

Machine-Learning Based Solution to Detect Defects in Semiconductor Manufacturing Process



Summary

A big semiconductor company was struggling with slow inspections. Workers checked wafers by hand, which took too long. Small defects were easy to miss. This led to delays, wasted time, and unhappy customers.

INTECH built an AI tool that scans wafer images and finds problems in seconds. Now the client catches defects early, moves faster, and makes better chips.

About the Client

Our client makes chips used in things like phones, computers, and cars. Their wafers need to be perfect. Even a tiny flaw can ruin a whole batch.

Manual checks weren't good enough anymore. They needed a better way to keep up with the speed of modern chipmaking.

Client's Challenges: Slow Inspections and Missed Defects

Inspecting wafers by hand was too slow. Workers took hours to look for flaws. Many small defects were missed. Production lines had to stop while wafers were checked. Mistakes slipped through and caused expensive problems later.

The client wanted faster, more accurate inspections to keep quality high and production moving.

Key Challenges:

Time-Consuming Checks

Manual inspections slowed everything down.

Overlooked Flaws

Tiny defects were hard for people to see.

Complex Designs

New wafers had patterns that were tough to check by eye.

Costly Mistakes

Missed defects led to rework, waste, and returns.

No Tracking

Manual checks didn't keep records of defects to help improve.

Manual checks were too slow and unreliable, causing delays, waste, and missed chances to improve.

Intech's Solution: Fast, Smart AI Inspections

INTECH made an AI system that looks at wafer images and spots defects instantly. The AI knows what flaws look like and keeps learning over time.

Now, inspections happen much faster. Staff can see clear results on a simple screen. They can act quickly and keep wafers moving through production without long waits.

Here are the key features:

Instant Checks

- ▶ AI scans images in seconds, not hours.

Accurate Results

- ▶ Finds 32 types of defects, even tricky combinations.

Learns Over Time

- ▶ Gets better the more it inspects.

Simple Dashboard

- ▶ Shows easy-to-read results so staff can act fast.

Detailed Records

- ▶ Saves data on defects so trends are easy to see.

Handles Complex Patterns

- ▶ Works even with the newest wafer designs.

Implementation process

First, we collected lots of real wafer images with different types of defects. We trained the AI on these pictures so it could recognize flaws.

Then we set up the AI on the client's production line. We tested it with live wafers until it caught defects quickly and accurately. Finally, we trained staff on how to use the new system and trust what it showed.

Here is how we did it:

- 1 Building a Defect Library**
Needed many pictures of real flaws to train the AI.
- 2 Training the AI**
Made sure it could tell defects apart from harmless marks.
- 3 Integrating Smoothly**
Connected the AI with existing machines without slowing production.
- 4 Fine-Tuning**
Balanced speed and accuracy so the AI worked fast without missing anything.
- 5 Staff Training**
Showed workers how to read results and trust the system.

Business Impact

The new system made inspections faster right away.

The impact of our solution includes:

More defects caught early, avoiding costly problems later.

Inspections took minutes instead of hours, speeding up production.

Accurate records helped the client spot patterns and improve processes.

The client saved time, cut costs, and kept customers happy with better products.

INTECH's AI turned inspections from a slow, stressful task into a fast, reliable process that keeps production moving.

Tools and Technologies Used

We used proven AI tools that are easy to update and keep working well.

- ✦ **Deep Learning:** Helped the AI learn to find defects with high accuracy.
- ✦ **Neural Networks:** Allowed the system to classify many defect types fast.
- ✦ **Image Processing:** Made small flaws stand out in wafer pictures.
- ✦ **Defect Database:** Gave the AI examples to keep improving.
- ✦ **Clear Dashboard:** Let workers see results at a glance and act quickly.