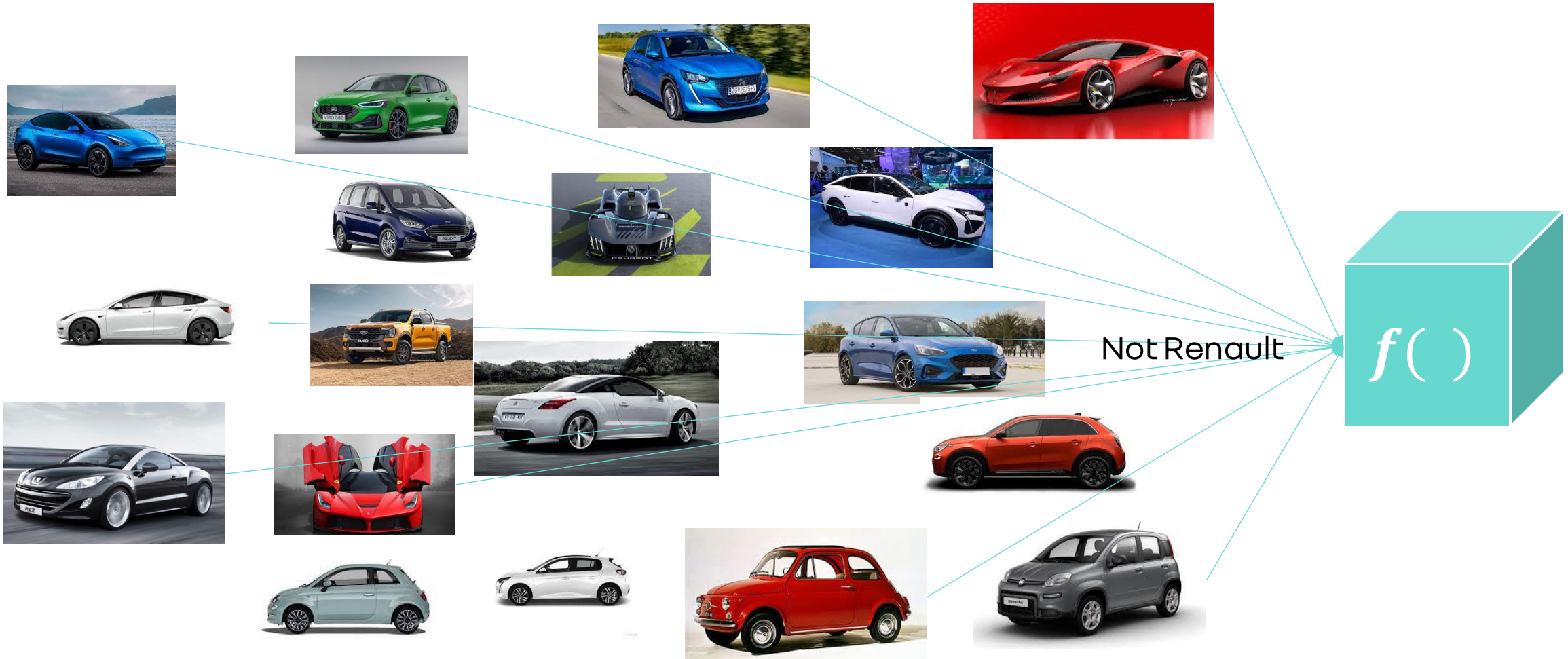
Learning by example

Examples of the first class

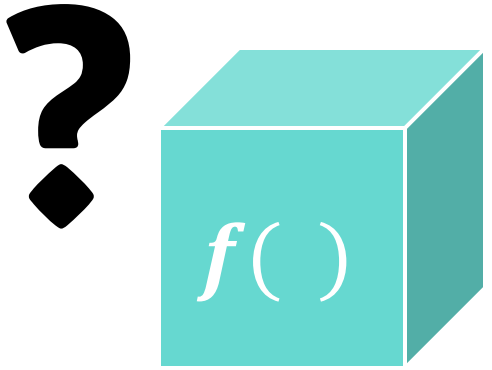


Learning by example

Examples of the second class

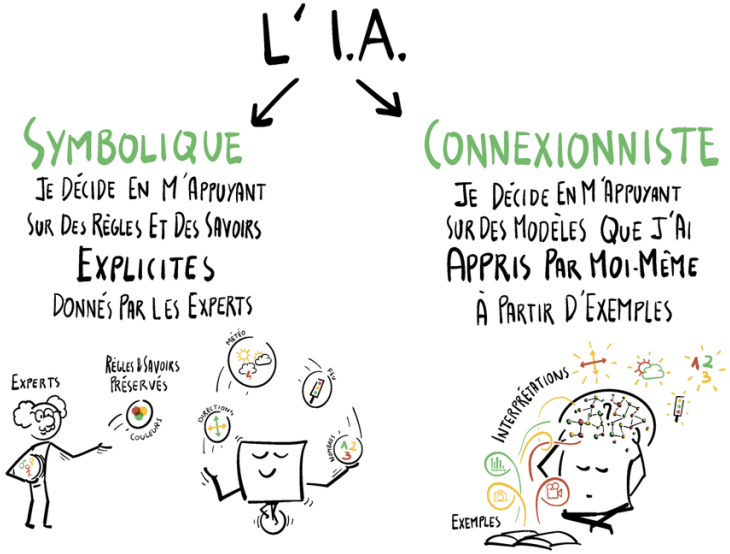


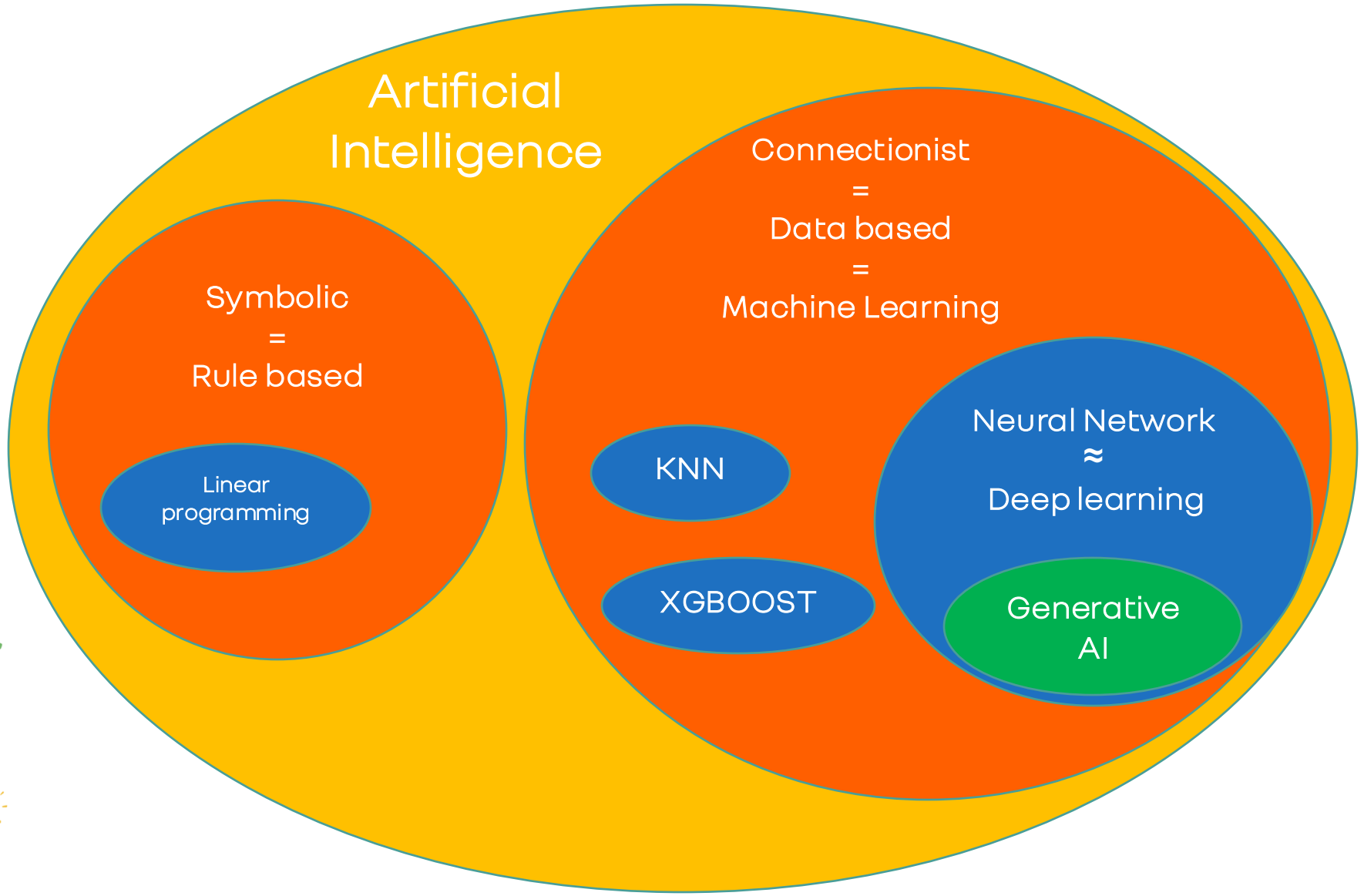
When learning is finished , the inference starts



Summary

AI cartography

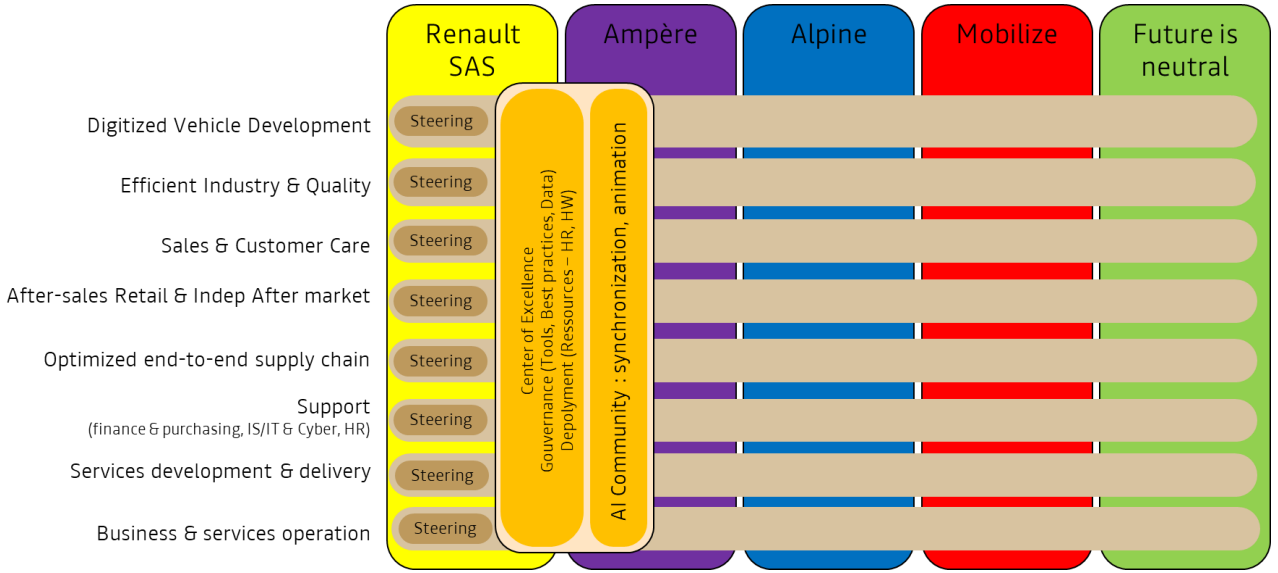




AI @ Renault Group

More than 500 people around the world

- Developers
  - 142 data scientists and Symbolic AI developers
  - 24 PhD students
- Catalysts
  - 94 data engineers
  - 150 managers and project maagers
- Users
  - 138 data analysts



Expertise network

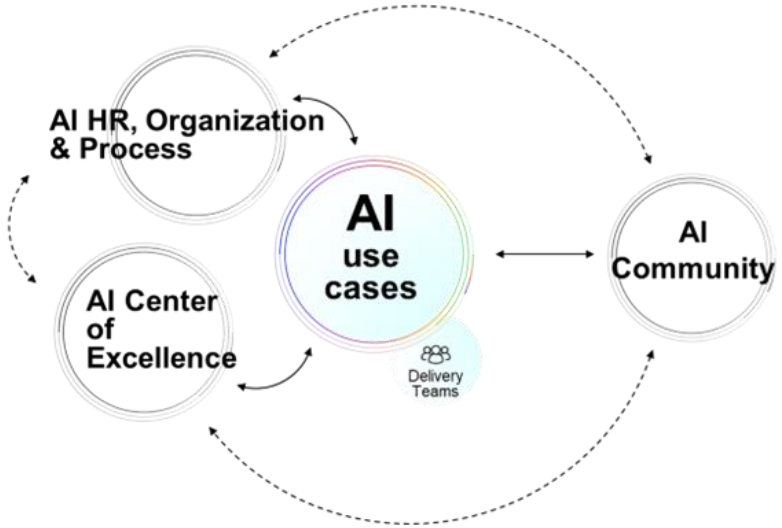
- 8 experts
- 10 specialists

Industrial partners

- Google
- IBM
- Qualcomm
- Microsoft
- …

Academic partners

- ANITI
- Telecom ParisTech
- Mines de Paris
- Ponts et chaussées
- IRT SystemX
- …

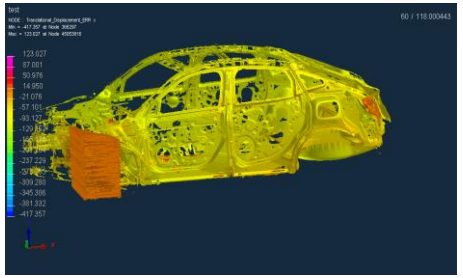


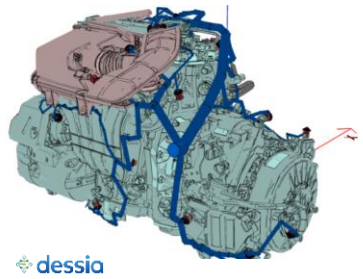
AI@Scale Transformation

Two aspects of AI @ Renault

Improvement of the operational performance

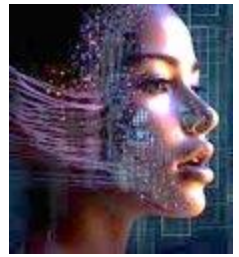
- Better and faster engineering, manufacturing, sales, supply chain, after-sales
- A dozen of high-priority projects selected by AI@scale





« Humanized » the car

- Use AI and other advanced technologies to improve the quality of the relationship between the users and the car
- My car knows me - My car protects me - My car enhances my sensations - My car surprises me - My car learns.
- Role of AI
  - Connectionist AI to understand the outside context and the inside situation
  - Symbolic AI to decide the relevant action



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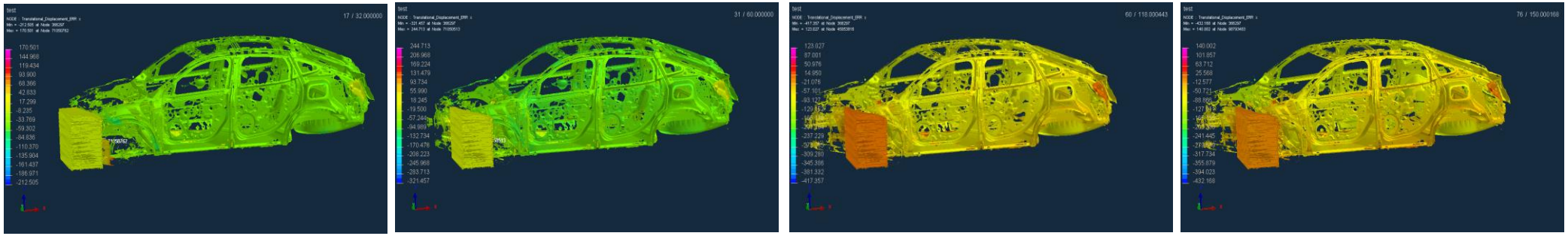
Some Applications

Model Reduction



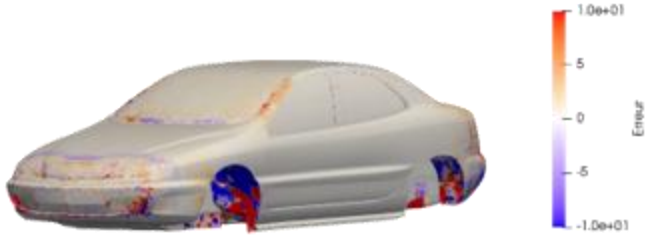
Exact physical model requires a lot of computing power

Training of a reduced model based on physical simulation

- Training on 200 snapshots from a single physical simulation

Reduced model can generalize

- Reproduction of the taught model
- Good results on different models



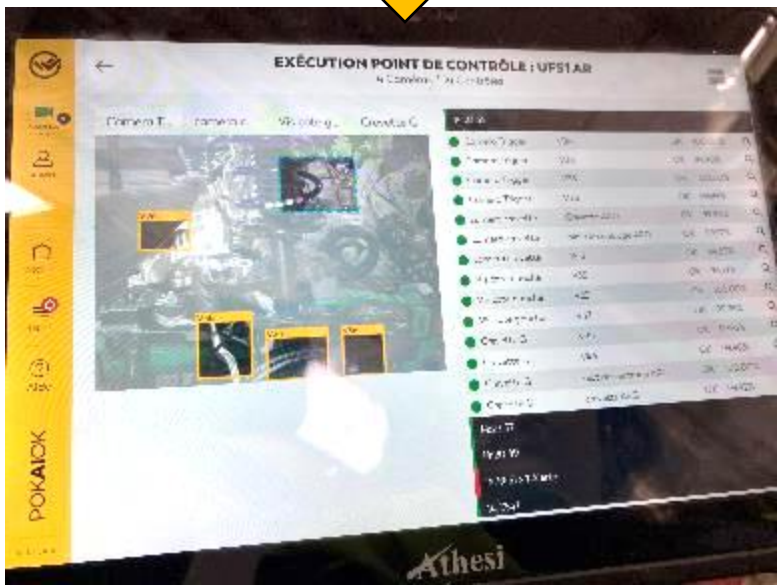
Application

- Crash
- Aerodynamics

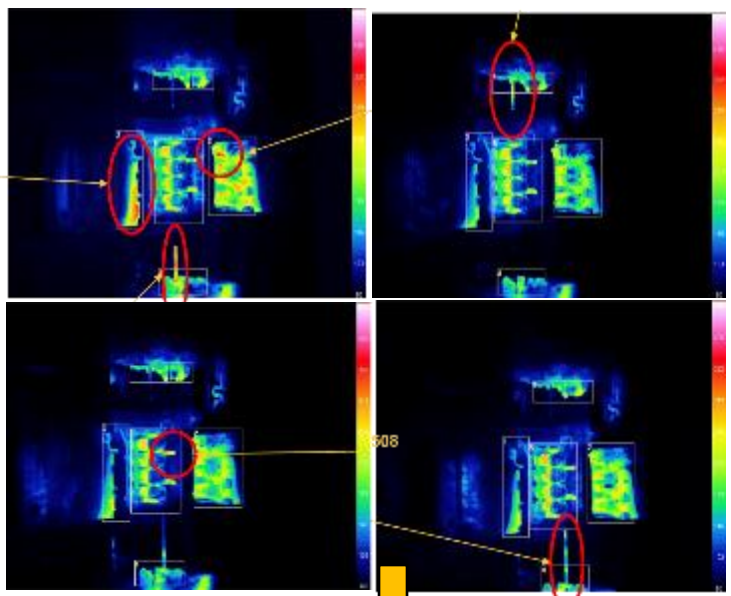
ASSISTANCE TO VISUAL INSPECTION

RG

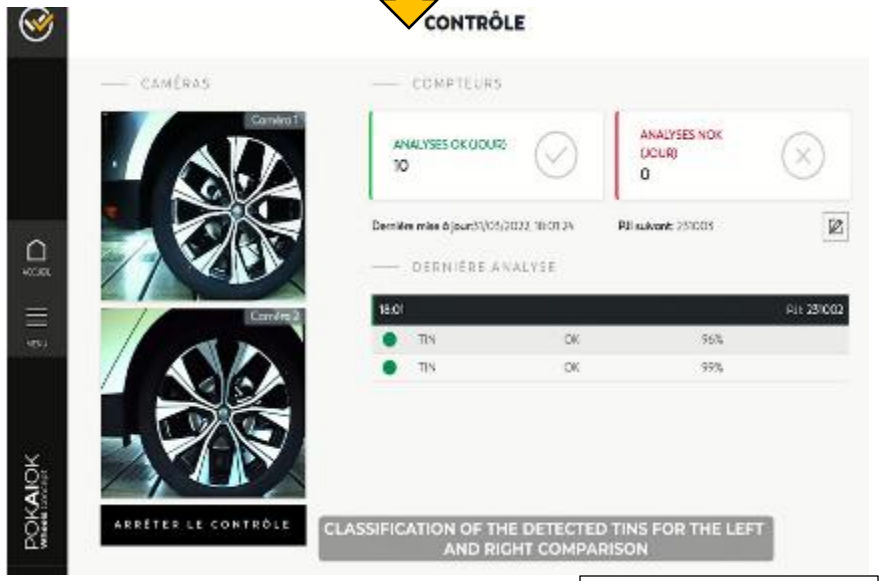
BATTERY SHOP



CASTING SHOP



FINAL VH ASSEMBLY

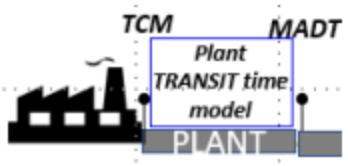


Renault

PREDICT : Delivery time prediction

12 different models

- Gradient boosting
- 15 key features
- Training on 500000 events / 18 months
- Testing on 110000 events / 6 months



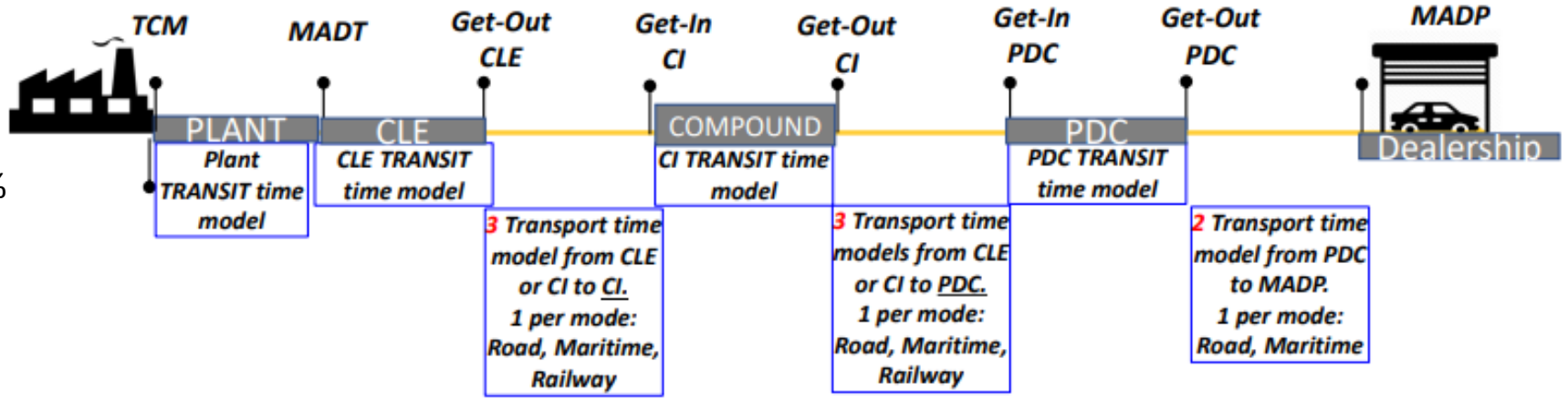

```
test evaluation :
test data size :  156752
RMSE: 1.5222
MAE: 1.1588
accuracy with corridor +/- 1 days : 90.24 %
accuracy with corridor +/- 2 days : 93.51 %
accuracy with corridor +/- 3 days : 94.9 %
```

Industrialization by Renault Digital

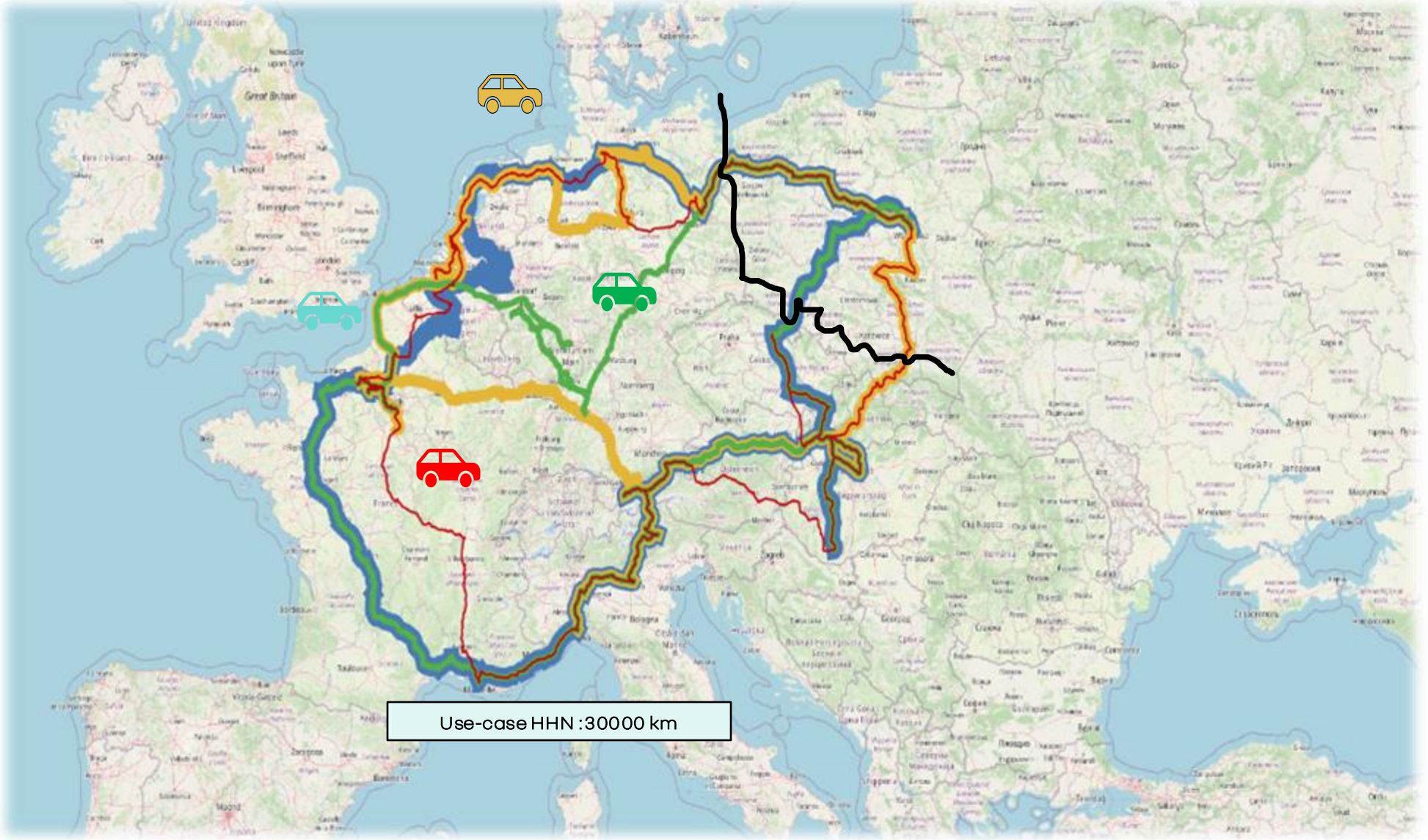
- Deployment on Vertex AI
- Go live : November 2022
- Retraining every 2 weeks

Benefit

- 0,5 M€/year
- Prediction improvement : 10%



Road trip design for ADAS validation



Natural Language Processing

Large language model have been developed (GPT, BERT,…)

- Source code accessible
- Based on generic corpus

Training on more focused data

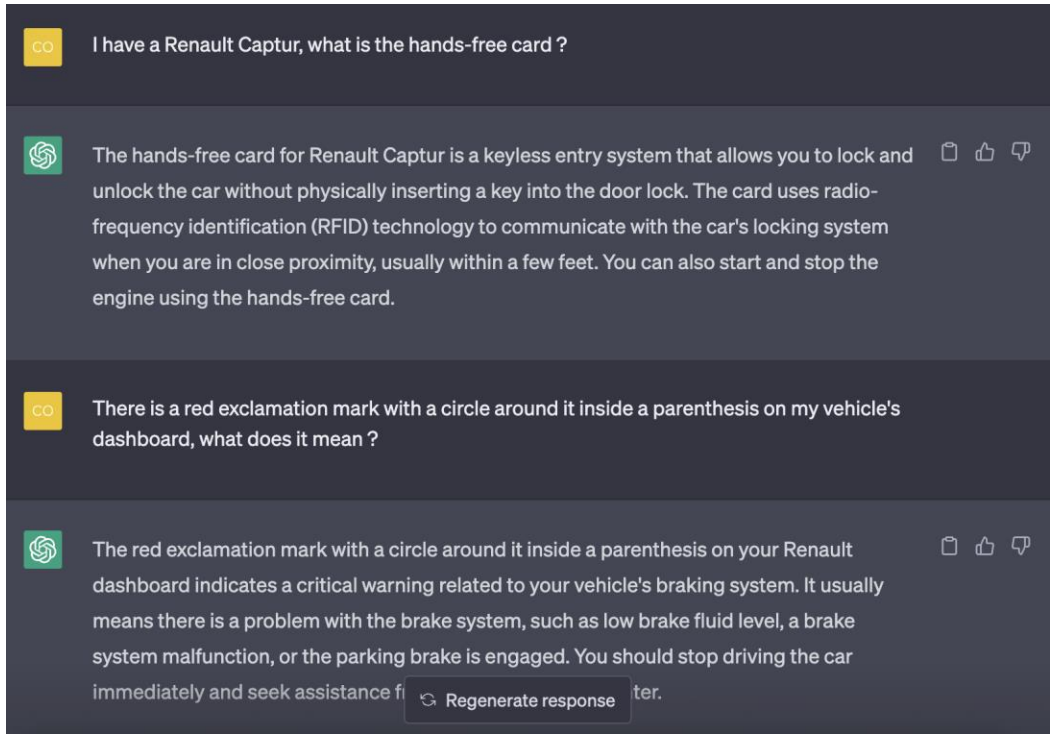
- Accurate knowledge of a technical domain
- No totally wrong answers

First use : natural language understanding

- Analysis of customer feedback

Second use : conversational agent

- Simplified access to the user manual with ChatGPT



Driving assistances

Scene understanding

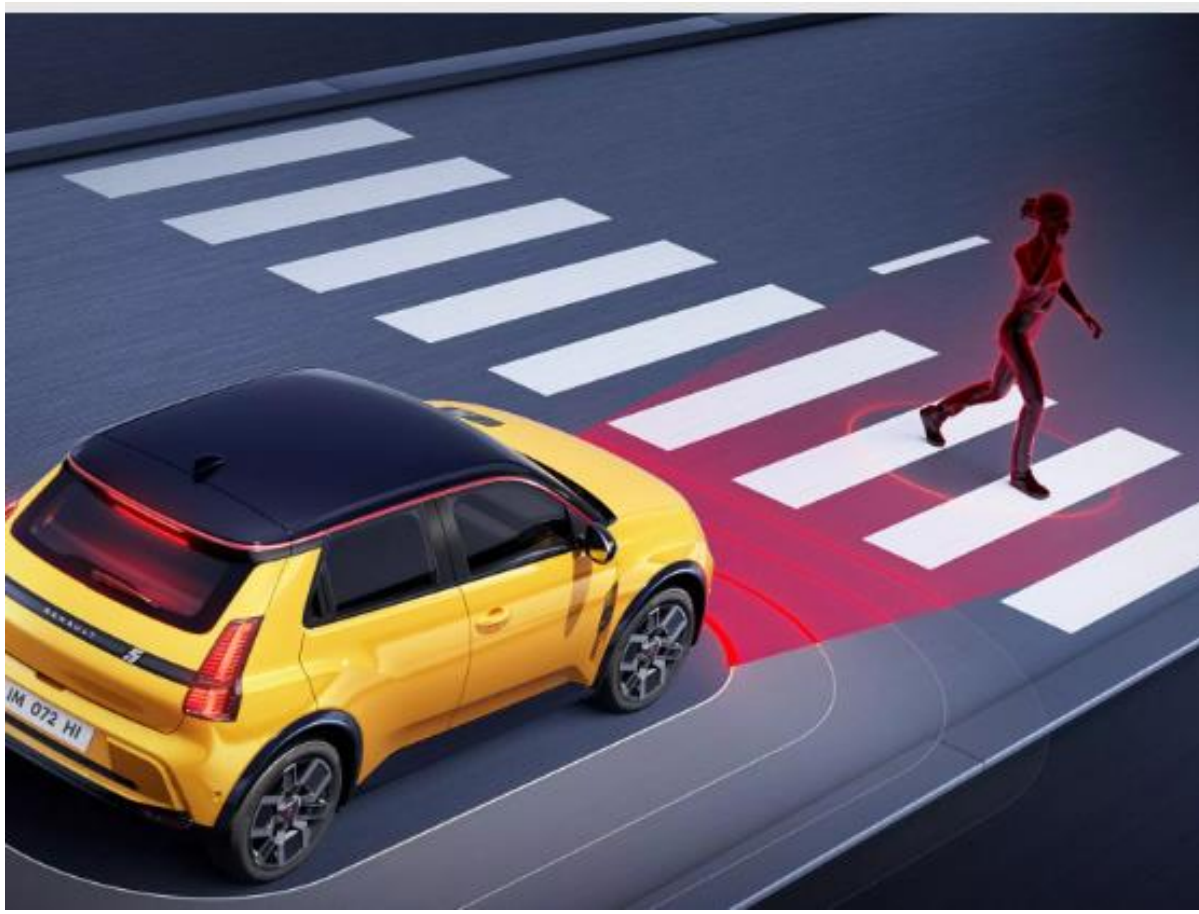
- Reconstruct the scene around the vehicle
- Provide an accurate representation to the driver
- Anticipate the movements of other vehicles

Adjust the behavior of the vehicle

- Emergency braking
- Adaptative cruise control
- Lane following

Coaching

- Hybrid vehicle journey optimization
- Electric Road planner
- Safety coach
- Car use optimization



Improved user experience

Hyper personalized and contextualized content

- Center of interest
- Driving conditions

New kind of interaction

- Tone of voice
- Message style

Knowledge of the driver

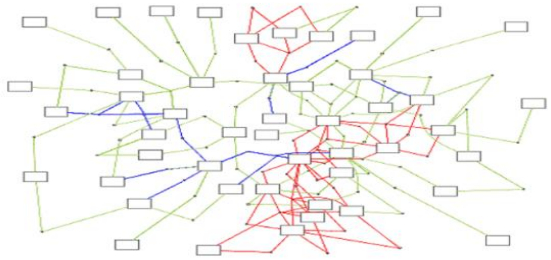
- Preference setting
- Preference collecting (social networks…)
- Preference guessing (driver habit learning)

Under
Driver's decision

So many other applications

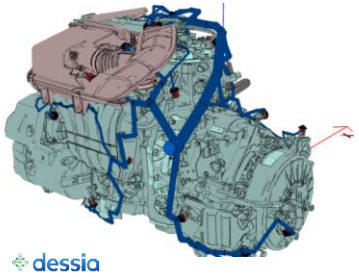
All professions, current and future, are concerned

Scoring

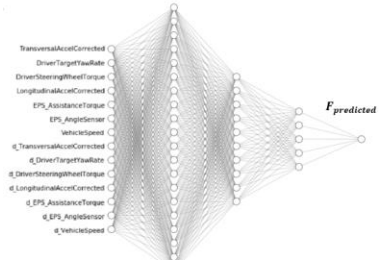


Diversity management

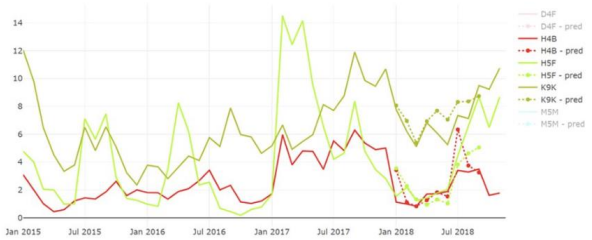
Data augmentation for validation



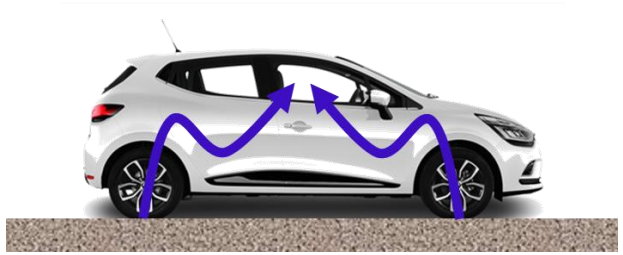
Optimization of cable routing



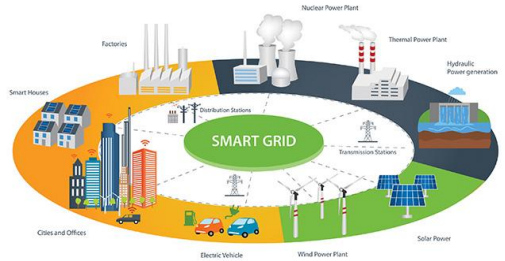
Virtual Sensor



Sales Forecasting



Performance prediction



Smart Grid

3

Towards a trustworthy AI

Can we trust AI ?

AI is famous for some weaknesses

Unknown unknown

Lack of robustness

Data obsolescence

Bias

AI Act: a European regulation

Ensuring that AI developed and/or used in Europe is risk-free

Guarantees

- Basic Human Rights
- Personal safety
- Infrastructure security

Risk classification

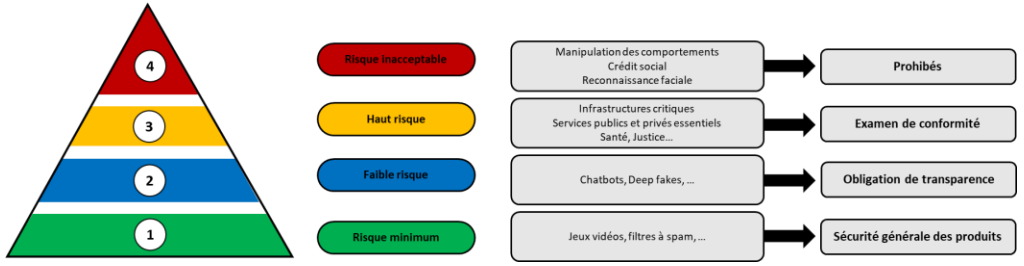
- Prohibited AI
- High-risk AI
- Low-risk or no-risk AI

Sanctions

- Enterprises
- 3 to 7% of turnover

First works: 02/2020

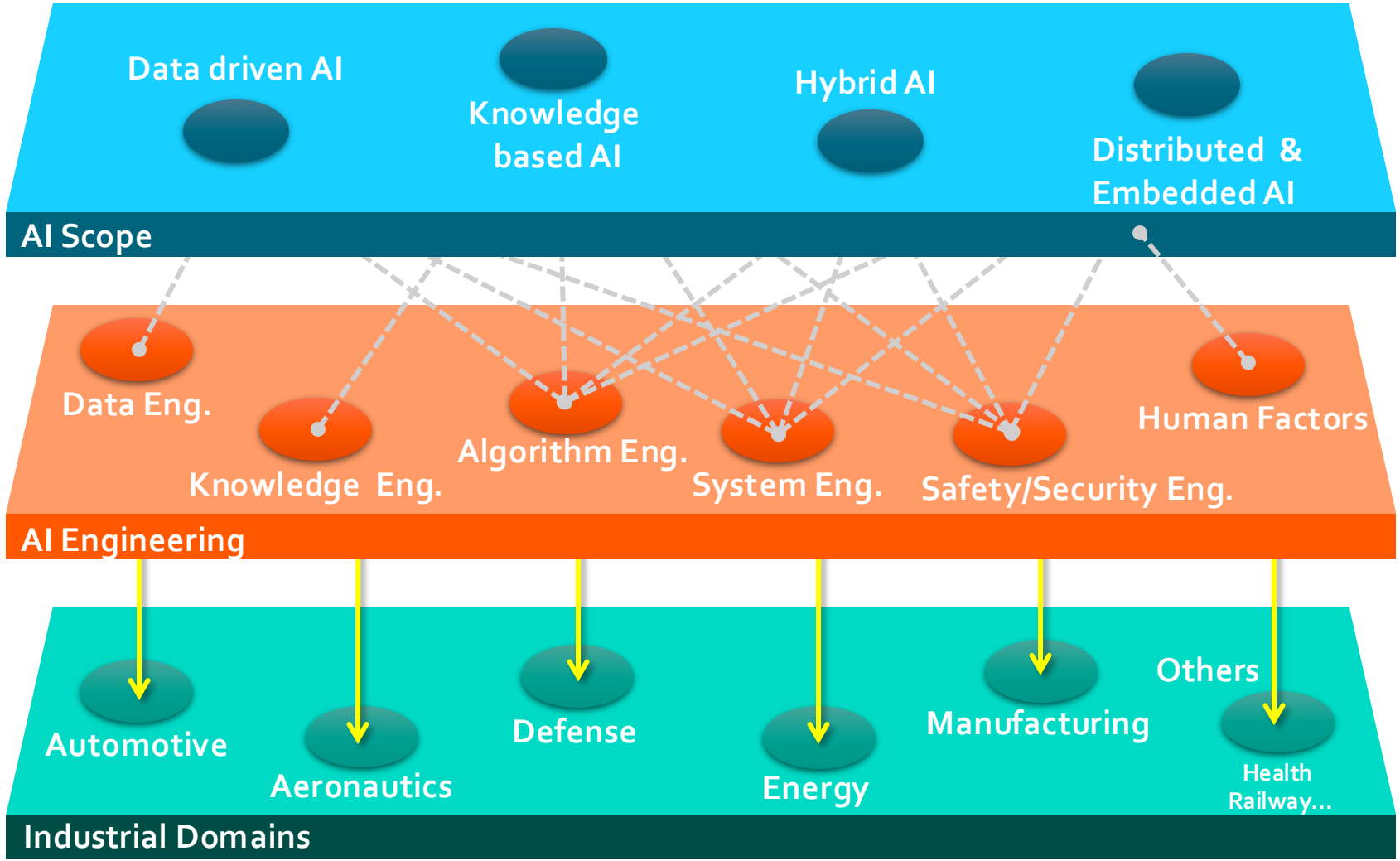
Final text validated: 01/2024



We don't classify a technology but a use

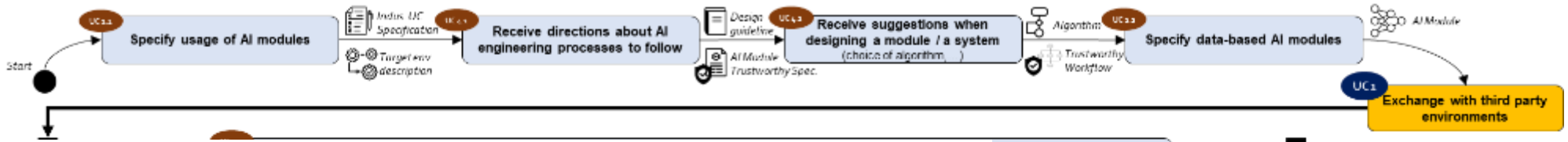
The Confiance.ai project

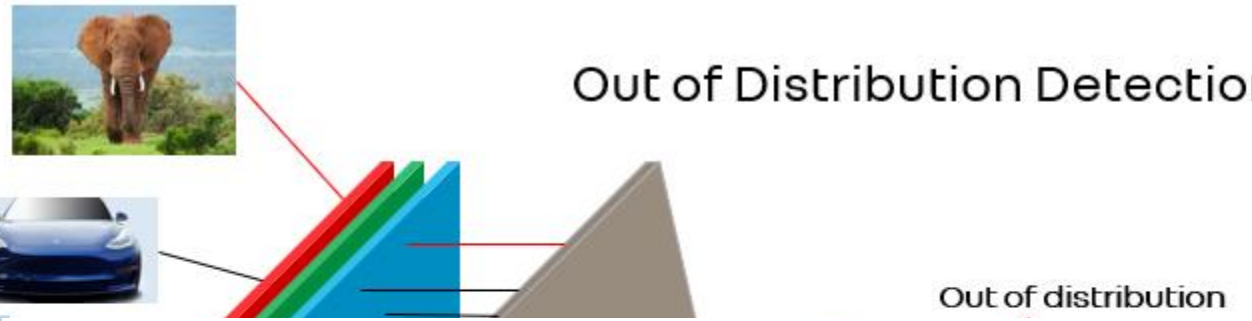
Industry driven – Multi domain – Multi technology

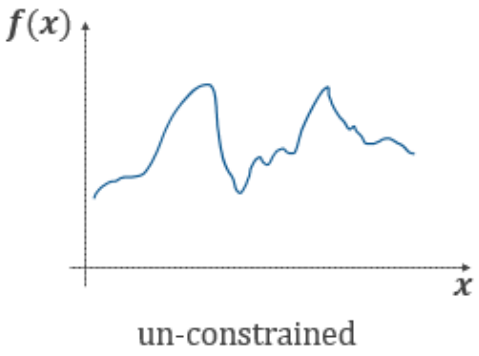


Example of production

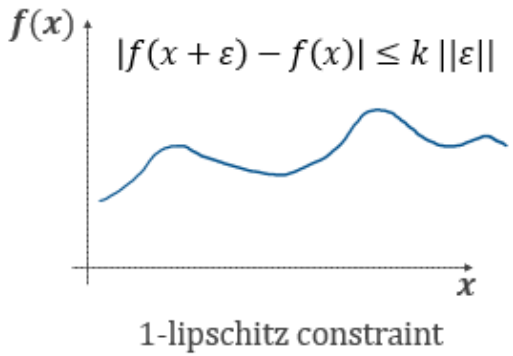
All along the development process



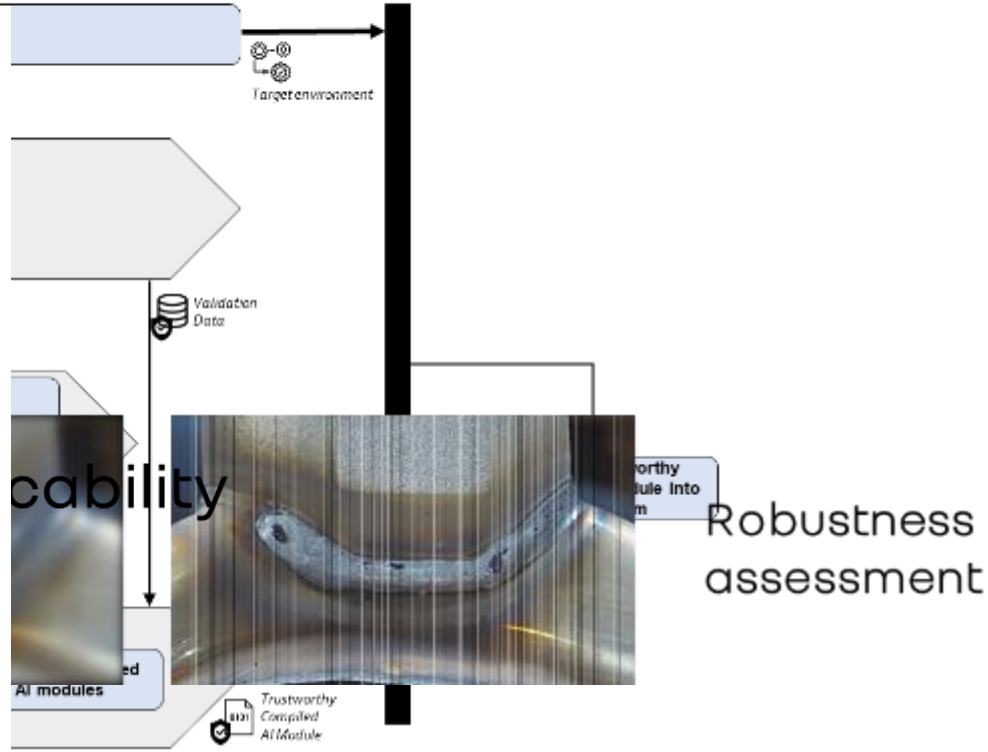




un-constrained

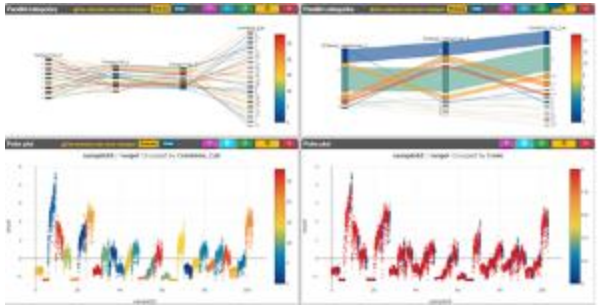


1-lipschitz constraint



Conclusion

Some solutions exist, industry must validate and deploy them



Unknown unknown

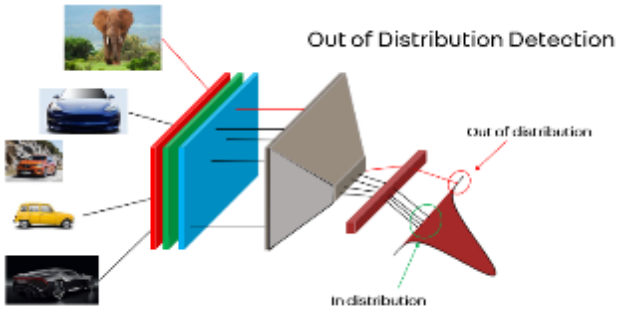
Lack of robustness

Lipschitz neural network

$f(x)$

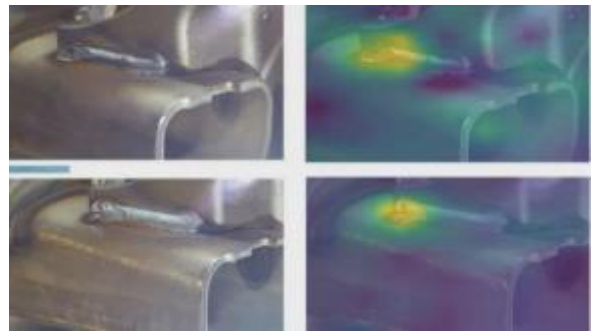
$|f(x+\varepsilon) - f(x)| \leq k\,||\varepsilon||$

x



Data obsolescence

Bias



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Conclusion

Learning comes at a price

Sources of cost

Data

- To be collected
- Respecting privacy
- To be recollected regularly

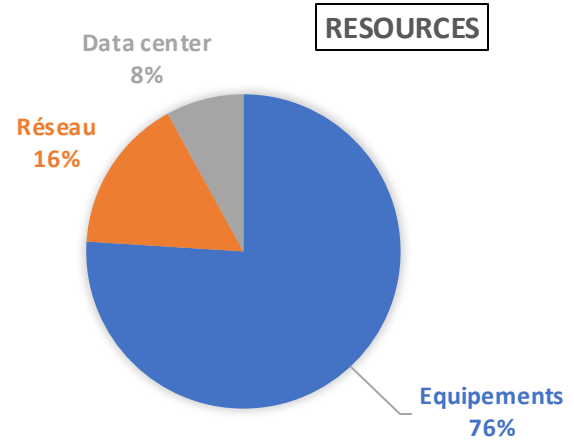
Human beings

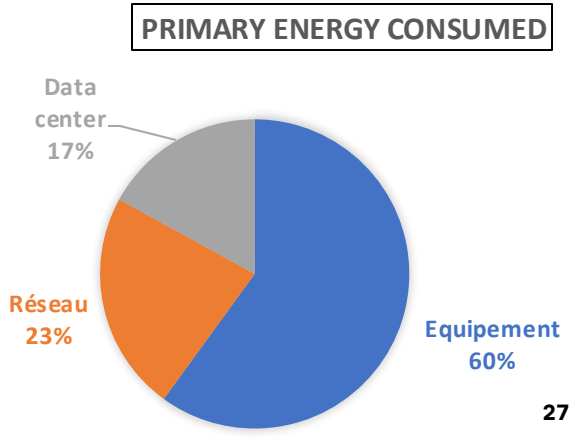
- To clean the data
- To label the data
- To design and tune algorithms

Energy

- 1 GPU card: 200W (20W human brain)
- Digital technology consumes 4.2% of the world's primary energy
- By 2040, 14% of CO2 will be emitted by computer servers(MIT study)

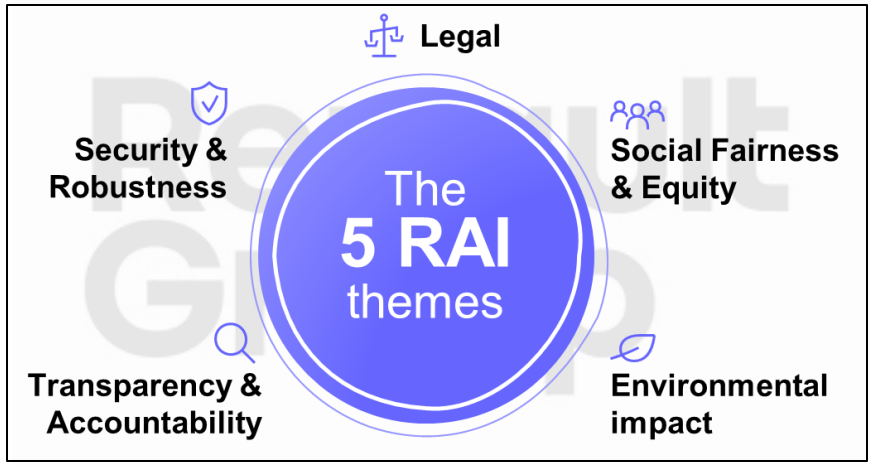
Digital Footprint





Conclusion

AI is a tool that everyone must learn to master



At the company level

At the individual level

4213 Practitioners

186 skippers

27 captains

Like every tool, it can be misused

Law must frame its usages


Thank you