AI for semiconductor industry

Czech-Taiwan Electrical and Electronic Industries Workshop
6th May 2021

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AI CHECK

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Semiconductor and AI industry relationship

Semiconductor Industry Leads in Artificial Intelligence Adoption (Accenture, August 2019)

AI Industry

AI has the potential to generate **huge business value for semiconductor companies** at every step of their operations, from research and chip design to production through sales.

(McKinsey&Company, April 2021)

symbiotic relationship

Semiconductor industry

AI industry **needs** end-to-end solutions for specific industries, ecosystem development, and **innovation** that goes **far beyond improving compute, memory, and networking technologies.**

(McKinsey&Company, December 2018)

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AI input: Data sources

Sounds

machines, people, environment

Images

scanners, sensor outputs

Speech

interaction between coworkers, requests for information and assistance

Videos
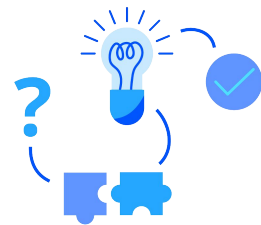
cameras, mobile phones

Sensors outputs

temperature, humidity, luminosity

Historical data, expert knowledge and other sources of information
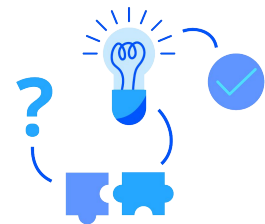
AI output: Benefits

Artificial intelligence is able to process large amount of data, predict outcomes, automate routine tasks, monitor surroundings, news and internet and make decisions.

Quality control	Predictive maintenance	Automatization	Adaptation

AI output: Benefits

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Quality control	**Predictive maintenance**	**Automatization**	**Adaptation**
Visual inspection			
Machine sound inspection			
Sensors analysis			

QA: Visual inspection

Input data

Images from cameras, microscopes, or **scanning-electron microscopes**.
Pair photos with batch IDs.

Microscope Valley

Tescan, Delong Instruments, Thermo Fisher Scientific

30% of all electron microscopes is made in Brno

On-line training of AI model

Batch is reported faulty – models are retrained using images from faulty batch as negative training samples. Other possible faulty batches are identified. Improve over time.

Delong Instruments LVEM

QA: Sound inspection

Input data

Audio records from microphones close to production lines and machines.

Joined research with Speech@FIT VUT

Brno VUT university is among **5 top the most influential organization** in speech recognition together with Google, Facebook, IBM and Carnegie Mellon University (Aminer, April 2021)

Anomaly detection

Automatically remove noise made by humans. Detect anomalies during manufacturing process. Report them, inspect them and learn from them.

spectrogram
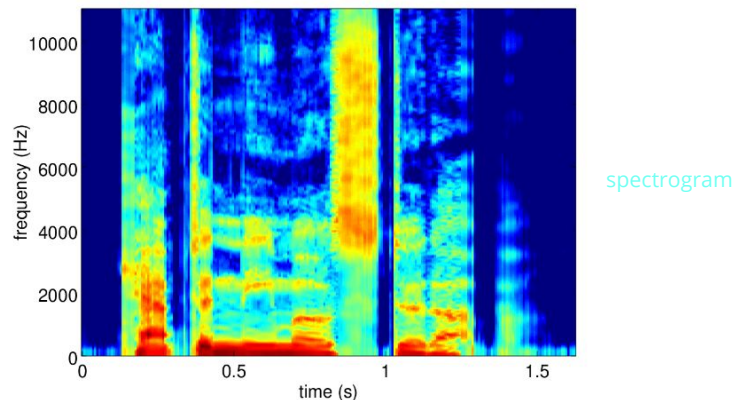
QA: Sensors analysis

Input data

Data both from tool operations and the wafer process status. Chamber statuses, robot arm's position, temperature, specifications and human reports (read them and parse them automatically).

Use history to predict future

Find out which information affect quality of products and which don't. Learn to predict risky conditions and prevent or compensate for deviation.
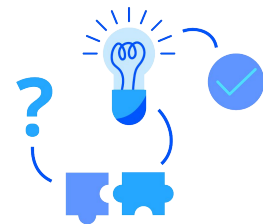
Internal IoT systems

As fabrication is scaling up (from 200mm to 300mm and above), more sensors can appear on tools to increase available data.

Fab's equipment and processes of many different types create a **big data challenge**.

Aggregate information, organize and analyze them and **let system safeguard manufacturing process**.
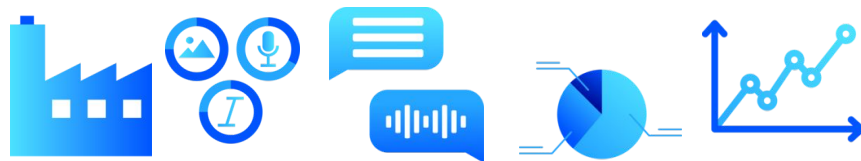
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Quality control	Predictive maintenance	Automatization	Adaptation
	Machine health		
	Machine service and planning		
	Cost reduction		

Predictive maintenance

Schedule service and maintenance when needed to save both time and money.
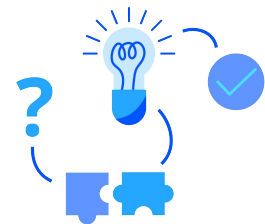
Machine health

Constantly watch status of hardware and predict outages and forced shutdowns.

Machine service planning

Follow both legal standards and real machine health to plan work of service department.

Cost reduction

Lower risk of outages and purchases planned in advance reduce cost of machine maintenance.

AI output: Benefits

Artificial intelligence is able to process large amount of data, predict outcomes, automate routine tasks, monitor surroundings, news and internet and make decisions.

Quality control	Predictive maintenance	Automatization	Adaptation
		Work scheduling Process and task mining Semantic knowledgebase	

Automatization

Move your processes to the next level with AI.
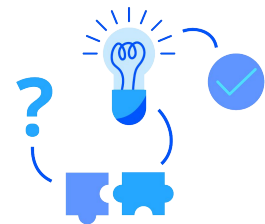
Scheduling

Optimize tasks order, minimize reconfiguration of production lines, react immediately to shortages or changed deadlines.

Process and task mining

Find bottlenecks and inefficiencies in your processes to increase productivity.

Semantic knowledge base

Improve onboarding and enhance performance of teams by tools helping you to know what you do not know (semantic search, scenarios, context).

AI output: Benefits

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Quality control	Predictive maintenance	Automatization	**Adaptation**
			Risky behavior detection
			Web monitoring
			Human resources

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Adaptation

Adapt quickly to changing environments.

Employee risky behaviour detection

Using logs, reports and visual records, detect anomalies in behaviour to prevent risky situations (cluster people by similar job responsibilities).

Web monitoring

Monitor availability and prices of raw materials, financial situation of suppliers and customers using web, news and reports.

Human Resources

Scan web, papers and social networks for people with right skill sets and mindsets for your open job positions.

Questions? Ideas? Feel free to contact us.

Thank you for your attention.

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