

IBAK

IBAK ArtIST

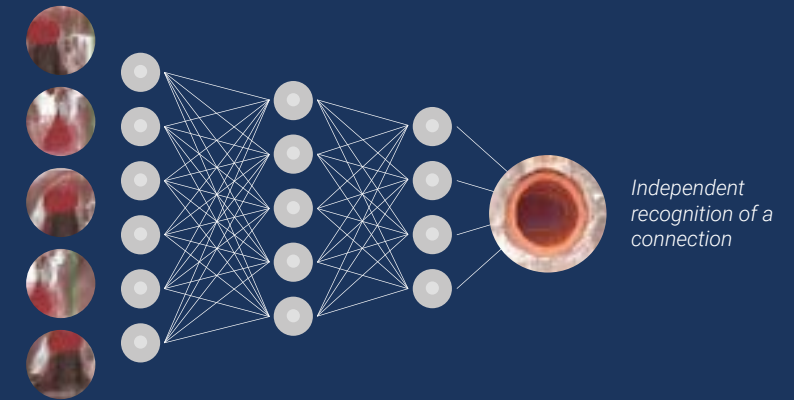
Artificial Intelligence
for Sewer Inspection



EN



Learning phase



Artificial Intelligence for Sewer Inspection

IBAK is making the innovative key technology available to the wastewater inspection industry.

What is ArtIST?

ArtIST (Artificial Intelligence Software Tool) is a cloud-based extension to the IBAK sewer analysis software IKAS evolution for automatic condition identification in inspection films. The smooth integration of the ArtIST service into IKAS evolution automates the otherwise very time-consuming and labour-intensive procedure of capturing the condition data. The creation of inspection reports is speeded up considerably with ArtIST and at the same time a consistent, objective and reproducible data quality is achieved.

What assistance does artificial intelligence (AI) provide?

ArtIST software development is based on the techniques of artificial intelligence (AI). AI makes it possible for machines to learn from data and not from being explicitly programmed. Artificial neural networks are trained to identify patterns in a volume of data. At the learning stage, the AI system is told whether it has made a correct or an incorrect assignment. Depending on the feedback, the network changes the connections between the neurons. Those that were correct become stronger. Those that were incorrect become weaker so that the system finally becomes more 'intelligent'. The use of this innovative technology enables ArtIST to process large volumes of data unsupervised, to identify patterns in the data autonomously and to categorise them. The capture of sewer condition data is a predefined, recurrent task and ArtIST is being trained for this.

Why does the wastewater industry need AI?

Inspection data forms the basis for deciding on rehabilitation measures and maintenance strategies. To maintain a sewer system in a functional state for a service life of several generations is a cost-intensive undertaking. To use funds in the best possible way and to ensure intergenerational fairness, defects must be detected early enough and remedied at the right time both from an operational and an economic point of view. This is only possible if exact and appropriate inspection data is available. Well-trained, qualified personnel and intelligent automation tools are required in order to meet the ever-increasing demand for condition data. With AI-supported condition data capture, the available resources can be used with greater efficacy. The heavy demands on time and effort for sewer inspection can be satisfied considerably more productively.

The basis for the use of AI in the wastewater industry has been available for decades: inspection data.

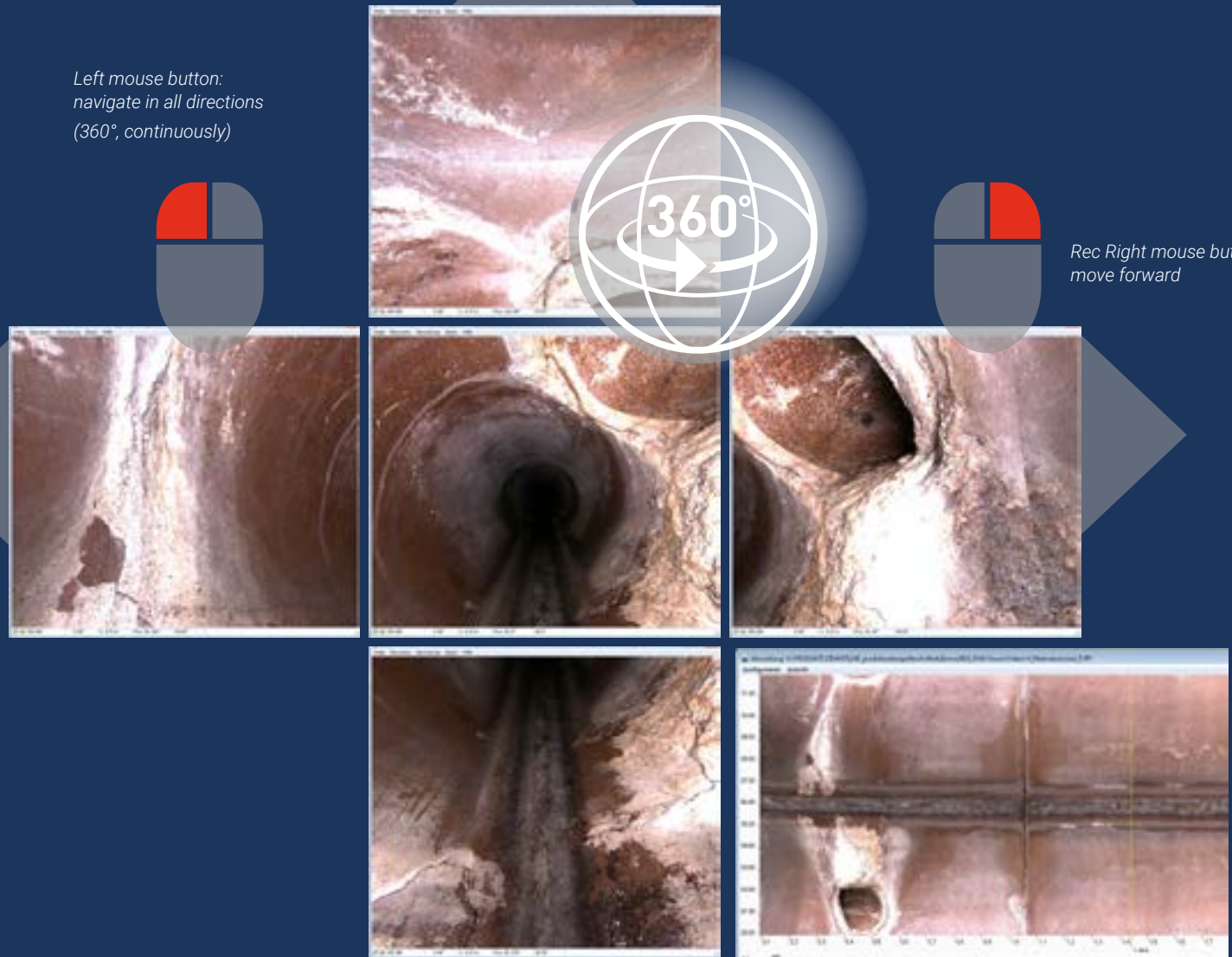
How does the data affect the results?

For AI-supported applications, data is required for testing and training the algorithms. The IBAK PANORAMO camera system has now been capturing sewer inspection data for more than 15 years. This 360° camera technology supplies optimum image data for the AI software, because it provides 100% coverage of the interior of the pipe. It ensures comprehensive basis data because there is no possibility of overlooking and therefore not recording relevant pipe segments. PANORAMO data is used as learning matter for ArtIST.

More important than a great volume of data is the data quality and a correct context. To make the image data usable, it must be supplemented with information. IBAK is in possession of the know-how required to ensure the quality of sewer inspection data. The data is always evaluated by experts who were not involved in capturing it. It is validated in-house and crosschecked and verified externally. In this way, the high quality of the results of the ArtIST software is achieved sustainably and objectively.

*Left mouse button:
navigate in all directions
(360°, continuously)*

*Rec Right mouse button:
move forward*



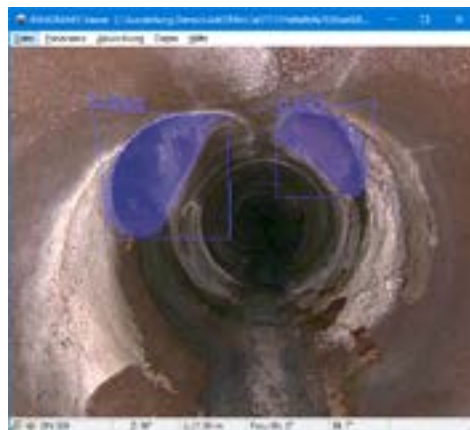
*PANORAMO unfolded view for a quick overview
of the entire inspection*

IBAK's AI training already covers some 80% of all the entries that have to be made regularly by an inspector in an urban environment during the capture of standard features and defects.

Was does the AI system learn from the data?

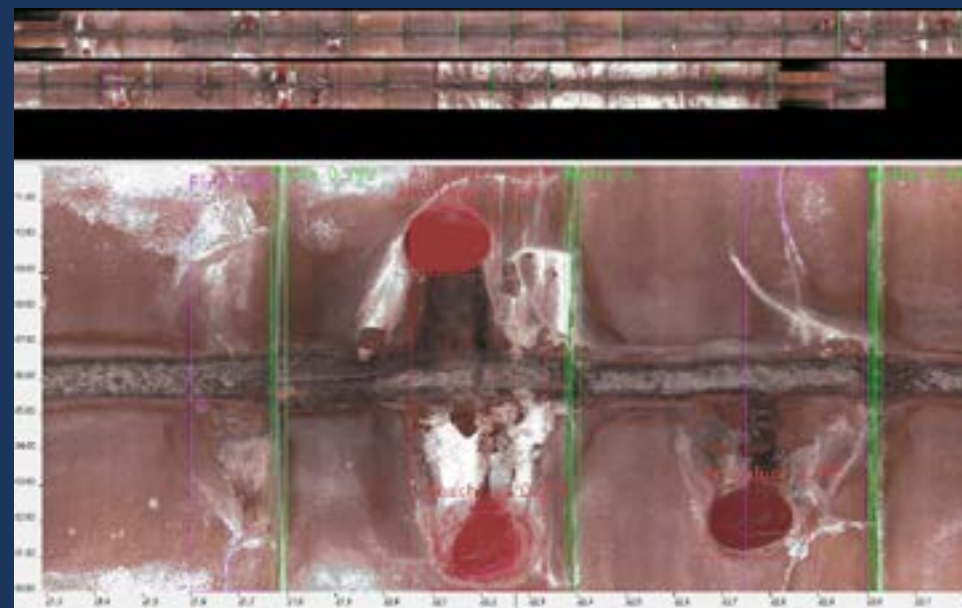
PANORAMO scans that have already been analysed are used as training images. These are categorised¹ by defect codes. Defined codes are allocated to the various types of defects and are specified as correct answers with the training images. In this way, the program learns what connections, cracks, intruding roots and other defects look like. If the AI software is shown a new inspection film, it can analyse this according to the learned pattern. The trained defects are identified even if they look a bit different each time. Output will be effected in the form required by the user: besides EN13508-2 and DWA M149-2, ArtIST will support all commonly used coding systems.

IBAK achieves high success rates with the trained features and defects. Both the identification rates and the proportion of correctly assigned condition codes are greatly improving. The system learns more each day from new data. With further training, ArtIST is learning how to distinguish complex defects. Even defects that do not often occur are included in the course of training.



Connections visualised by maskings (shown in purple) identified as such with the main code and the characterisation by the IBAK ArtIST software tool in a film shown to the AI system for the first time

¹ Editor's note: 'Categorised' is used here in the context of data processing. 'Assessment' and 'Classification' are the terms commonly used in the wastewater industry for the evaluation of the results of optical inspections with regard to any need for action. This is generally performed by sewage contractors.



Maskings on the unfolded view of the PANORAMO system for a fast overview of the complete inspection

If the manual routine work that has to be done in the course of capturing standard features and defects is performed by the computer, you will have more time for additional orders.

What is the daily working procedure with ArtIST?

The ArtIST software tool will be provided as an additional, web-based function of the IBAK sewer analysis software IKAS evolution. ArtIST data-technical support will be integrated as follows into the inspector's working procedures:

- A PANORAMO scan is performed to capture the optical inspection data
- The PANORAMO film is loaded into the ArtIST cloud via IKAS evolution
- ArtIST generates an inspection report document with DWA M-149-2² coding
- The report document is returned from the ArtIST cloud to IKAS evolution and is available in the form of an observations list containing the condition data
- The inspector checks the list of conditions and completes it if necessary

² The coding system can be selected in the project configurations.



What advantages do ArtIST users have?

1. Faster results

AI assessment can be performed at any time, whether the inspector is on form or not, and independently of the availability of human resources (e.g. at night). Sharing the work between the inspector and the computer means that the condition data capture can be performed more rapidly.

2. Results of a consistently high quality

The basis of AI condition data capture is the expertise of many decades that has gone into the assessment of several thousands of inspection films. The AI results are technically well-founded and factually objective.

3. Improvement of efficiency

The time and effort required for condition data capture by an inspector can be considerably reduced by the use of AI. If the routine manual work required for the capture of standard features and defects is performed by the computer, this gives users valuable time for other tasks. The IBAK AI development project can already support the inspector with over half of the input he has to perform solely by automatically identifying the connections. If you also take into consideration the defects codes, master data and control codes that have already been examined by IBAK, some 80 % of an inspector's data capture work is already being covered during the training of the AI software.

Is AI the future of sewer inspection?

AI is viewed worldwide as an extremely relevant technology. It is being used in more and more industries and fields of application. The effective implementation of possible AI applications is considered to be a decisive factor for sustainable business success.

In the past, time was often the limiting factor when it was a question of handling as many inspection jobs as possible. IBAK has recognised the potential of AI for the wastewater industry. With the ArtIST WebService, IBAK is opening up the use of this innovative key technology to customers, thus facilitating their day-to-day work and providing them with solutions for success.

Right from the beginning of the AI development project, IBAK has had in mind various possible applications that could be of benefit during sewer inspections in future. All future AI applications will be based on the stage of development reached at the time of their implementation. The AI system only has to learn what it does not already know. The experience gained from training with the PANORAMO data will also be of use when IBAK extends the AI system in the future to MPEG data. The extension of the AI system to include the assessment of video data captured with a pan and rotate camera is already being taken into account during training.

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As a worldwide operating manufacturer and supplier of sewer inspection and rehabilitation systems, IBAK employs a staff of more than 400 at seven locations in Germany and a registered office in Australia. In addition to this, the Kiel-based owner-managed family business is represented by over 40 distributors and service partners all over the world. Technology designed by IBAK can travel through sewers and pipes to optically assess their condition and to rehabilitate them where necessary. IBAK founder Helmut Hunger introduced the world's first sewer inspection system in 1957. Building on this pioneer achievement, fully equipped sewer inspec-

tion vans form the core business of the over 75-year old company. Besides small mobile systems and systems for sewer rehabilitation, the product portfolio of the pioneer of the industry also includes software solutions. IBAK introduced the first sewer analysis software in 1987. Since then, the company has continually further developed and improved the reliable software solutions and provides additional, practice-oriented functions so that the users can extend their scope of services in line with their requirements.



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