11th ACM/IEEE Workshop on Variability Modeling and Characterization (VMC)

Co-located with the 37th ACM/IEEE ICCAD, November 8, 2018, San Diego, CA, USA

Agenda

Time	*Title*	Speaker
1:00pm – 1:10pm	*Welcome Note and Opening Remarks*	Abe Elfadel, Khalifa U., UAE
1:10pm – 1:50pm	*Machine Learning in Semiconductor Manufacturing and Test: Can Deep Learning Save The Day?*	Yiorgos Makris , UT Dallas, USA
1:50pm – 2:30pm	*Data-Efficient Machine Learning for Variation-Aware Design Automation: A Tensor Perspective*	Zheng Zhang, UC Santa Barbara,
2:30pm – 3:10pm	*Lithography Optimizations through Machine Learning*	Youngsoo Shin, KAIST, Korea
3:10pm – 3:50pm	*Poster Pitches/Coffee Break/Poster Viewing*	
3:50pm – 4:30pm	*Machine Learning for Variability Modeling and Mitigation of Energy-constrained Systems*	Mehdi Tahoori, Karlsruhe Institute of Technolog, Germany
4:30pm – 5:10pm	*Application of Boolean Sampling and Learning to the Error Localization and Correction in Semiconductor Designs*	Victor Kravets, IBM Research, USA
5:10pm – 5:40pm	*Panel: Machine Learning and VMC*	Invited Speakers
5:40pm – 6:00pm	*Wrap-up and Closing Remarks*	Abe Elfadel, Khalifa U., UAE

Abstracts of Invited Talks

Title: Machine Learning in Semiconductor Manufacturing and Test: Can Deep Learning Save The Day?
Speaker: Yiorgos Makris, UT Dallas, USA
Time: 1:10pm – 1:50pm

Abstract: While many applications of machine learning in various semiconductor manufacturing and testing tasks have been heavily researched over the last two decades, few have actually seen the light of day in a real production environment. Recently, the popularity of contemporary artificial intelligence methods, such as deep learning, has reignited the enthusiasm and reinvigorated the discussion regarding the potential of statistical and machine learning-based solutions towards reducing test cost, increasing test quality, improving test floor logistics and providing guidance to both designers and process engineers. In this presentation, we will first review the key challenges in transitioning machine learning-based solutions from a research to a production environment; then, we will discuss the main advantages of contemporary methods, such as deep learning, over traditional machine learning solutions. Ultimately, the intention of this presentation is to caution against considering deep learning a panacea to test (and, thereby, prevent disappointment), as well as to steer attention towards the true operational challenges which need to be addressed in order for any machine learning or statistical solution, traditional or contemporary, to be effective in a real production environment.

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Title: Data-Efficient Machine Learning for Variation-Aware Design Automation: A Tensor Perspective
Speaker: Zheng Zhang, Assistant Professor of ECE, UCSB
Time: 1:50pm – 2:30pm

Abstract: While machine learning is a valuable tool for vast engineering applications, many popolar machine learning algorithms (e.g., deep learning) may not be directly applied to electronic desgin automation. These popular machine learning frameworks oginated from big-data applications, and their overly parameterized algorithm models usually requires a huge amount of training data. However, EDA problems normally have limited simulation or measurement data, and obtaining each piece of data is expensive or time-consuming. Therefore, this talk focuses on "data-efficient" machine learning -- how can we build machine learning models with a small number of training data for EDA problems? We specifically investigate tensor computation techniques to address this challenge, which allows efficient compression of high-volume data or extract information of big data from a small amount of samples. Two EDA problems will be demonstrated: tensor methods for high-dimensional uncertainty quantification, and Bayesian tensor completion for variation data prediction.

Title: Lithography Optimizations through Machine Learning
Speaker: Youngsoo Shin, Korea Advanced Institute of Science and Technology, Korea
Time: 2:30pm - 3:10pm

Abstract: Machine learning is an ideal toolbox to quickly predict the result of a complicated and time-consuming process. Two example applications of machine learning for lithography optimizations arereviewed in this talk: optical proximity correction (OPC) and etch proximity correction (EPC). In OPC application, extracting polar Fourier transform (PFT) signals for each edge segment to be corrected and use them to drive a machine learning network helps reduce the number of network input parameters while accurate mask bias value is obtained. In EPC application, a network is constructed to predict etch bias values from actual measurement. EPC based on this network is shown to provide a more accurate EPC solution than EPC methods based on rules or models.

Title: Machine Learning for Variability Modeling and Mitigation of Energy-Constrained Systems
Speaker: Mehdi Tahoori, Karlsruhe Institute of Technology
Time: 3:50pm – 4:30pm

Abstract: Energy-constrained Systems-on-Chips (SoC) are becoming major components of many emerging applications, especially in the Internet of Things (IoT) domain. Although the best energy efficiency is achieved when the SoC operates in the near-threshold region, the best operating point for maximum energy efficiency could vary depending on process corner, operating temperature, running workload, and the power-gating state (power modes) of various SoC components. In this talk we review various machine-learning based schemes, both after the manufacturing (during testing) and at runtime to predict and tune the SoC to the most energy efficient operation point.

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Title: Application of Boolean Sampling and Learning to the Error Localization and Correction in Semiconductor Designs.
Speaker: Victor Kravets, IBM Research, USA
Time: 4:30pm – 5:10pm

Abstract: Many things can go wrong when designing and manufacturing semiconductor chips, including errors in design specification and failures due to process variability. For the reasons of cost-saving in the design development cycle, it is therefore desirable and often time-critical to have methods that track down and correct functional problems within a design. In this presentation, we describe how rigor of Boolean reasoning can help in localizing and correcting design errors. We examine how Boolean rigor adapts to the knowledge of a design's behavior. A new sampling technique is introduced that make the process of solving functional queries about the design computationally scalable. It is used in the development of a new engineering change order engine, that has been successful in producing rectifications that meet designer's estimate of the smallest change.

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