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PASSION FOR INNOVATION

Applied Data Science Project

Politecnico di Torino

Lecture 2

ellis
European Laboratory for Learning and Intelligent Systems

Turin

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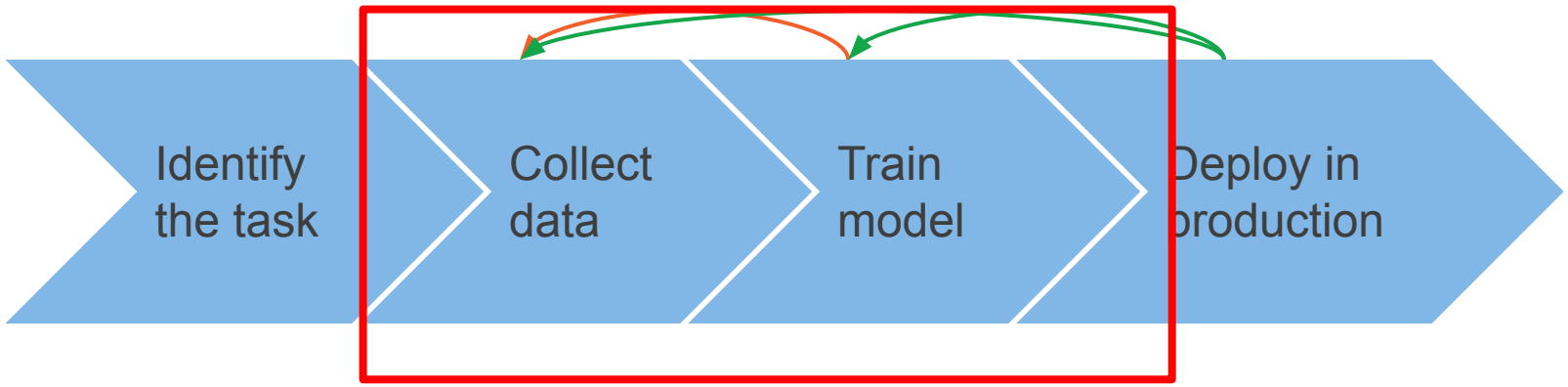
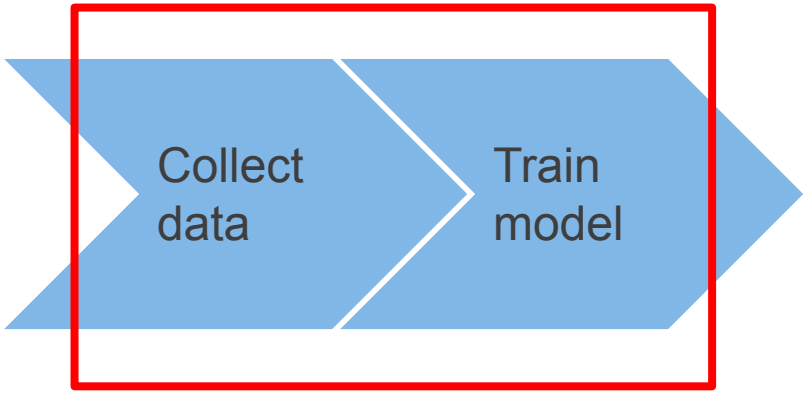
Machine intelligence

iterative processes meant to refine the quality of the solution

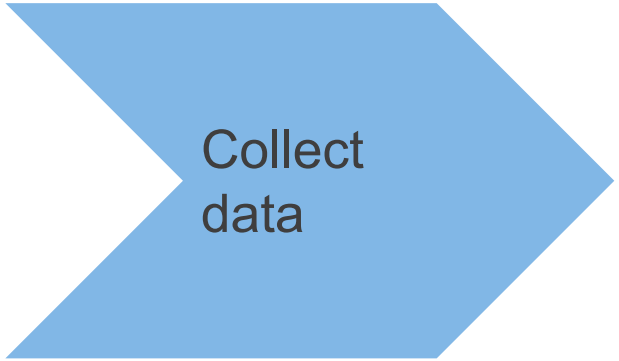


Data + Model



machine intelligence = data + model (software + algorithm)

Data



data is vital for creating any sort of machine intelligence

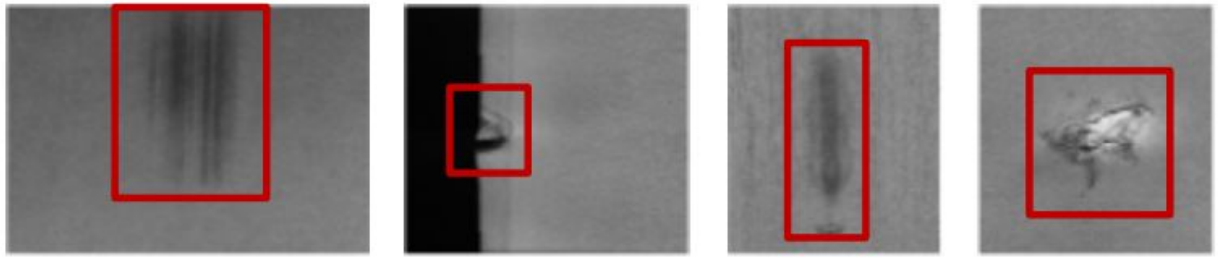
Data

improving data has a big impact to machine intelligence even more than model optimization

unless of radical changes in the code thus not optimization

Inspecting steel sheets for defects

Examples of defects



Baseline system: 76.2% accuracy

Target: 90.0% accuracy

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Improve code vs improve data

	Steel defect detection
Baseline	76.2%
Model-centric	+0% (76.2%)
Data-centric	+16.9% (93.1%)

Other examples

	Solar panel	Surface inspection
Baseline	75.68%	85.05%
Model-centric	+0.04% (75.72%)	+0.00% (85.05%)
Data-centric	+3.06% (78.74%)	+0.4% (85.45%)

Easier step

Improving data turns out to be key for a better machine intelligence

Note: Improving a code is different than designing a new, breakthrough, code however the effort for the latter is way higher than improving data and the return of the effort (may) be very high

Take home message: we consider the data improvement as an easier and necessary step when developing a machine intelligence before starting a new venture

Data improvement

Two strategies for data improvement:

- consistency
- completeness

Consistency

Task: Label cars

Consistency

Task: Label cars

Annotator 1

Consistency

Task: Label cars

Annotator 2

Consistency

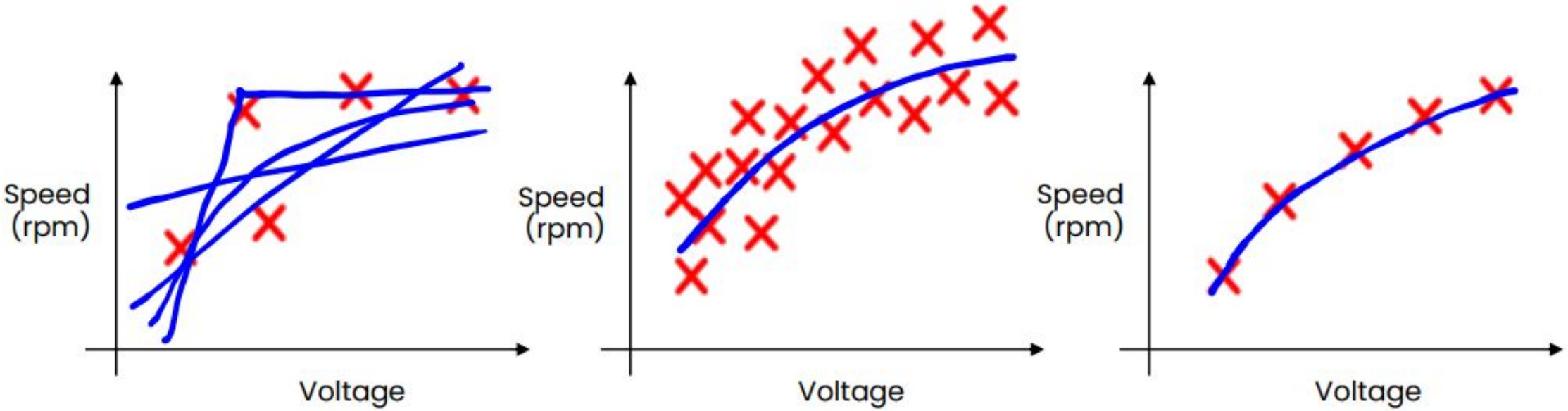
Consistency in annotation turns out to be crucial for the minimizing the potential error of the intelligence

However, ensuring a consistent dataset is a not obvious task

It involves:

- how the task has been conceived
- how the intervention of the human has been designed
- how did human annotators perform their task
- how the dataset has been packaged

Small Data and Label Consistency



- Small data
- Noisy labels

- Big data
- Noisy labels

- Small data
- Clean (consistent) labels

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Completeness

Task: Label cars

Completeness

Task: Label cars

Annotator 1

Completeness

Task: Label cars

Annotator 2

Completeness

Completeness in annotation turns out to be crucial for improving coverage to the intelligence

However, ensuring a complete dataset is a not obvious task

It involves:

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Good data

~~Big data vs small data~~

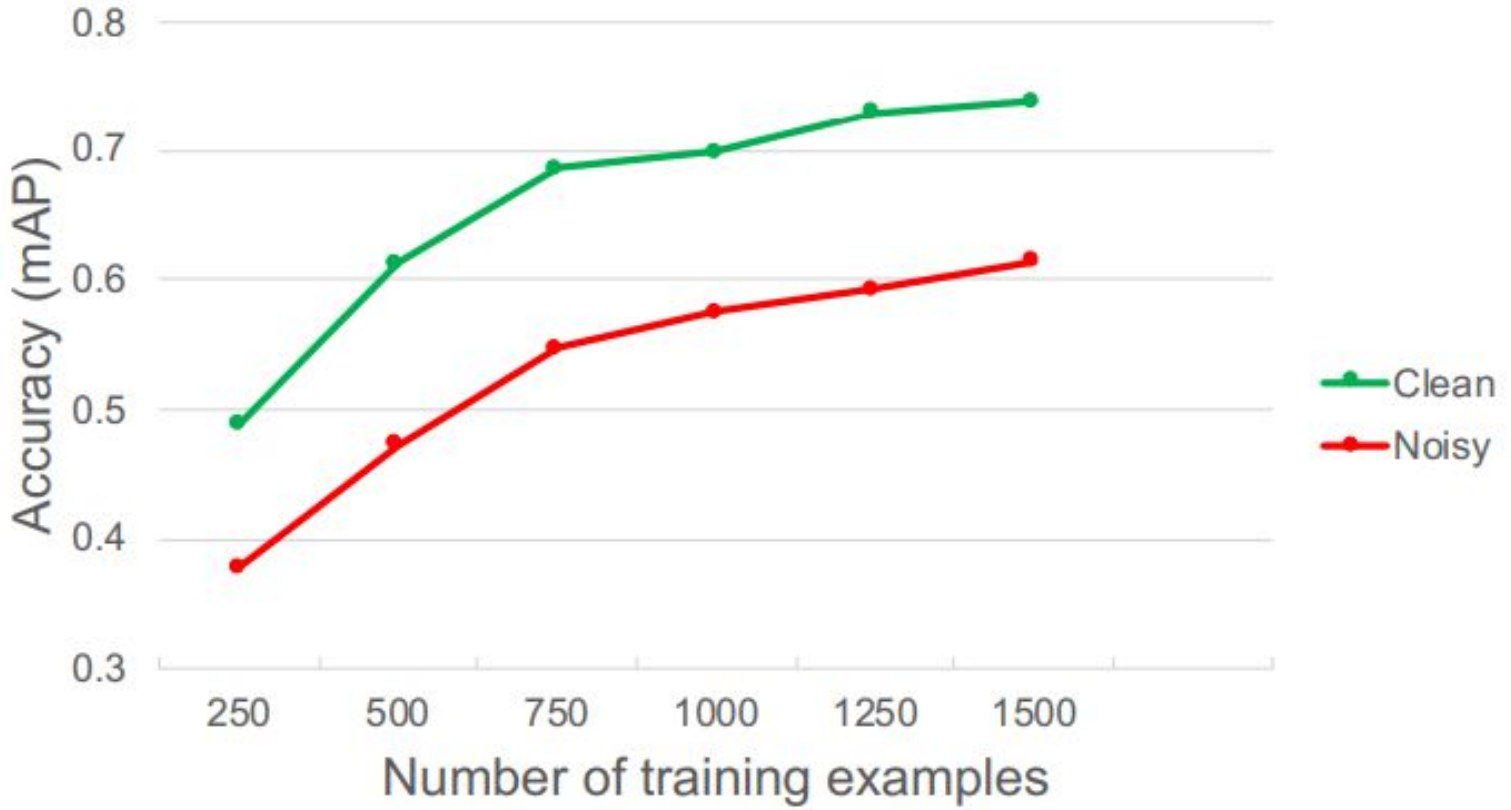
good data

Good data is:

- Defined consistently (definition of labels y is unambiguous)
- Cover of important cases (good coverage of inputs x)
- Has timely feedback from production data (distribution covers data drift and concept drift)
- Sized appropriately

We also refer to good data with the concept of clean data

Example: Clean vs. noisy data



Note: Big data problems where there's a long tail of rare events in the input (web search, self-driving cars, recommender systems) are also small data problems.

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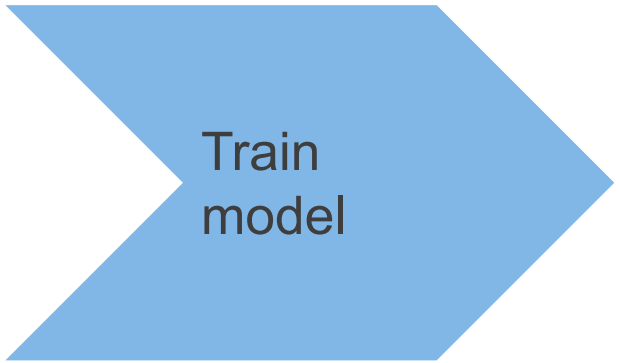
Model



model encapsulates the intelligence in an executable environment

Model

Improving a model is a hard task because it inherits the challenges related to optimize both data and algorithm

The traditional approach is to:

- collect data as much as possible, then standardize it with preprocessing
- optimize the model to be enough robust to cover noise iteratively by minimizing the error

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Thank you for your attention.

Questions?

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