AI-BASED HIGH-THROUGHPUT SCREENING PLATFORM FOR QUANTITATIVE PHENOTYPE ANALYSIS OF *XENOPUS LAEVIS*

Sanzhar Askaruly[1], Seongmin Yun[1], Geoseong Na[1], Hyunmo Yang[1], Jung Kweon Bae[1], Taejoon Kwon[1], and Woonggyu Jung[1]
[1]Department of Biomedical Engineering, Ulsan National Institute of Science and Technology (UNIST), Office 709, Bldg. 110, 50 UNIST-gil, Ulsan, 44919, South Korea
E-mail: s.askaruly@unist.ac.kr

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ABSTRACT:
Xenopus is an efficient animal model to study various diseases because it can provide a large number of biological systems in a short time period. Although morphological evaluation of massive *Xenopus* data throughout development stages is an essential procedure, it currently requires labor-intensive and manual inspection under an optical microscope. Here, we propose a high-throughput monitoring method via customized optical imaging tool and PDMS microwell plate. We also developed a novel artificial intelligence-based analysis software that transforms massive images as comprehensive and quantitative information.
As presented in Figure 1, we built the wide-filed and high-throughput screening system modifying the office scanner. We also fabricated the customized imaging well plate to contain *Xenopus laevis* embryos. With our device, we were able to monitor the morphological changes of *Xenopus laevis* embryos acquired from more than 180 wells in four days. CNN-based deep learning architecture formed the core of segmentation and phenotype classification tasks.
As demonstrated in Figure 2, the software platform performs automated embryo segmentation, provides quantitative phenotype results, and, importantly, can predict morphological abnormalities at early stages. In conclusion, compared to conventional microscope screening, our platform offers high-throughput, accurate, and fast quantitative phenotype analysis. With the help of deep learning, the suggested platform could become a promising tool for developmental studies, drug testing, and phenotype-genotype assays, where statistical knowledge is critical.

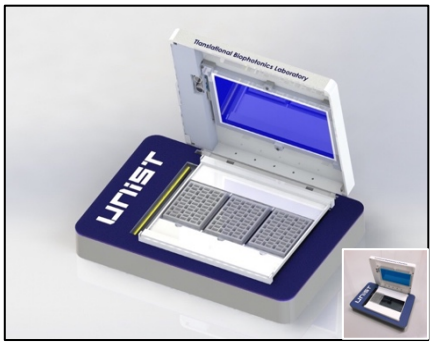

Figure 1: High-throughput screening platform

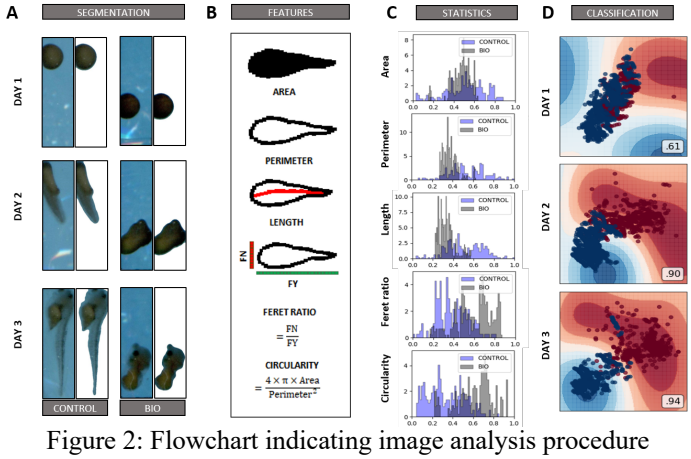

Figure 2: Flowchart indicating image analysis procedure

References:

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