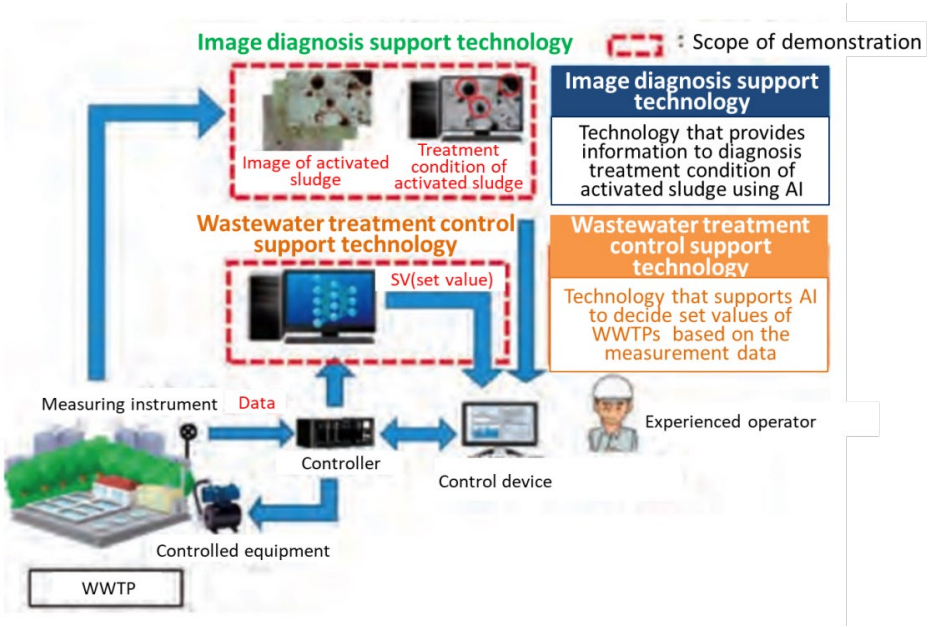
B-DASH: Feasibility Study on AI Technology for Operations Management Support in Wastewater Treatment

(Research for FY 2018-2019)

1. Purpose

Figure 1. Image of wastewater treatment operations management support technology using AI



This study deals with AI technology for operations management support in wastewater treatment.

The purposes of the research are to establish the application procedures of the technology using the actual WWTP data, verify its performance, including prediction accuracy, and study its adoption possibility for WWTPs and promotion possibility.

2. Summary of the Technology

Figure 1 shows that the technology tries to make wastewater treatment facilities efficient and labor-saving with two elemental AI technologies. Two elemental technologies are;

- **Treatment control support technology**: Random forests estimate set values of operations conditions, including aeration volume and excess sludge withdrawal volume, and make guidance.
- **Image diagnosis support technology**: Deep learning image recognition identifies and counts specific microorganisms, such as Protozoa and micrometazoa, for microscope images of activated sludge.

3. Outcomes of This Year

This year's research dealt with more facilities and microorganisms as targets than in 2018 to verify the applicability and versatility of the technology.

- Treatment control support technology: The research targeted two wastewater treatment facilities with a different scale from 2018's study. The researchers established the model predicting aeration volume and excess sludge withdrawal volume with the past measuring data. As a result, their annual average mean absolute percentage errors (MAPE) were 8.3-9.9% and 4.9-8.4%. Both satisfied the target value of 10% and had less prediction accuracy. Besides, the research confirmed that model establishment specified unusual conditions such as rainfall could improve prediction accuracy.

- Image diagnosis support technology: Researchers tried image recognition of microscope images of *Arcella* and *Epistylis* in addition to *Rotaria* investigated in 2018. Learning with each 500-image data achieved 89% of mean average precision (mAP) for *Arcella* and 84% for *Epistlylis*, satisfying a target value of 80% more. In addition, the technology could recognize images including both *Rotaria* and *Arcella* with the above mAP.

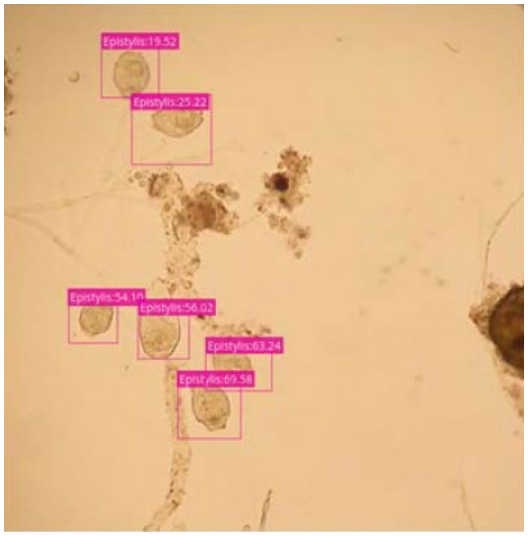


Figure 2. Image of Epistylis detection

4. Conclusion

The study established data collection and model establishment procedures for the two AI support technologies and verified two technologies satisfied enough practical performance.

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Keywords: **Operations management support, AI, Random forest, Deep learning**