

ABSTRAK

SISTEM DETEKSI DAN *MONITORING* AKSI BUANG SAMPAH MENGGUNAKAN MULTI - KAMERA BERBASIS *CONVOLUTIONAL NEURAL NETWORK – LONG SHORT TERM MEMORY* (CNN – LSTM)

(2026: xxvi + 113 halaman + 30 gambar + 8 tabel + Daftar Pustaka + Lampiran)

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Permasalahan pembuangan sampah pada saluran irigasi dan sungai dapat menghambat aliran air serta meningkatkan risiko banjir dan pencemaran lingkungan. Proses pemantauan yang masih dilakukan secara manual memiliki keterbatasan dalam mengawasi aktivitas secara berkelanjutan sehingga diperlukan sistem *monitoring* yang mampu mendeteksi aksi buang sampah secara otomatis. Penelitian ini bertujuan untuk merancang dan mengimplementasikan sistem deteksi dan monitoring aksi buang sampah menggunakan multi - kamera berbasis *Convolutional Neural Network - Long Short Term Memory* (CNN - LSTM). Sistem menggunakan dua kamera CCTV sebagai sumber *input* video, sedangkan YOLO digunakan pada tahap praproses untuk mendeteksi dan melakukan *cropping* area manusia sebelum proses klasifikasi aktivitas oleh model CNN - LSTM. Hasil deteksi ditampilkan melalui *dashboard monitoring* secara *real-time* yang menyajikan status kamera, tampilan video langsung, label aktivitas, nilai *confidence*, *snapshot* kejadian, riwayat deteksi, dan log sistem.

Hasil pengujian menggunakan 175 data *testing* menunjukkan bahwa model CNN - LSTM memperoleh nilai *accuracy* sebesar 90,86%. Pada kelas Normal, model menghasilkan *precision* sebesar 0,9595, *recall* sebesar 0,8452, dan *F1-score* sebesar 0,8987. Sementara itu, pada kelas Buang Sampah, model memperoleh

precision sebesar 0,8713, *recall* sebesar 0,9670, dan *F1-score* sebesar 0,9167. Nilai *recall* yang tinggi pada kelas Buang Sampah menunjukkan bahwa model mampu mengenali sebagian besar aktivitas yang menjadi fokus penelitian. Selain itu, sistem berhasil diimplementasikan pada dua kamera CCTV dan mampu menampilkan hasil deteksi secara *real-time* melalui *dashboard monitoring*. Dengan demikian, sistem yang dikembangkan mampu mendeteksi dan memantau aktivitas buang sampah secara otomatis serta berpotensi mendukung proses pengawasan kawasan saluran irigasi secara lebih efektif dan berkelanjutan.

Kata Kunci: *CNN - LSTM, deteksi aktivitas, monitoring, multi-kamera, buang sampah*

ABSTRACT

LITTERING DETECTION AND MONITORING SYSTEM USING A MULTI - CAMERA BASED ON CONVOLUTIONAL NEURAL NETWORK - LONG SHORT TERM MEMORY (CNN - LSTM)

***(2026: xxvi + 113 pages + 30 figures + 8 tables + References +
Appendices)***

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Waste disposal into irrigation channels and rivers can obstruct water flow and increase the risk of flooding and environmental pollution. Conventional manual monitoring has limitations in providing continuous surveillance, creating the need for an automated monitoring system capable of detecting waste disposal activities. This study aims to design and implement a multi - camera waste disposal detection and monitoring system based on the Convolutional Neural Network - Long Short Term Memory (CNN - LSTM) method. The system employs two CCTV cameras as video input sources, while YOLO is utilized during the preprocessing stage to detect and crop human regions before activity classification is performed by the CNN - LSTM model. Detection results are displayed in real time through a monitoring dashboard that provides camera status, live video streams, activity labels, confidence scores, event snapshots, detection history, and system logs.

Experimental results using 175 testing samples demonstrate that the proposed CNN - LSTM model achieved an accuracy of 90.86%. For the Normal class, the model obtained a precision of 0.9595, a recall of 0.8452, and an F1-score of 0.8987. For the Waste Disposal class, it achieved a precision of 0.8713, a recall of 0.9670, and an F1-score of 0.9167. The high recall obtained for the Waste Disposal class indicates that the model is capable of identifying most of the target activities. Furthermore, the system was successfully implemented using two CCTV cameras

and was able to display detection results in real time through the monitoring dashboard. These findings indicate that the proposed system is effective in automatically detecting and monitoring waste disposal activities and has the potential to support more efficient and sustainable monitoring of irrigation channels.

Keywords: *CNN - LSTM, activity detection, monitoring system, multi-camera, waste disposal detection*