Efficient Robot Programming mixing Reusable Code and Data

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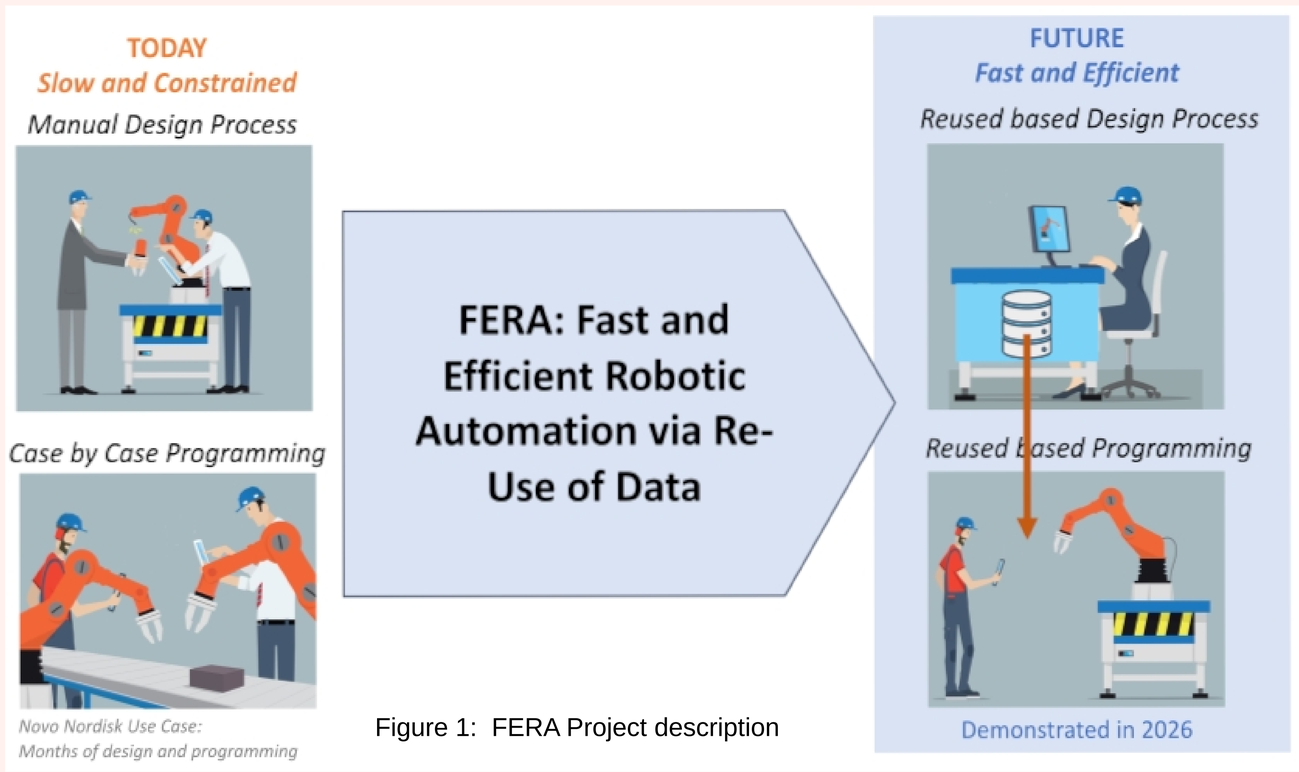


Figure 1: FERA Project description

Problems

- Labor shortage driven by an aging workforce and younger generations' reluctance to take on repetitive tasks.
- Demand for higher production quality due to innovations, evolving customer expectations, and stricter legal standards.
- Adoption of automation faces different barriers, including high implementation costs, a lack of automation knowledge, and slow case-by-case programming for achieving reliable solutions (Figure 1).
- Robotics data is highly varied (poses, trajectories, forces, type of materials, etc…), which complicates the transfer of solutions from one setup to another, limiting data reuse in robotics.

Observation

Small and Medium-sized Enterprises (SMEs) often encounter analogous technical issues when assembling objects with structural similarities (Figure 2), suggesting that solutions to one problem could be adapted for others.

Goal

Remove skill and cost barriers for SMEs and help them in programming automation solutions that can learn from existing solutions, reducing the need for manual work and custom programming by experts

Figure 2: Examples of Injection devices

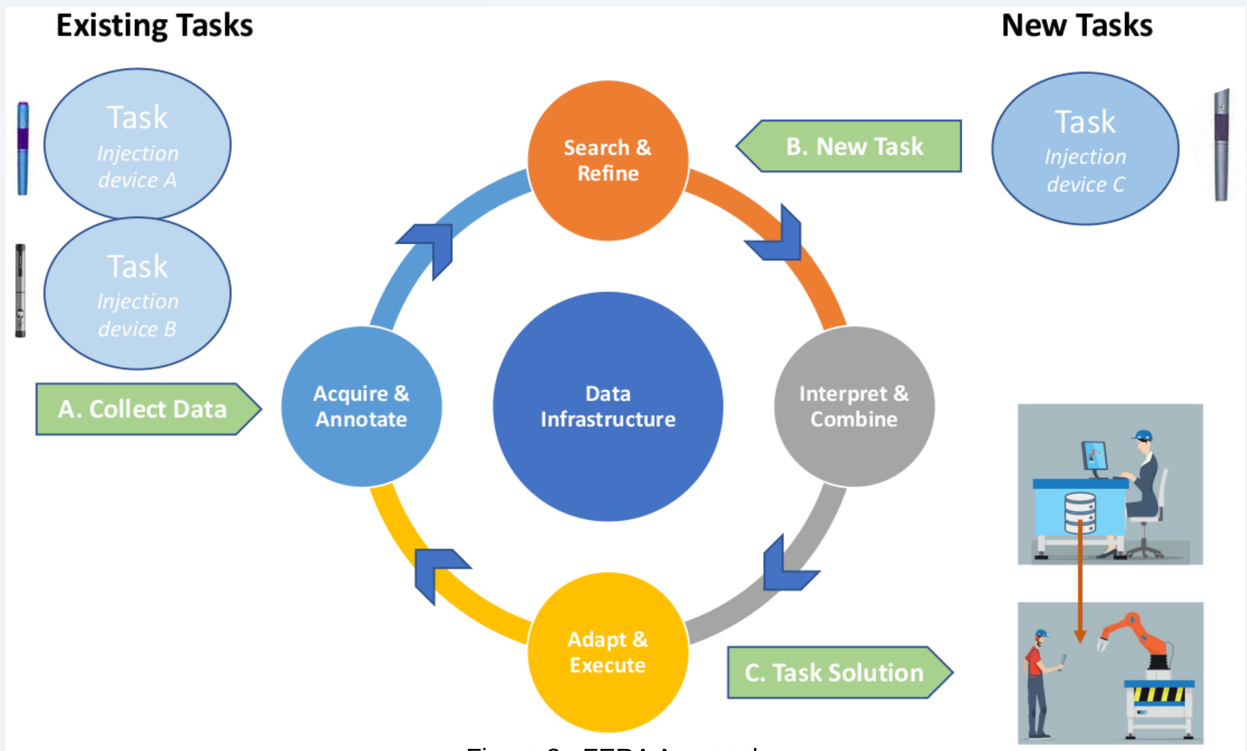


Figure 3: FERA Approach

Scientific Approach

1: Acquire&Annotate:
Investigating current data and robot programming processes in SMEs, and save them in a data infrastructure.

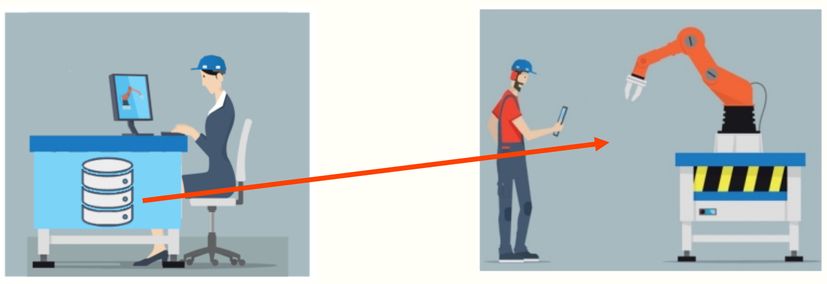
2: Search&Refine:
Search the data infrastructure using queries to output “information snippets” containing a summary of data/code from the database,
e.g. Force Data of Positive Insertions of Object A week 3

3: Interpret&Combine:
From ”information snippets” generate new robotic solutions,
e.g. Classifier (KNN, RF, SVM, etc…) of Positive and Negative Insertions based on Force Data (Figure 4B).

4: Adapt&Execute:
The executable solution implemented to an actual robotics platform.

Novelty

A human operator can use a search tool to retrieve relevant information from past robot installations using “information snippets” to create new robot programs (Figure 3: Interpret&Combine), differing from cognitive systems as it avoids abstract skills or human language



Some practical cases of Data Reuse

Figure 4: (A) Object Pose Estimation (left) and (B) Classification using Force Data (right)

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