

Towards full automation of bond pad imaging in microchips via object detection

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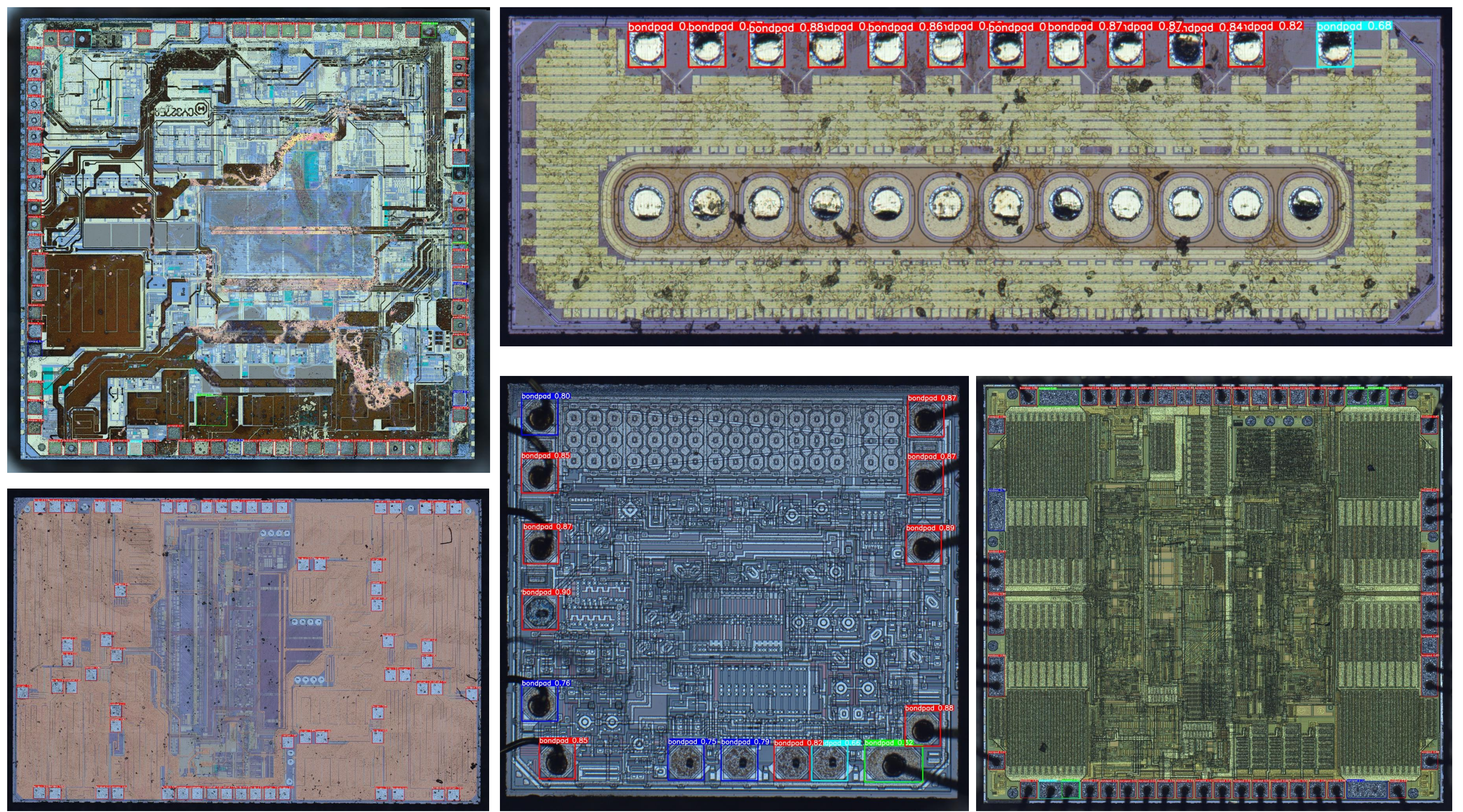
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Motivation and use-cases

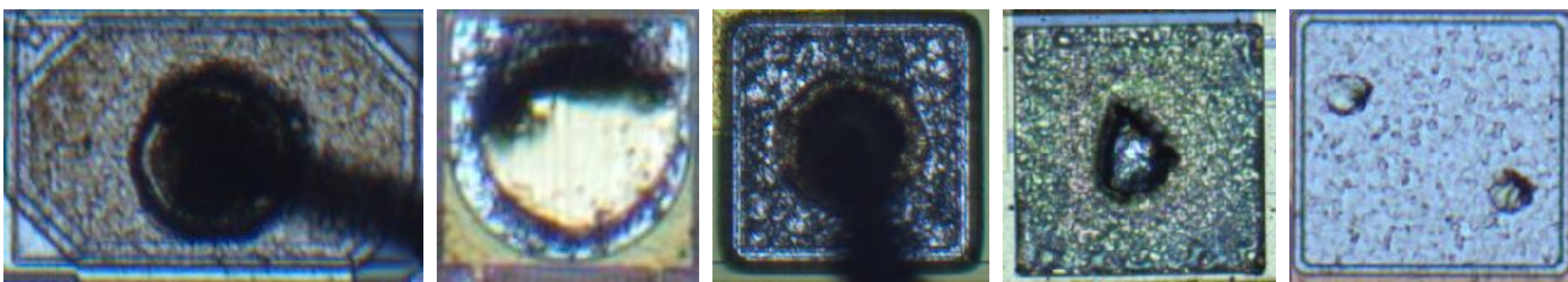
- Crack inspection of bond pads is a critical quality control step, often hindered by the large volume of samples requiring analysis
- Cracks are located beneath the bond pads, and their detection requires prior identification of the bond pads
- The inspection is typically manually and time-consuming, placing a significant burden on engineers tasked with visually inspecting each sample (e.g., >250 bond pads) for defects.
- While some automated approaches have been developed, they are generally limited to specific sample types, reducing their applicability in diverse manufacturing environments.
- Existing ML-model lacks generalization and needs retraining for every new sample type.

Bond pad detection model

- Single-shot object detection model:
YOLOv9
Trained on 81 LM images of 22 samples
Evaluated on 26 LM images (includes 7 new test samples)
- Dataset:
Training: 11399 image patches (640x640px)
Validation: 3404 image patches (640x640px)
- Generalizes on more than 25 sample types
- 30x faster than conventional image processing approaches
- 0.98 precision and mAP0.5-0.95 of 0.85

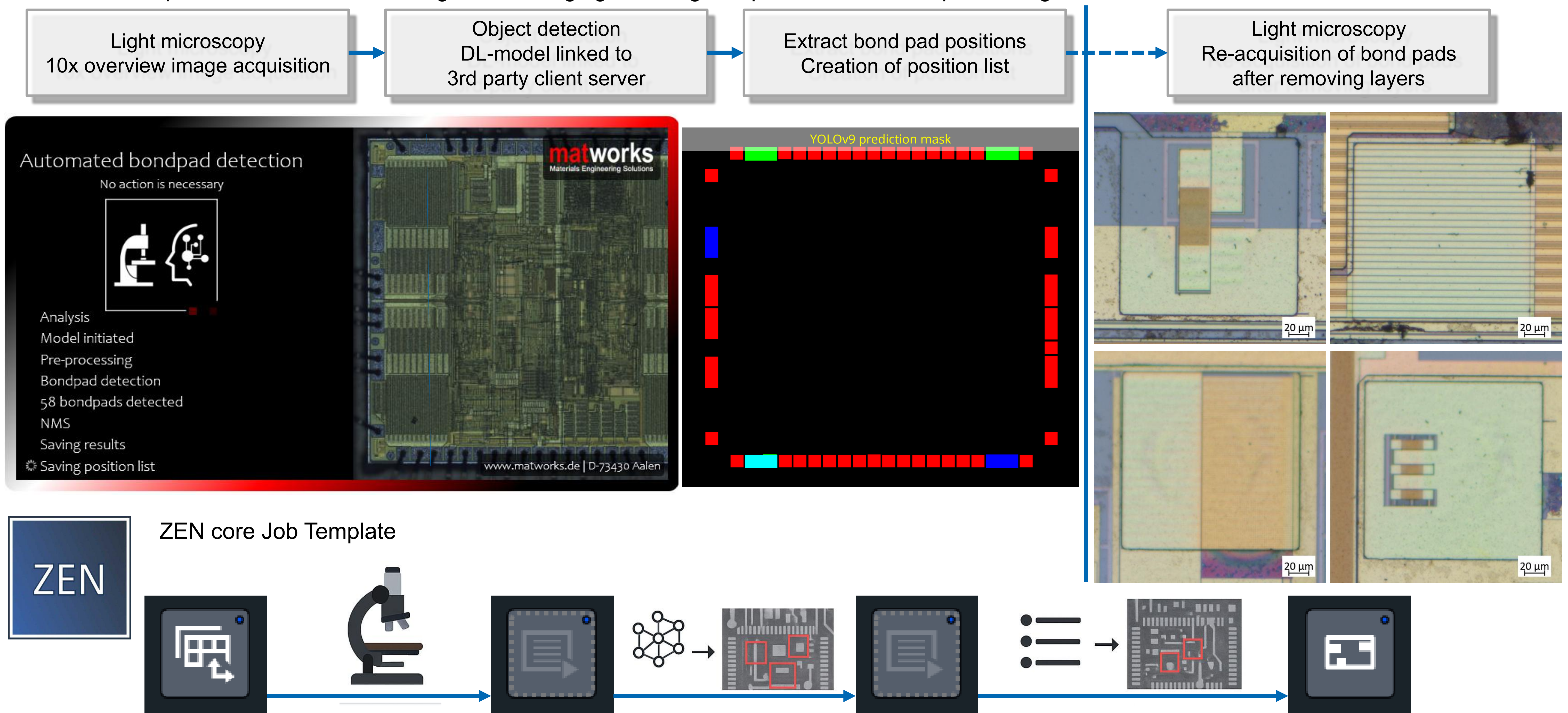


Diversity of bond pad dataset



Semi-automated imaging and analysis pipeline for the robust localization of bond pads

- Integration in ZEISS ZEN core microscopy software environment
- Outputs precise spatial coordinates of each detected bond pad, allowing further mechanical layer removal for failure analysis
- Generation of positions list to facilitate targeted re-imaging following sample modification or processing



Conclusions

- Generalized model valid across 25+ bond pad types
- Integration evaluated for ZEN core platform
- End to end workflow suitable for correlative microscopy

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