



## SOLUTION SHOWCASE MUSASHI

### AI at the Edge with NVIDIA Jetson

#### Challenge

- > Reduce inspection costs from 30% of total manufacturing cost
- > Find inspection experts for a tedious job
- > Increase inspection accuracy, capabilities, and speed
- > Build and train an AI solution for the manufacturing industry

#### NVIDIA Solution

- > High-speed parallel computing with GPUs for training and inference
- > Ready-to-use AI software stack across platforms
- > Small form factor with low power consumption

#### Results

- > Compact and robust design meeting industrial requirements
- > 20% of overall processing time optimized and automated
- > Clear maintenance and update path with NVIDIA JetPack

## TRANSFORMING MANUFACTURING THROUGH AUTOMATED OPTICAL INSPECTION

*"Our vision is to explore creative manufacturing while contributing to society. Visual inspection is a high cost, time consuming task that uses skilled workers to maintain quality. With Jetson TX2 and AI we have built an autonomous optical inspection (AOI) system that contributes to better quality and accuracy. With AI and employees working together it allows us to reduce costs, be more efficient, and deploy resources to more effectively."*

- Hiroshi Otsuka, CEO, Musashi Seimitsu Industry Co., Ltd.

### Neural Cube, a Robust Platform with Software Plug-and-Play Capability for Industrial Environments

Optical inspection for defects in gears and welding has traditionally been a manual process and takes up to 20% of Musashi's manufacturing time. This type of work is repetitive, stressful, and not very engaging. It also requires a large number of trained inspectors, which limits the operational capabilities and potential growth of Musashi.

With the Neural Cube, this process is automated with a robotic arm that moves the part to be inspected from a tray into an illuminated box. Here, it's rotated in front of cameras and the images are analyzed by NVIDIA® Jetson™ TX2 to identify defects.

### NVIDIA Platform

Musashi used NVIDIA DGX Station™ to develop and train their Inception v2 Keras network algorithms. The optimized network was then processed using NVIDIA Jetpack™ and NVIDIA TensorRT™ for inference and deployed in a Jetson TX2. Jetson TX2 comes with preinstalled software and peripheral support, allowing Musashi to quickly build and deploy Neural Cube to the manufacturing floor. It analyzes the images, identifies and categorizes defects, and communicates next steps to the

### Products Used

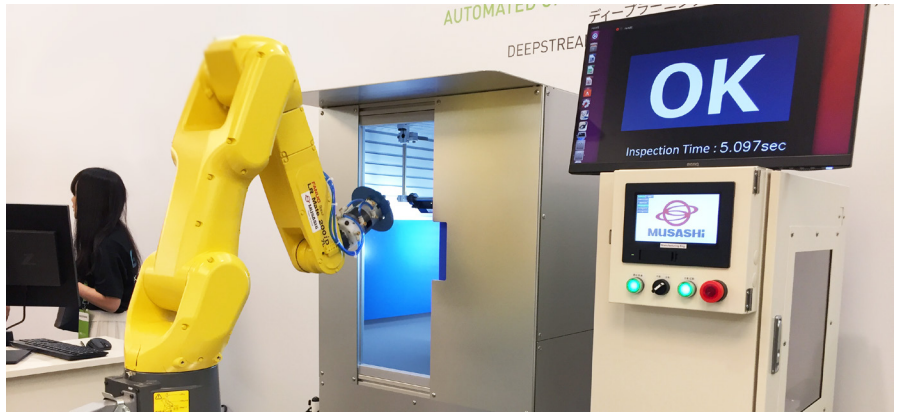
- > Jetson TX2
- > JetPack 3.3

### Processing Engines Used

- > Industrial inspection on NVIDIA Pascal™ CUDA® Cores
- > Control and management on ARM processors

### Software Used

- > JetPack and DeepStream SDKs
- > Keras and TensorFlow for deep learning inference
- > OpenCV for the vision system
- > CUDA for GPU acceleration



robot arm. Good parts are placed in the next stage of manufacturing, while faulty parts are rejected.

This first version of the software takes ~5 seconds to find 1 mm defects on gears and ~7.5 seconds to find 0.5 mm defects on welding with 99% accuracy. Jetson allows Musashi to gather more data and continually optimize their algorithms while Neural Cube is in operation.

### Mushashi Results

Musashi's inspection employees can now focus on more value-added tasks, and Musashi can expand its capabilities without having to hire new people. Inspection data is fed back to the algorithm, improving its performance and overall manufacturing results. The ability to perform training on DGX Station and quickly deploy a trained inference algorithm to Jetson on the manufacturing floor enables Musashi to evolve and adapt to manufacturing needs.

### About Musashi

Musashi Seimitsu Industry Co., Ltd., is a global auto parts Tier 1 company for automobiles and motorcycles. Headquartered in Toyohashi, Japan, it owns 33 manufacturing sites spread across Europe, North and South America, China, and Southeast Asia. Based on the philosophy "More human-friendly work for people," Musashi is working on innovation by implementing AI at manufacturing sites.

Musashi specializes in designing, developing, and manufacturing powertrain products such as differential assemblies, planetary gear assemblies, transmission gears and assemblies, and reduction gears for xEVs, which are supplied to global OEMs and Tier 1s. Linkage and suspension products are also strategic products of Musashi.

