

# Enhancing River Management Facility Maintenance and Management Efficiency through New Technologies including AI

## River Department

In recent years, river management facilities owned by national and local governments have been aging. Malfunctions in these facilities could lead to severe consequences in the event of a disaster. Additionally, there has been a significant decrease in the number of inspection technicians. To tackle these urgent challenges, we are conducting research to develop streamlined inspection and evaluation methods for river management facilities, aiming to achieve labor savings.

## Social background and challenges

- Because of a declining population, there is a shortage of skilled workers, and the transfer of expertise from experienced technicians has become a pressing issue.
- Meanwhile, advancements in digital technology have simplified the acquisition of image data and three-dimensional point cloud data. Additionally, data analysis through artificial intelligence (AI) and other methods has become more accessible.
- Thus, to ensure the sustainable maintenance and management of river management facilities, we explore ways to incorporate these new technologies in inspecting river levees.

## Details of Research

### Development of technology for automatic deformation extraction, covering 12 inspection items for river levees (earthen levees)

We developed an AI-based technology capable of automatically detecting 12 types of deformations in levees as specified in the *Guidelines for Assessing Inspection Results of River Management Facilities, Including Levees\**.

Based on specific characteristics of deformations that occur in earthen levees, we aimed to automatically identify 8 types of deformations, utilizing 3D point cloud data, and 4 types of deformations through image analysis.

\* April 2019, River Environment Division, Water and Disaster Management Bureau, Ministry of Land, Infrastructure and Transport

Traditional approaches to extracting deformations from 3D point cloud data involve time-consuming processes such as converting the data into images and data thinning. Moreover, direct use of 3D point cloud data was not possible, leading to decreased data accuracy. This time, we have developed a technology that directly extracts deformations from 3D point cloud data using AI. This represents the first case of such technology in Japan's river management sector, allowing us to overcome the challenges discussed above.



Red: Can be extracted based on image

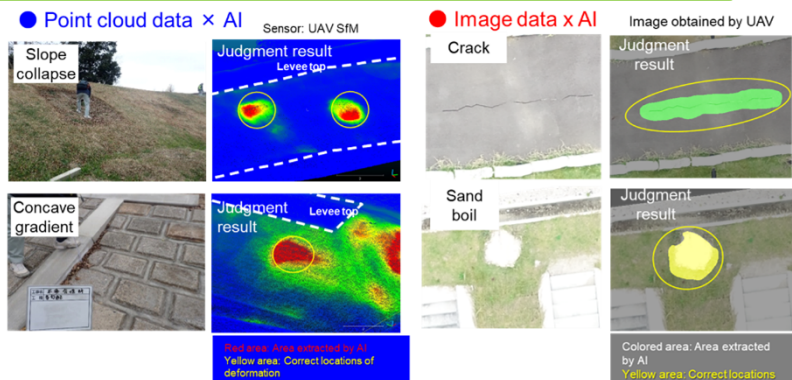
Blue: Can be extracted based on 3D point cloud data

Levee deformations subject to automatic deformation extraction

### On-site demonstration of automatic deformation extraction technology

During the weeding work, we captured images of deformations and simultaneously obtained 3D point cloud data using a UAV-based aerial photogrammetry survey. Subsequently, we discovered that our AI-based automatic deformation extraction method could efficiently identify all deformations. This method will enhance the efficiency of identifying deformations in levee inspections, a process that has traditionally been time-consuming and labor-intensive.

In the future, we plan to collect a large volume of deformation measurement data from real levees. This data will enhance the accuracy of automatic deformation extraction, enabling us to further our study for practical application in actual levee management.



Example of field demonstration of automatic deformation extraction

Contribute to the sustainable development and management of the infrastructure, even in the face of a declining population

#### Relevant articles

- Initiative to increase the efficiency of levee inspections utilizing new technologies, including AI (p. 48)