Project: A Convolutional Approach to Photolithography Process Control

Project Description:

Photolithography is responsible for projecting the placement of each layer on a chip. These projections must be exact to within a few nanometers, and in several dimensions. We call this "registration" (reg), with important characteristics such as connections between layers being called "critical dimensions" (CD). Photolithography tools are not perfect, and each comes with certain flaws that must be accounted for to achieve the required precision. These imperfections also build up layer to layer since the offset in one layer must be accounted for in the offset of the layers above it.

We have a supervised APC (advanced process control) system currently in place that accomplishes this, but it too is imperfect. It has tendencies to overfit which result in what we call "dedications", wherein certain tools are restricted for certain processes, which greatly reduces manufacturing flexibility. Our objective is to improve our current scheme by replacing it with a convolutional classifier, which we believe will greatly enhance the precision and comprehensiveness of our photolithography system. In the short term this would require setting up a dataflow and a properly curated set of process data so that we can train a preliminary proof-of-concept model. Long term, the idea is to completely replace our current photolithography APC with the model we develop.

Statistical process control (SPC) is a huge deal in our industry and as such, we *__need__* some method of enforcing SPC accountability onto the model. Given that it is "unsupervised", this poses some challenges as each process does not have an inherently transparent calculation in the way the current supervised algorithm does. As such we also want to develop a means of cross-referencing the outputs that the model provides by essentially backtesting every run to discard any externalities of the unsupervised model in order to avoid runaway effects such as overfitting or hallucination. We have a robust SPC solution

As a basis, you will be working with Oracle SQL Database, Microsoft SQL Server, C#, Python (expect NumPy, Keras, JAX, Theano/TensorFlow, Pandas, etc.), vSphere and/or Microsoft Azure, camLine's SPACE, and more.

Deliverables:

- **Phase 1:**
    - Database
    - Data flow into database
    - Proof of concept model
- **Phase 2:**
    - Fully comprehensive and trained model
    - SPC integration

Preferred fields: computer science, mathematics (linear algebra emphasis), electrical engineering.