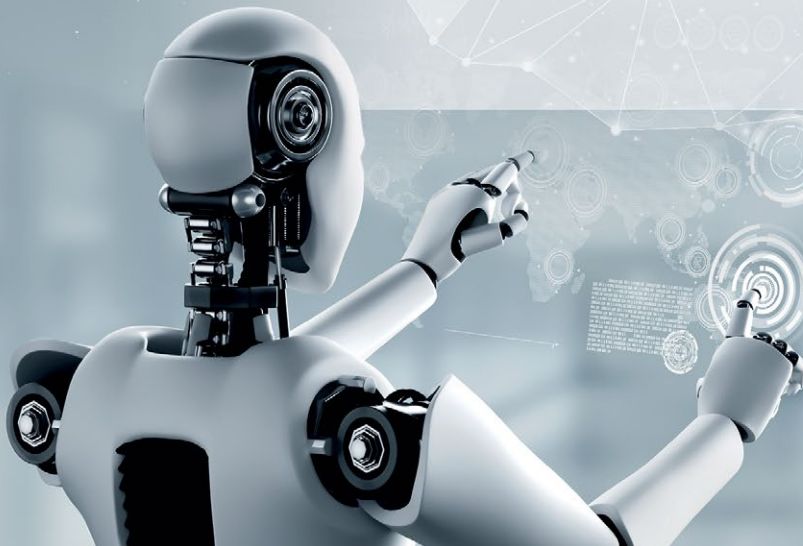




DEEP LEARNING VISION SYSTEMS

Machine vision with artificial intelligence
AI tools by VisionTools





Deep Learning Vision Systems

AI – Artificial Intelligence

Classical machine vision was and is superior to human capabilities in terms of speed, repeatability and accuracy and achieves best results in quantitative measurement of structured scenes.

In contrast, humans are suited to learning by observing examples or specifications of test parts. In this way, he can distinguish between slight errors in appearance, such as those caused by perspective distortions or differences in brightness, and actual functional errors. It can assess for

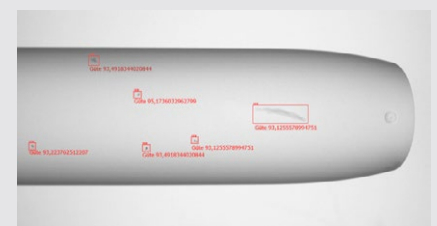
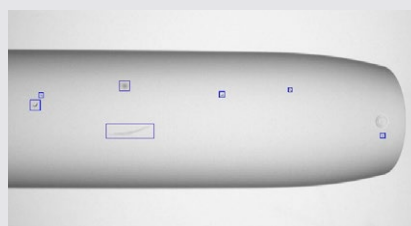
itself whether a change in appearance affects the required quality.

AI technology uses neural networks to achieve a learned knowledge that enables it to distinguish between anomalies, shapes and characters, while tolerating natural deviations. Thus, artificial intelligence combines the superior flexibility of humans with the performance of a machine system.

Examples of applications with the use of AI

- The **surface inspection of a curved housing** is one of the most problematic tasks in conventional machine vision. In the image data, a wide variety of NOK examples are classified using so-called labels, then taught in by AI training and reliably found in the evaluation.

| Bereiche | Merkmal Auswählen | In Zeile | Merkmal in Tabelle Eintragen | | | | | |
|----------|-------------------|----------|------------------------------|------|-------------------|----|----|-----|
| 6 | NOK | 5 | X | Y | Merkmale (Klasse) | | | |
| | | | 1 | 264 | 896 | 23 | 24 | NOK |
| | | | 2 | 791 | 107 | 21 | 23 | NOK |
| | | | 3 | 1014 | 1087 | 25 | 24 | NOK |
| | | | 4 | 1496 | 873 | 19 | 19 | NOK |
| | | | 5 | 1126 | 890 | 28 | 28 | NOK |
| | | | 6 | 323 | 930 | 19 | 19 | NOK |

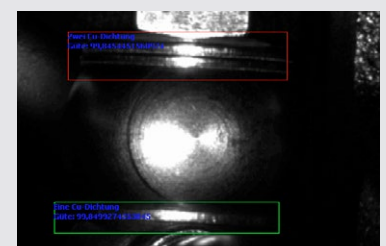
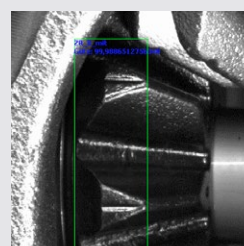


Labelling in V60 can be done manually or fully automatically. Surface errors are reliably evaluated by the AI.

- **Character recognition**, even of embossed characters cropped in the image - **99% recognition**.



- **Type recognition** based on a taught-in feature. **Completeness check** of sealing rings - **99% recognition**.




Cloud Service by VisionTools AI Training and File Management


- **AI training** on a server hosted in Germany without own expensive hardware.
- The training is carried out with **high-performance GPUs (NVIDIA T4)** and is scalable as required, i.e. several trainings can be carried out simultaneously.
- Upload **any amount of labelled image data**. The training data is stored on the server.
- Data security is **TISAX certified**.
- Simple, fair billing system.
- The dashboard will expand to include other useful AI tools in the future, e.g. an **online labelling tool**.

- The user has **various pre-trained algorithms** for object recognition at his disposal, with which an optimally functioning model can be trained for any application.


Balanced: Balanced compromise between inference speed and precision. Recommended as standard if there are no special requirements.




Fast: Increased inference speed at the cost of precision. Recommended for high cycle frequency or for small images.



Precise: Increased precision at the cost of inference speed. Recommended for very difficult distinctions or small features (relative to image size).



Segmentation: Uses masking labels instead of rectangular bounding boxes. Recommended for more complex feature shapes, which would contain a lot of invariant background within their bounding boxes.




AIBox by VisionTools

Multicore GPU Workstation with REST-API interface for AI evaluation

The **Edge Device** is fanless, energy-efficient and designed for a wide temperature range.

The robust housing and the connections meet all industry standards. The power supply is optionally via **PoE+** or external 24V DC.

A powerful **NVIDIA Jetson AGX multi-core GPU** with 32GB (512 CUDA and 64 Tensor Cores) is used as processor.

An **integrated web server** is available for configuration and upload of a trained model.

The internal software basis is the **TensorFlow framework**. The programme runs within a Do-

cker container with the **REST API interface**. The VisionTools V60 image analysis software communicates with one or more Docker containers using „REST objects“.

The AI's feedback about found classes is output as a result via the machine interface by means of quality evaluation in V60.

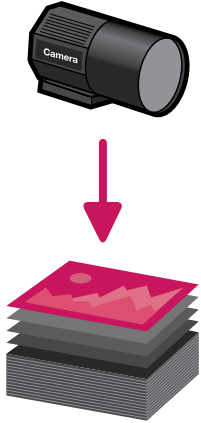
With the independent module, **even older systems can be retrofitted with artificial intelligence**. Everything necessary for use with V60 is already pre-installed.

By using the REST-API interface, the device can also be used for other software solutions.

AI Tools by VisionTools

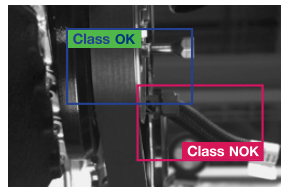
For the use of artificial intelligence in machine vision projects, VisionTools offers ALL tools for the installation of a Deep Learning inspection system.

INPUT



Any type of camera is available to acquire the necessary image data.

LABELLING



With V60, the images can be **labelled automatically** or **manually** depending on the inspection task and prepared for training.

TRAINING



In **Vision Cockpit**, different **pre-trained neural networks** are available to the user. These can be used to train an optimally functioning model for the required evaluation.

EVALUATION



The trained model is uploaded onto the **VisionTools AIBox**.

The V60 evaluation software communicates with the AIBox via the **REST interface**.

„ Do you have questions about solutions in the field of artificial intelligence? We will implement a system based on AI for you or help you to successfully use deep learning technologies yourself in your application. “