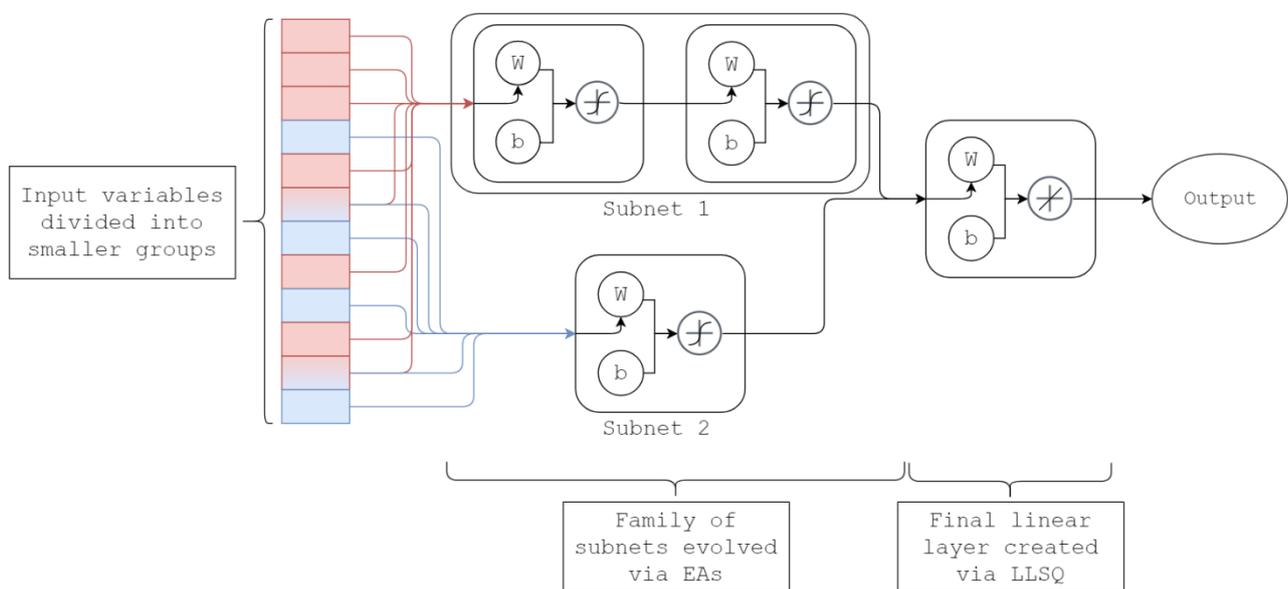


Data-driven Evolutionary Optimization in Metallurgical and Materials Engineering

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The schematics of EvoDN2 algorithm

ABSTRACT

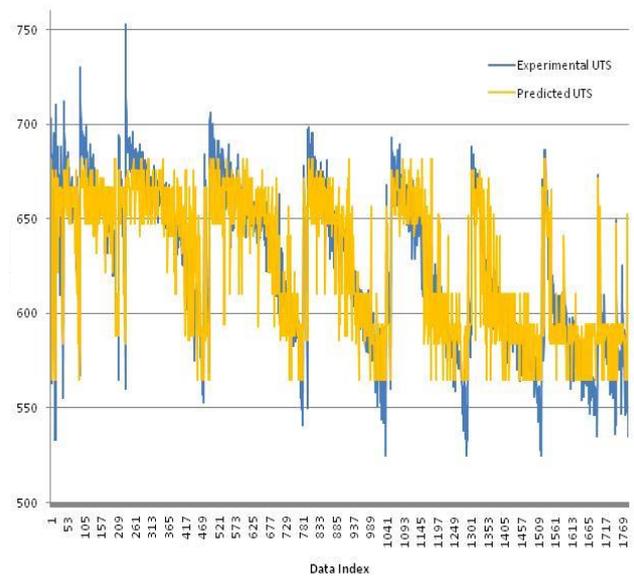
In this presentation I will talk about some recent algorithms EvoNN (Evolutionary Neural Net) Bi-objective Genetic Programming (BioGP) and EvoDN2 (Evolutionary Deep Neural Net) developed by me and my global collaborators which are now being widely used in diverse areas of metallurgical and materials research. Among them BioGP is now integrated in the commercial Kimeme software, the flagship product of Cyber Dyn Srl, an Italian software company. Open source codes of these algorithms are also available from me. These algorithms are based upon a nature inspired approach, trying to mimic some basic aspects of evolutionary biology in a non-biological context, for example, the materials related problems, and follow the principles of multi-objective optimization. The starting point is the noisy data from diverse sources that could be either from industry, experiments or simulation and the next step is to create a set of optimum models following an

intelligent strategy for avoiding the random noise in the original information. For a given system, several such models can be created for various conflicting objectives pertinent to the system in hand, and all these algorithms allow the users to optimize them simultaneously following the concepts of *Pareto Optimality*, which tends to find out the best possible tradeoffs between these conflicting requirements. Once a model is created, it also allows the users to evaluate the interaction between the decision variables, following a simple, intuitive approach.

In presentation the basic working principles of these algorithms will be explained in a nut shell and their efficacy will be demonstrated based upon some recently conducted studies on blast furnace iron making and some special steel developments conducted in my group. The results obtained using these three in house softwares will be shown and analyzed along with the information obtained through the commercial software Kimeme that provides the users with several alternate strategies.

About the speaker

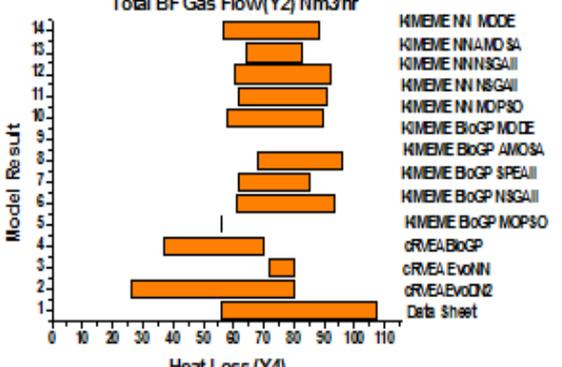
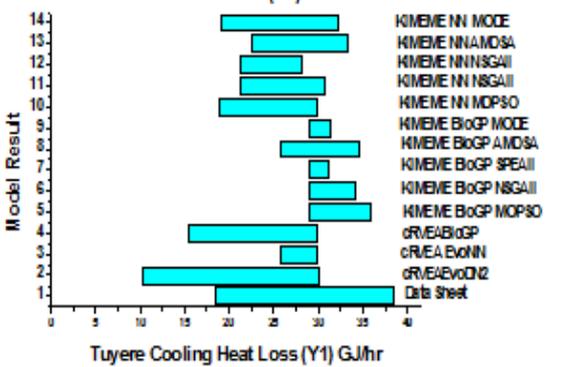
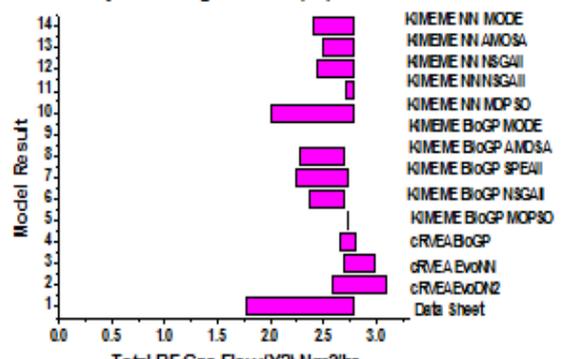
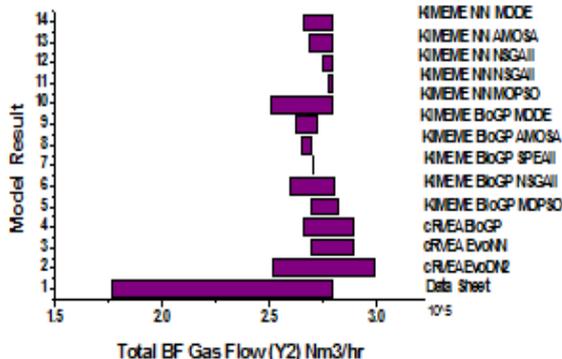
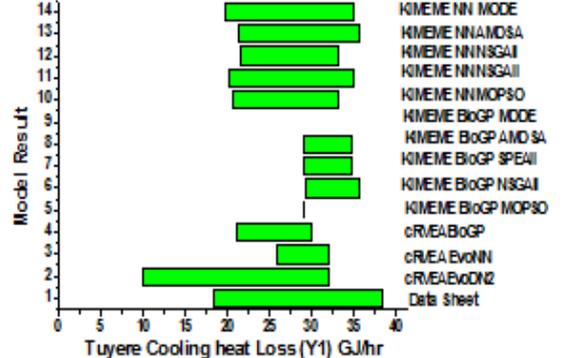
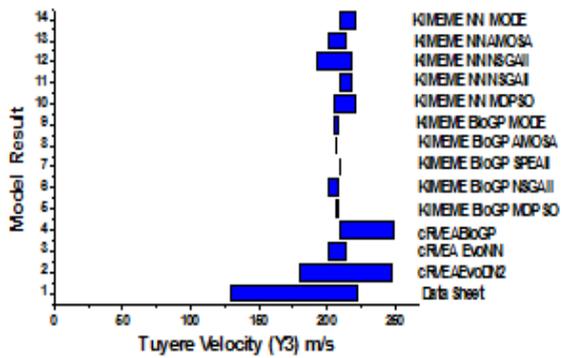
Nirupam Chakraborti is a Higher Academic Grade Professor at Indian Institute of Technology, Kharagpur in India. He received his Ph.D in 1983 from University of Washington in the USA and taught and conducted research extensively in many universities and research laboratories located across the globe. His major research effort is in the area of evolutionary modeling and optimization for the systems of metallurgical and materials interest. He has written numerous papers and book chapters in this area and is considered to be one of the frontrunners of nature inspired modelling and optimization.



No
by Noisy data for UTS of micro alloyed steel and model
obtained by the EvoNN algorithm

Pareto Comparison Result Y1-Y2-Y3

Pareto Comparison Result Y1-Y2-Y4



Parameter optimization for a working blast furnace