

Translational AI Center (TrAC) Seminar Spring 2026

Yang Du

March 6th at 11:00 AM (US Central Time)

Location and zoom link: <https://trac-ai.iastate.edu/event/trac-seminar-series-yang-du/>

Deep learning for spatter analysis in laser powder bed fusion additive manufacturing

Abstract

To capture the complex metallic spatter and melt pool behavior during laser powder bed fusion process, high-speed cameras are applied to capture and record the rapid interaction between the laser and metal material. Four deep learning algorithms are applied to analyze the record videos. The well-trained deep learning models achieved high accuracy and low loss, demonstrating strong capability in accurately detecting and tracking spatter behavior. A stability index is proposed and calculated based on the melt pool length change rate. A high stability index correlates with fewer spatters and a more stable melt pool, leading to higher-quality parts. In addition, a novel, dimensionless spatter index was introduced to quantify the synthetic influence of vapor recoil and surface tension forces on spatter formation. This index is derived using an analytical model based on calculated temperature fields and alloy-specific properties. The spatter index exhibits a clear linear relationship with both spatter amount and ejection speed, offering insight into formation mechanisms. Together, the image-based stability index and force-driven spatter index provide powerful, complementary tools for diagnosing and improving LPBF processes.

Short Bio

Dr. Yang Du is an Assistant Professor in the Department of Materials Science and Engineering at Iowa State University. She earned her Ph.D. from Tianjin University and completed postdoctoral research at Penn State, Princeton, and Texas A&M. Her research focuses on metal additive manufacturing, integrating computational modeling, machine learning, and experimental characterization to optimize processes and reduce defects. Dr. Du serves as guest editor for multiple journals, reviews for NASA and NSF panels, and has authored numerous publications on laser-based manufacturing and physics-informed machine learning.

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