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Development of automated image capturing for Zebrafish embryo toxicity model

M.M.R. Ahamed¹✉, C. Amarasinghe¹, T. Thevathayarajh², D.S.P.P.G. De Silva³,
K. De Zoysa⁴, D.P.N. De Silva³

¹*Department of Science and Technology, Faculty of Applied Sciences, Uva Wellassa University, Sri Lanka*

²*Department of Agricultural and Biological Engineering, Mississippi State University, Mississippi State, USA*

³*Department of Animal Science, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Sri Lanka*

⁴*University of Colombo School of Computing (UCSC), Sri Lanka*

✉ prasadi@uwu.ac.lk; +94704499090

Zebrafish embryo is considered as one of the most suitable alternatives to animals in toxicity testings due to their special features like a transparent embryo, high fecundity (200-250 eggs), and the short period of embryonic development. The main problem with Zebrafish embryo toxicity model is the manual image inspection. The process is complex and unfeasible sometimes leading to misunderstanding sub-lethal endpoints. To help address this problem, this study aimed to develop a deep-learning model to analyze images. The deep-learning model was developed to detect seven embryonic development stages and ten morphological features of Zebrafish using the YOLOv5 algorithm. Different augmentation and preprocessing methods were used to improve the accuracy. The developed and fine-tuned model performed well with the mAP (Mean Average Precision) of over 85% in detecting most of the embryonic development stages. But it had mAP values of less than 80% in detecting the morphological features. The study results have shown that the proposed deep-learning model is a very promising step in detecting embryonic development stages and needs minor improvement in detecting morphological features.

Keywords: Zebrafish, Toxicity, Image inspection, Deep learning model