ICT PHD - XXXVII

Research project for a PhD curriculum in ICT – Computer Engineering and Science

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Proposed Title of the research:
Big Data for sustainable industrial processes

Keywords – (5)
Data-centric AI, Big Data, Data Integration, Energy data, Process optimization

Research objectives

The goal of the research is to identify new techniques for the management of Big Data and their analysis through *data-centric AI* techniques, related to industrial manufacturing processes that allow to optimize the energy efficiency of production processes. The first challenge is to integrate and prepare the huge amount of heterogeneous data produces by the high number of available sources (IoT sensors, information systems, CRMs, etc.) to make it usable to the downstream application. In fact, the quality of the data to feed ML/AI model is as much as important as the quality of the model itself for yielding good analysis/predictions. Thus, data-centric AI solutions for the production processes in the manufacturing sector will be studied; in particular, to minimize defects and production waste and optimize the collection and management processes of industrial waste.

Proposed research activity

The research will study the problem of integrating and cleaning huge amounts of heterogeneous data produced in the industrial manufacturing processes to minimize the industrial energy waste. In fact, a core problem is to study how the quality of the data affects the ML/AI model employed downstream for optimizing the energy consumption of the production processes. This problem will be formalized in a cost/benefit data-centric AI framework: the operations involving humans and machines to collect, curate, and prepare the data will be represented as costs, while the accuracy of the ML/AL model consuming that data will represent the benefit. The framework will be employed to devise data driven algorithms, methodologies, and/or techniques to optimize in general production processes.

Supporting research projects (and Department)

This project will be carried out at the Department of Engineering "Enzo Ferrari". The candidate will also spend a period up to 12 months at DataRiver Srl, which will fund the research for one year. The remaining period will be funded with the traditional scholarship.

Possible connections with research groups, companies, universities.
The research may involve the undergoing collaborations with research groups at:

- University of Potsdam, HPI, Germany (Prof. Felix Naumann)
- University of Paris, Descartes, France (Prof. Themis Palpanas)
- Georgia Tech, US (Prof. Xu Chu)