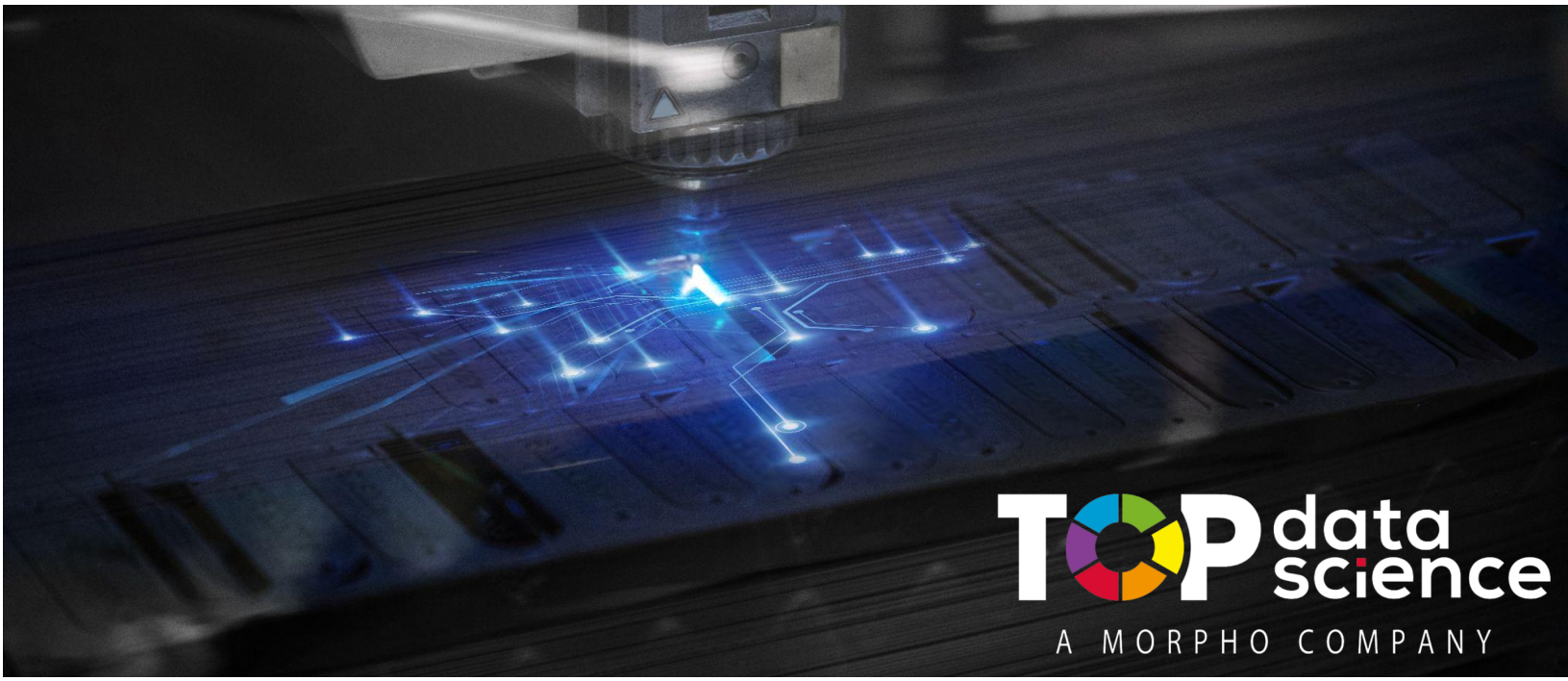
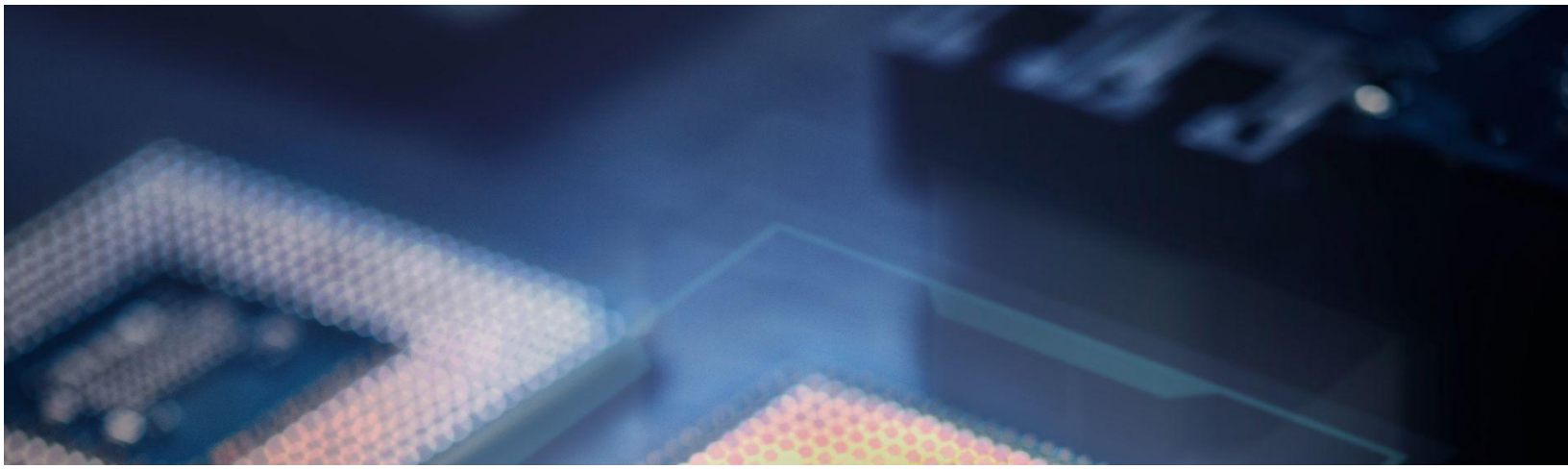
Whitepaper

Quality Assurance with Industrial Computer Vision



AI-based computer vision solutions for quality assurance create concrete business value in today's world. Such solutions can either partially or fully automate various time-consuming and error-prone manual inspection tasks. Scalable nature of these technologies enable significant cost savings, productivity improvements, and standardization of quality monitoring processes.



Executive summary

Traditional **computer vision** algorithms have been utilized for several years in various tasks in the industry. With recent advancements in **artificial intelligence (AI)** based computer vision algorithms and significant hardware improvements, employing computer vision solutions in production is more lucrative than ever. One of the common use cases for industrial computer vision is quality assurance.

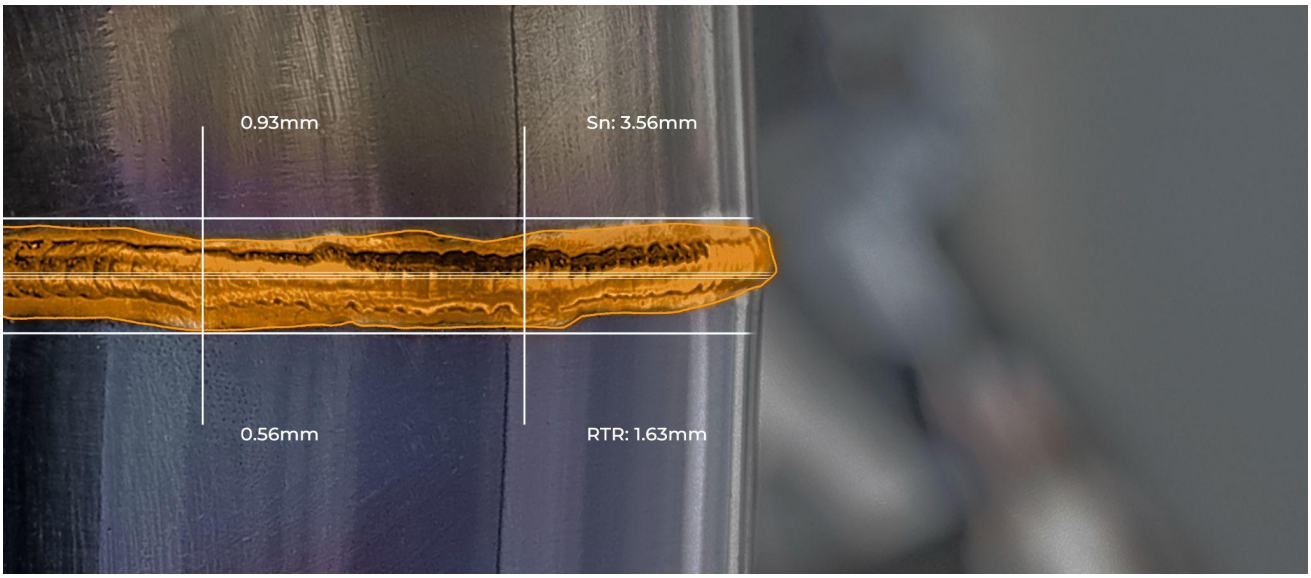
Companies that need to monitor the quality of their product lines or assembly processes are moving more and more away from manual monitoring that relies on human visual inspection. We help our clients in this transformative journey with accurate and scalable quality assurance solutions. Our industrial computer vision technologies can be easily deployed on top of AWS, Microsoft Azure, or Google Cloud Platform and can utilize the full capabilities of such ecosystems.

We list the key benefits of our solutions in the following box on the right:

Key Benefits

- **Cost Savings:** Automating quality assurance processes results in significant reduction in costs by freeing up manual inspection resources.
- **Reduced Faults:** While quality assurance reduces the prevalence of faulty products or wrong assemblies, with computer vision based solutions the performance of quality assurance itself increases significantly as well.
- **Scalability:** Unlike traditional computer vision systems, AI-based computer vision solutions do not rely on hand-tuned rule-based logic. As visual attributes (contours, shapes, textures, etc.) for quality assessment are learned from raw images in a data-driven manner (e.g. supervised learning), our solutions have high scalability and generalizability.
- **Standardization:** With the help of AI, quality monitoring becomes objective, reproducible, and traceable. Person-dependent, subjective quality assessments are avoided and consistency is established.

Case: Weld Seam Quality



Deep learning based segmentation algorithms perform critical measurements with high accuracy for various weld seam types.

Problem Landscape

Welding is a significant part of various industrial applications and especially the automotive sector has several of them. For instance, various components in cars such as rails under car seats have welded metal parts. As these welded parts are exposed to different forces during their lifetime (e.g. shear, moment, vibration), weld seams need to satisfy certain physical measurements for ensuring safety and quality. These measurements are specific to each weld type and there can be hundreds of different weld types in several production sites. This quality assurance process is very time-consuming as it requires several manual measurement steps on digital images. Furthermore, there is significant measurement variability between different human operators which leads to lack of standardization and coherence.

We are proud to have Brose, leading mechatronic component producer and supplier in the global automotive industry, as our customer who currently utilizes our solutions.

Solution Technology

We utilize advanced AI algorithms, i.e. **deep neural networks**, to perform **instance segmentation** of various objects (weld seams, welded parts etc.) in captured weld seam images. Our AI models are trained in a supervised manner and are customized for high fidelity contour details, batch processing, and fast inference. We have deployed and

operationalized our AI models in the cloud and also developed user-friendly software solutions for operators and line managers. Our solution grants flexibility and control to our clients when monitoring the welding quality in various production lines in several countries.

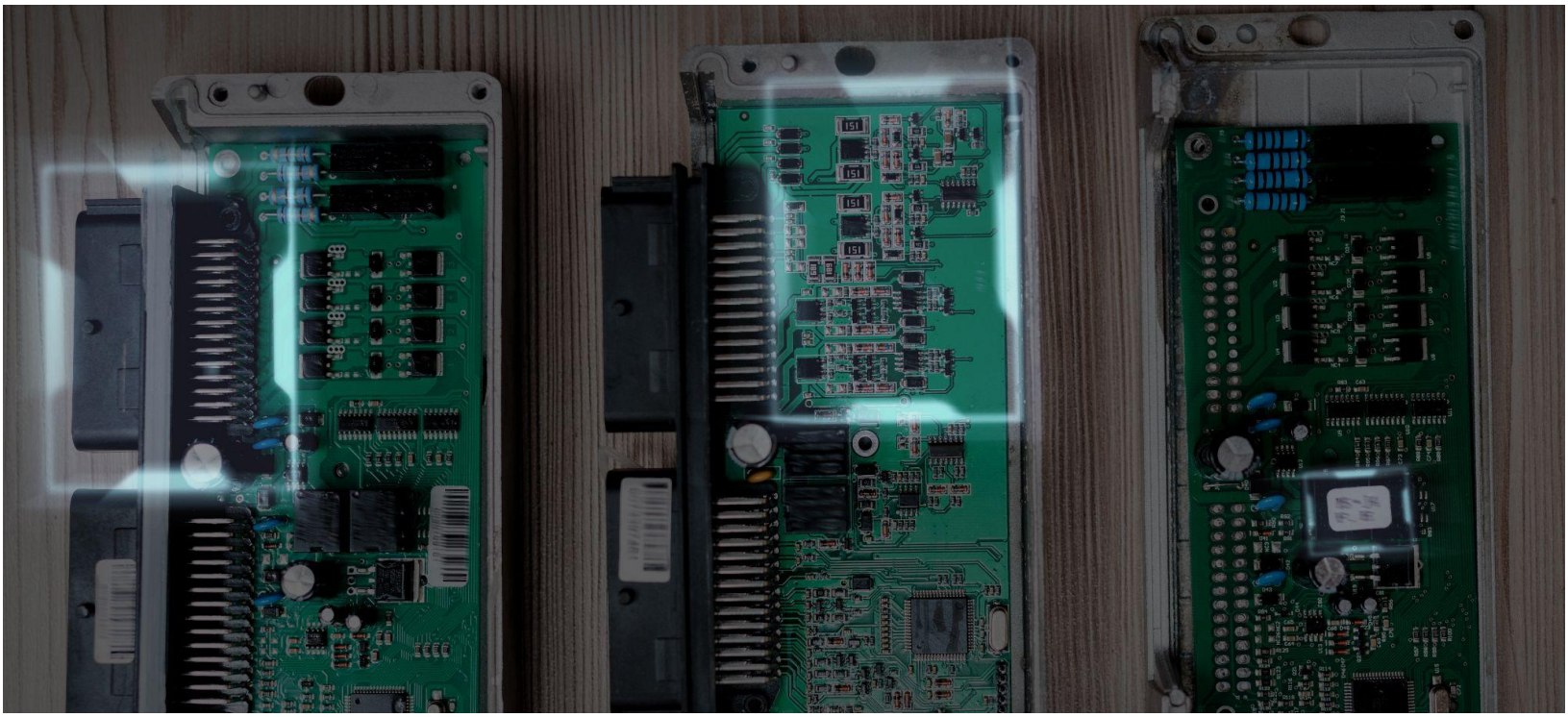
Flexibility & Scalability

Our solutions, both computer vision algorithms and production software, are developed with flexibility and scalability in mind. In our computer vision algorithms we utilize deep learning to avoid traditional rule-based logic. This ensures high generalization power across different welding types, modular design, and less technical debt. Our production software enables traceability and intuitive monitoring of the welding process as well as possibility of extracting detailed reports. Whole solution can be deployed to any infrastructure, local or cloud (including platforms such as Amazon Web Services, Microsoft Azure, and Google Cloud Platform).

Business Value

Our weld seam quality inspection solution enables business value in several dimensions. First, by replacing the manual measurement processes, our clients benefit from fast quality assessment and significant cost reduction. Secondly, AI-based computer vision systems generalize well for different weld seam types. This eliminates the need to implement specific rule-based logic for each new weld seam type in the future. Finally, our solution establishes a standardization in the quality assurance process. We eliminate the quality assessment variability coming from subjective opinions of different operators. Our software solution enables the production managers to monitor the quality of the welding processes in a holistic manner.

Our solution was the winner of the *Brose Innovation Award* in 2020. Read more here.



Case: Electronic Assembly

Problem Landscape

Electronic products are composed of various small components that need to be assembled in a correct manner and in correct order for proper functionality. Typical quality assurance of the assembly process includes manual inspection of the presence of various electronic components as well as other mechanical parts such as screws and bolts. This process is error-prone and very time-consuming. We provide effective computer vision solutions to enable high quality quality monitoring for our customers.

Solution Technology

By employing deep learning based **object detection** algorithms, we enable highly accurate monitoring of electronic assembly processes. Our computer vision solutions focus on two key features: speed and accuracy. In typical assembly environments visual inspection (manual or automatic) of the product parts has to be performed in a fast manner. Running cutting-edge AI models with low latency in real-time without sacrificing detection accuracy is an engineering problem we successfully tackle. Furthermore, our solution enables fast training of AI models with

realistic synthetic images to increase the robustness of the solution in varying lighting, camera angle, camera distance, and focus level conditions.

Business Value

By developing cutting-edge computer vision technologies, we provide accurate monitoring of the electronic assembly process for our clients. This leads to less errors and faults in the assembled products which translates to higher product quality, higher customer satisfaction, lower manual inspection resources and lower repairing and replacement costs.

Conclusion

Quality assurance systems are becoming more and more autonomous with the help of effective artificial intelligence and computer vision technologies. Top Data Science brings the best practices, state-of-the-art tools, and world-class expertise in AI and software engineering to help companies build computer vision solutions for industrial quality assurance.

About Top Data Science

A highly experienced team of data scientists, software engineers and business development professionals from Helsinki, Finland.

Excellent customer track record in Finland, Germany, Denmark, Japan, Vietnam, Israel, USA

100+ AI/Machine Learning projects & solutions delivered

AAA credit rating 2018-2021

Part of Morpho Inc. (https://www.morphoinc.com/en) since 2018

Customers & Partners