Theme: Semiconductor Equipment

- Sub theme: AI/ML Solution for semiconductor equipment & process

Chip makers have been using AI-based methods in many areas of IC technology development and high-volume manufacturing. The complexity and the miniaturized scale of the semiconductor process forced fabs to gradually replace rule-based systems with AI-based systems especially focused on advanced semiconductor metrology/inspection and fabrication process.
However, AI is not one size fits all method. In each process, measurement, and inspection, the most suitable AI algorithms need to be selected, adopted, or developed by data scientists who also have expertise in semiconductor processes & equipment knowledge. Several different algorithms may be stitched to build one model (a hybrid approach), and even worse, there are thousands of process steps and numerous equipment and process chambers but outcomes of each process can be often simplified as yields which lead to almost impractical signal to noise ratio. Moreover, selected algorithms need confirmation by process & equipment experts both by the large set of training/test simulations and by the physicality of the cause-and-effect.

Overcoming the challenges outlined above will require extensive research to address the following objectives. 1) Exploring various algorithms beyond conventional machine-learning methodologies to properly represent equipment state, equipment to final outcome prediction capabilities in real-world data scenarios; 2) exploring new approaches to assess where data are too sparse, noisy, or are otherwise inadequate to build real world predictive models; to generate testable hypotheses; to identify high-value experiments that could alleviate the problems of data shortfalls, and to quantify the confidence of predictions outside of the training space. 3) Exploring and developing new AI architectures and approaches by leveraging physical laws and models governing complex physical phenomena in semiconductor manufacturing processes. 4) Exploring approaches to learn with limited labeled data and to find lighter/faster networks to reduce the inference time. 5) Exploring multimodal learning algorithms from various types of data: images, spectra, and other equipment sensors. 6) Exploring learning techniques in spatio-temporal domains, beyond the limits of learning based on existing spatial domains.

As part of this program, various solutions related to machine learning generalization and links to equipment controls are of interest. These include, but are not limited to:

1. Network learning based cognitive equipment validation system
2. Spatio-temporal anomaly detection technique using small (or large) training data for semiconductor equipment
3. AI based equipment matching
4. AI based equipment signal processing & control
5. Label-efficient machine learning in semantic segmentation/regression
6. Network pruning for fast and light inference model in production
7. Multimodal representation learning for equipment diagnosis and metrology/inspection

※ *The topics are not limited to the above examples and the participants are encouraged to propose the original idea.*

※ *Funding: Up to USD 150,000 per year*