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A posteriori assessment of a mixture of experts (MoE) framework for high-dimensional flamelet tabulation OPEOLUWA OWOYELE, PINAKI PAL, CODY NUNNO, PRITHWISH KUNDU, Argonne National Laboratory — One of the main limitations when deploying tabulated flamelet models for computational simulations of practical combustion systems is the excessive computational storage requirements associated with high-dimensional flamelet tables. This study introduces and validates an approach for circumventing this issue, by learning the table using an ensemble of deep neural networks to predict the species mass fractions and progress variable source term as functions of the control variables. In the proposed approach, a mixture of experts (MoE) technique is used, where multiple artificial neural networks, called experts, are trained concurrently. The artificial neural networks compete for training samples within the manifold, and another network, known as the gating network, rewards the experts that have superior training performance with stronger training signals. This leads to specialization of the experts in different portions of the table. The MoE framework is applied to unsteady flamelet progress variable (UFPV) modeling of an n-dodecane Spray A flame based on the Engine Combustion Network (ECN). It is demonstrated that the MoE-based tabulation can accurately predict global flame characteristics such as the lift-off length and ignition delay over a range of ambient conditions.

Opeoluwa Owoyele
Argonne National Laboratory

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