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Pairing plasma diagnostics, theory and simulations with machine learning to overcome the limitations of big data analytics in complex plasma processes

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Big data analytics is the methodology around examining large data sets to uncover correlations among/within them and other insights of practical value. The application of big data analytics in industry is surging; the semiconductor industry is no exception. Typical examples involve advanced machine learning techniques such as PCA and pattern recognition. Rare are examples integrating the underlying physics for the purpose of extracting target metrics such as CD and etch depth. Plasma diagnostics paired with appropriate sensor technologies can reduce the advanced data processing load by enabling the direct extraction of variables that should correlate with target metrics via theory or a model. We call this augmented big data analytics. Here we present the successful real-world process example of pairing of plasma diagnostics with a for a critical device parameter. As a judge of success, we consider multiple factors and important ones are model robustness and need for retraining preventative maintenance (PM) cycles. We conclude with a few words on the importance of sensor-to-sensor and installation-to- installation variability.