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Supervisor Expression of Interest MSCA-IF Marie Sklodowska Curie Action-Individual Fellowship 2019

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Department Name: Research topic: (https://www.polimi.it/en/scientific-research/research-at-the-politecnico/departments/)	Department of Energy (DENG) Research Topic: PE6_11 Machine learning, statistical data processing and applications using signal processing (e.g. speech, image, video)
MSCA-IF Research Area Panels	<input type="checkbox"/> ENG_Information Science and Engineering
Politecnico di Milano Areas:	<input type="checkbox"/> Industry 4.0
Brief description of the Department and Research Group (including URL if applicable):	The Department of Energy (http://www.energia.polimi.it) coordinates the activities of several research groups for providing an interdisciplinary approach to the complex problems of the energy sector. Mission of the Department is to push forward technical and scientific competences in the energy sector, through high-level education, fundamental and applied research, technology transfer to industry, thanks to the work of over 250 members (professors, technical and administrative staff, and PhD students). The research project will be carried out within the “Signal and Risk Analysis research group” (www.lasar.polimi.it) of the Department of Energy



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Brief project description:
(max 1 page)

Title: Deep Neural Network-based predictive analytics for the industry 4.0 revolution of the energy sector in the big data era.

As the digital, physical and human worlds continue to integrate, the 4th industrial revolution, the internet of things and big data, are changing our industrial world. In this fast-pace changing environment, the energy industry is only starting its race to digitalization for improved efficiency, maintenance and operation, business continuity, asset management etc.

The major changes of the energy industry, such as the increased use of intermittent renewable sources, the phase-out of other energy sources, the increased attention to storage and the investments in smart transmission and distribution grids, combined with the vastly increasing collection and flow of information from a variety of sources call for an Energy 4.0 industry.

The capability of predicting the future behaviour of energy systems in the big data era is one enabler of this. Since traditional analytics used in the energy industry typically deal only with numerical data, i.e. signals measured by sensors, new analytics able to deal with other types of information (e.g., images and videos collected by unmanned aerial vehicles, audios collected to monitor the vibration of rotating machineries, texts reporting maintenance work orders, ...) need to be developed. In this context, the present project aims at investigating methods for predictive modeling for energy applications, ranging from load and generation forecasting for short-term energy system operation to failure prognosis for predictive maintenance of energy components and systems. In particular, the focus will be on deep neural networks (DNNs) such as Convolutionary Neural Networks (CNNs) and Generative Adversarial Networks (GANs) which have shown very satisfactory predictive performances also when used with non-numerical data, such as images and audios in problems of handwritten digit and speech recognition. Furthermore, given the Deep Learning intrinsic capability of extracting representative information from large amount of raw data, DNN are expected to directly and automatically provide high-level abstractions of the big data, without requiring hand-crafted and labour-intensive data analyses.

The methods for developing DNN prediction models will be validated by application on artificial and real case studies from partner energy industries like A2A, EDISON, ELECTRICITE' DE FRANCE (EDF), ENI and others.