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COMPOSITES for Quality Composites Design for Manufacturing

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Abstract:

Machine learning (ML) techniques are being increasingly used in building predictive analytic for engineering materials and their manufacturing. A large amount of data is however required for developing and training such models for reliable outcome. Gathering such data is mostly resource-heavy and time-consuming, especially on composites due to the challenges involved in producing specialty specimen and conducting ample experiments. Also, numerical simulations and optimization of manufacturing processes and quality are always intricate.

Smaller datasets are still available, however, need to be boosted systematically for ML. The current work specifically focuses on this issue. A newly developed, knowledge-based data boosting (KBDB) process, named 'COMPOSITES', helps in logically enhancing any such small dataset without further experimentation or very detailed simulation. All the steps involved in the COMPOSITES process, their significance and the implementation are explained.

A few classic examples on composites manufacturing and the quality enhancement are presented and discussed A systematic boosting of datasets for 1-2 cases is demonstrated and presented. In most cases, user can work in two-dimensional domain where only one dependent variable can be predicted. This work presents a case study where ways to combine more output variables for more involved predictions is also demonstrated.

Biography:

Dr. Sunil C. Joshi received his doctorate in 1999 at Monash University, (Clayton), Australia, for his work on advanced composites manufacturing processes. Prior to that, he had obtained M. Tech. in Aeronautical Engineering from Indian Institute of Technology, (Bombay), Mumbai, and worked as a Scientist at the National Aerospace Laboratories, Bangalore, India, from 1988 to 1994. After his Ph.D., Dr. Sunil joined Nanyang Technological University Singapore, in 2000, as a faculty in the School of Mechanical and Aerospace Engineering. His teaching encompasses aerospace materials, structures and manufacturing. Prof Sunil has worked on several R & D projects funded by external agencies and industries. He was the team leader responsible for designing and developing thermal controls for XSAT, Singapore's first fully designed and built micro-satellite.

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