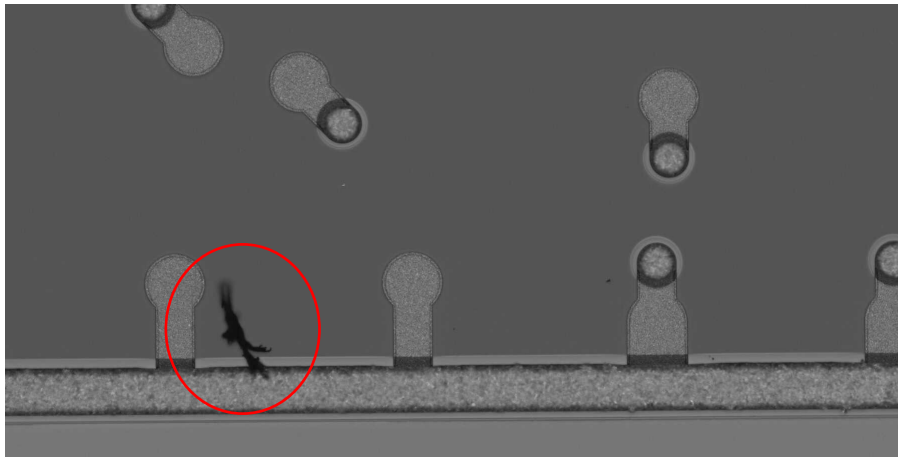
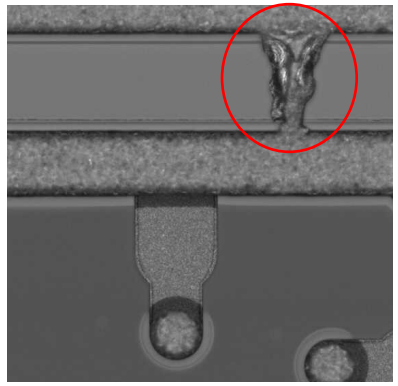
AI/ML assisted fault detection in foundry processed devices

- Highly accurate fault detection in foundry produced microelectronics is crucial to ensuring quality of devices that leave the foundry
- However, many current IC defect detection flows are human-centric and have potential to be a **bottleneck** in the foundry
- Objective of this study is to find ways to leverage recent advances in AI/ML to **enhance and accelerate** the fault detection flow

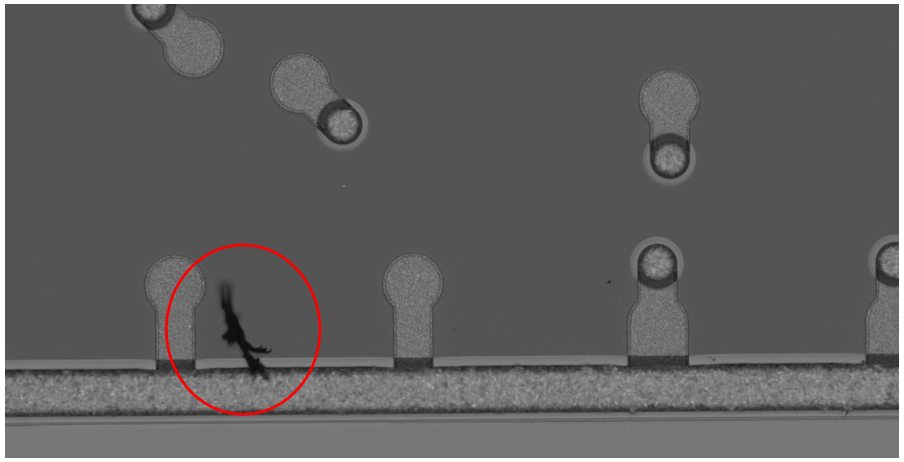


Sample defect- foreign material in IC spanning multiple structures

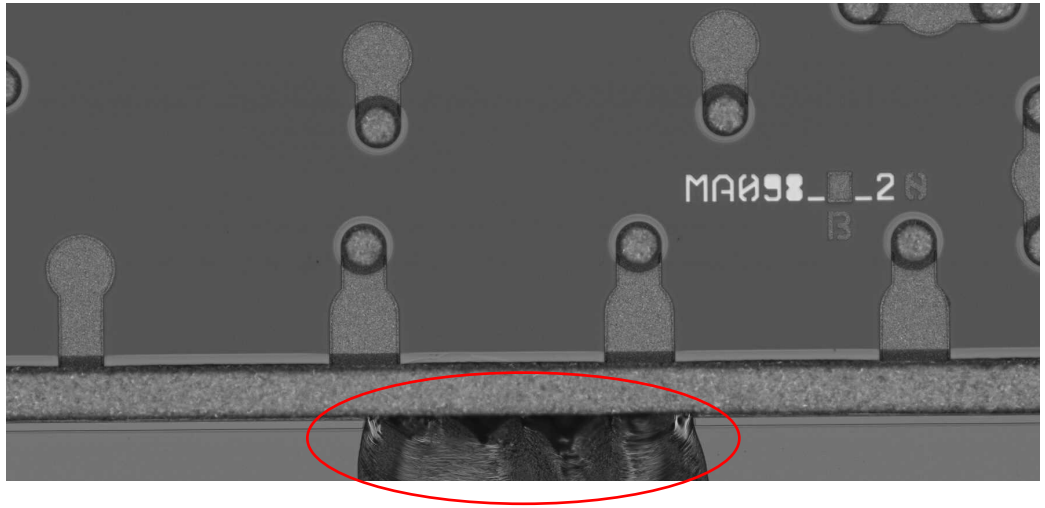
Challenge 1: Many different types of defects



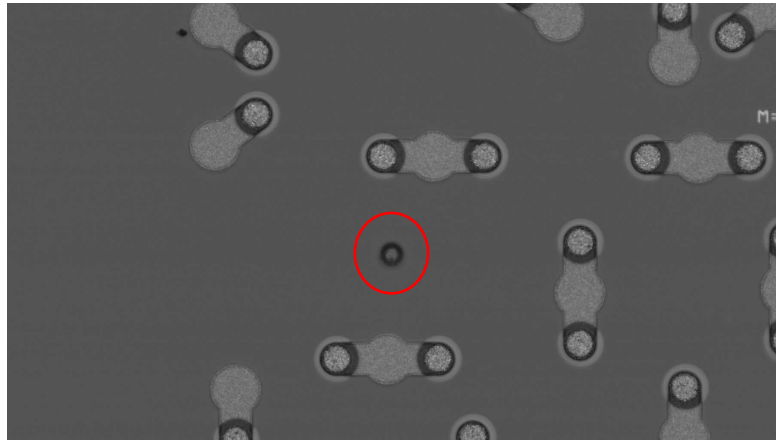
Metal bridging



Foreign material



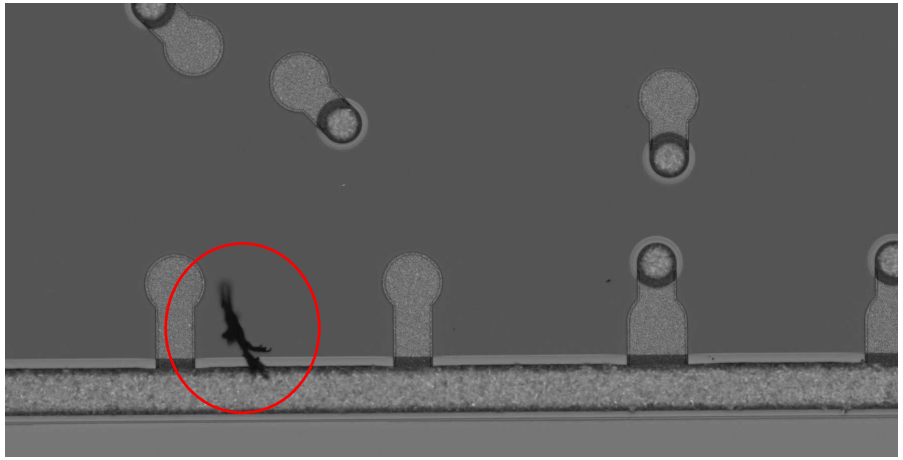
Chip out



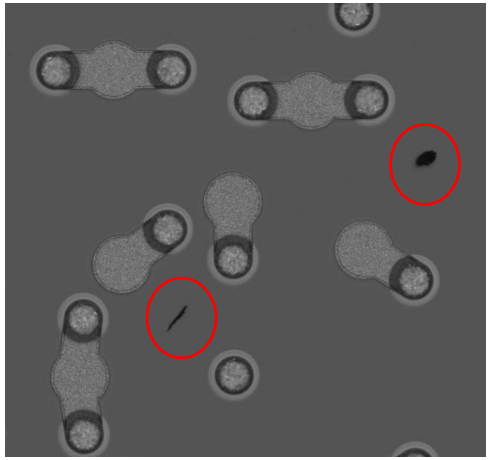
Wafer pitting

Defects have many different shapes and sizes

Challenge 2: Not all defects are show-stoppers



Foreign material crossing boundaries

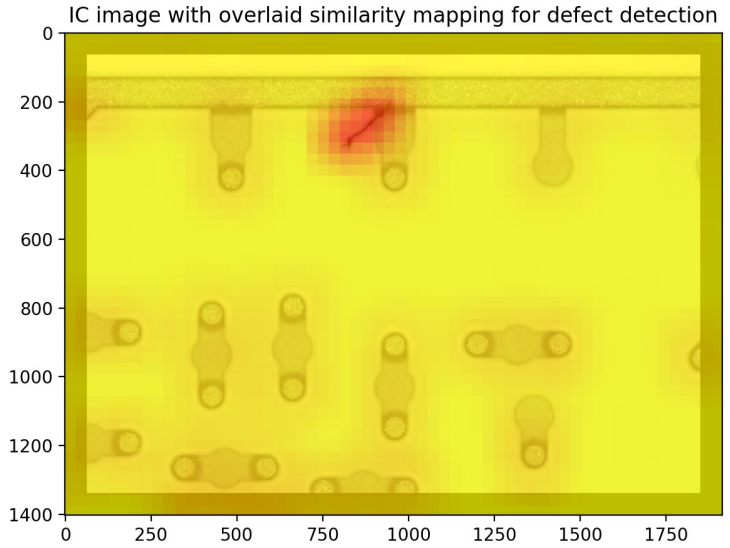


Foreign material in IC wafer

Not all defects impact performance of IC, and some are considered acceptable

Project objectives

- Due to **large variety of types of defects**, training a model to identify defects using a completely supervised based approach is **not viable**
  - **Difficult to collect large training corpus** with many samples of each type of defect
  - Want model to be able to **identify when IC has a defect even when defect example** was not included in data used to train model
- Better approach is to train model that **learns what IC should look like**, and to recognize when there is a defect
  - Involves development of anomaly detection models
  - Stretch goal is to find a solution that makes use of **pretrained feature extractors**



Sample similarity mapping generated using deep image embeddings for defect detection

Thank you!

If there are any questions, or if you have further interest, please reach out to:

- Andy Rittenbach: arittenb@isi.edu
- JP Walters: jwalters@isi.edu