|  |  |  |  |
| --- | --- | --- | --- |
| Title | MultiResEdge: A deep learning-based edge detection approach | | |
| Author(s) Name | Kanija Muntarina a b, Rafid Mostafiz c, Fahmida Khanom d e, Sumaita Binte Shorif a, Mohammad Shorif Uddin a | | |
| Contact Email(s) | Corresponding author.  shorifuddin@juniv.edu | | |
| Published Journal Name | Intelligent Systems with Applications | | |
| Type of Publication | Collaborative | | |
| Volume | 20 | Issue | November 2023, 200274 |
| Publisher | Elsevier | | |
| Publication Date | 4 September, 2023 | | |
| ISSN | 26673053 | | |
| DOI | <https://doi.org/10.1016/j.iswa.2023.200274> | | |
| URL | https://www.sciencedirect.com/science/article/pii/S2667305323000996?via%3Dihub | | |
| Other Related Info. |  | | |
|  | | | |

|  |  |
| --- | --- |
| Abstract |  |
| Edge detection is a fundamental technique in [image processing](https://www.sciencedirect.com/topics/computer-science/image-processing) and computer vision that plays a crucial role in various applications including object recognition, shape analysis, segmentation, feature extraction, image enhancement, image understanding, compression, and preprocessing. It involves identifying the boundaries or edges between different objects or regions which enables us to extract valuable visual information, analyze image structure, and facilitate subsequent [computer vision tasks](https://www.sciencedirect.com/topics/computer-science/computer-vision-task). In this study, we highlighted two primary issues that are faced in edge detection: edge connectivity and edge thickness. Choosing the right threshold for reliable edge detection has long been one of the most difficult problems in traditional edge detection techniques. To deal with these issues, the present research is motivated to execute a new deep learning-based edge detection model named MultiResEdge which is a tweaked variant of the original UNet framework. Instead of directly integrating encoder and decoder features, the suggested model makes use of a MutiRes block to modify spatial information from different scales, and a residual path with a set of convolutions to convey the features from the encoder to the decoder. To reduce the gap between the encoder and decoder features, we advocate using a combination of convolutional and skip connections. We also incorporated semantic edge information with semantic curves to improve the border. In addition, we have integrated a multi-step [preprocessing technique](https://www.sciencedirect.com/topics/computer-science/preprocessing-technique) that mitigates the [false positives](https://www.sciencedirect.com/topics/computer-science/false-positive) and [false negatives](https://www.sciencedirect.com/topics/computer-science/false-negative) and hence improves the accuracy, precision, recall, and F1 score. The extensive experiment is performed using images from two benchmark datasets to justify the predicted edge comparing it with the corresponding ground truth in terms of various objective metrics (such as entropy, MSE, [PSNR](https://www.sciencedirect.com/topics/computer-science/peak-signal-to-noise-ratio), SSIM, and FSIM). Overall, our proposed edge detection model has obtained an accuracy of 99% along with an F1 score of 98% which is better than the related state-of-the-art methodologies. | |