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Automatic Garbage Classification Using YOLOV8

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Abstract: Garbage classification plays a crucial role in waste management. The existing method employs Convolutional Neural Networks (CNN) for garbage classification, providing accurate but computationally intensive results. This paper proposes the integration of YOLOV8, a state-of-the-art object detection algorithm, for real-time garbage classification categorization(like paper, cardboard, biological, metal, plastic, green-glass, brown-glass, white-glass, clothes, shoes, batteries, and trash) through live camera feed analysis. The proposed YOLOV8 model aims to address this limitation, optimizing both accuracy and speed for live garbage detection.

Keywords: Deep Learning, YOLOv8, Waste Management, Garbage Classification, Object Detection, Real-time, Environmental Monitoring.

I. I NTRODUCTION

One of the most important components of the infrastructure of contemporary society is waste management, which includes material recovery, recycling, and disposal. Despite being seen as useless, garbage, rubbish, or waste can cause serious environmental problems if improperly managed. Recycling, the practice of repurposing waste materials, is emerging as a viable way to reduce trash's negative environmental effects and save resources. Recycling has been done for ages; historical records show that different civilizations have reused materials in diverse ways.

Modern trash reduction depends on recycling, which is the third phase in the "Reduce, Reuse, and Recycle" waste hierarchy. By diverting waste production from the economic system and eliminating raw material input, it supports environmental sustainability. ISO 15270:2008 for plastics waste and ISO 14001:2015 for environmental management control of recycling practice are two examples of ISO standards that are relevant to recycling.

This study is driven by the pressing need to reduce the burden that improper waste management techniques are placing on landfills. This work intends to expedite recycling procedures, lessen manual labor, and advance sustainable waste management by introducing a revolutionary deep learning-based approach for waste classification. The application of this technology could greatly improve efforts to conserve resources and lessen environmental degradation.

II. BACKGROUND & RELATED WORK

The management of waste and garbage is a significant challenge in modern society due to its environmental and health implications. One crucial aspect of waste management is efficient garbage classification, where different types of waste are sorted for proper disposal or recycling. Traditional methods of garbage classification often rely on manual sorting, which is labor-intensive, time-consuming, and prone to errors.

This study implemented a real-time waste sorting system utilizing YOLOv8 for garbage classification. The research focused on training the YOLOv8 model to recognize various types of waste, including plastic, paper, glass, and metal. The system achieved high accuracy and efficiency in sorting different types of garbage, demonstrating the effectiveness of YOLOv8 for automated waste classification.

The related works collectively demonstrate the effectiveness of YOLOv8 in automated garbage classification applications and highlight its versatility in addressing various challenges associated with waste management and recycling. By leveraging the capabilities of YOLOv8, researchers and practitioners can develop innovative solutions for optimizing waste sorting processes and promoting sustainability.

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III. METHODOLOGY

A. Data collection:
A diverse dataset was assembled, containing images of waste items categorized into twelve distinct types, such as glass, metal, and plastic, to train the deep learning model.

B. Annotation:
Each image in the dataset was meticulously labeled with its corresponding waste type to ensure the model could learn accurate classification patterns.

C. Preprocessing:
The images underwent a series of preprocessing steps, including resizing and normalization, to make them suitable for analysis by the YoloV8 deep learning model.

D. Training:
The YoloV8 model was trained on the preprocessed dataset, using a combination of techniques to enhance its ability to distinguish between the different types of waste materials.

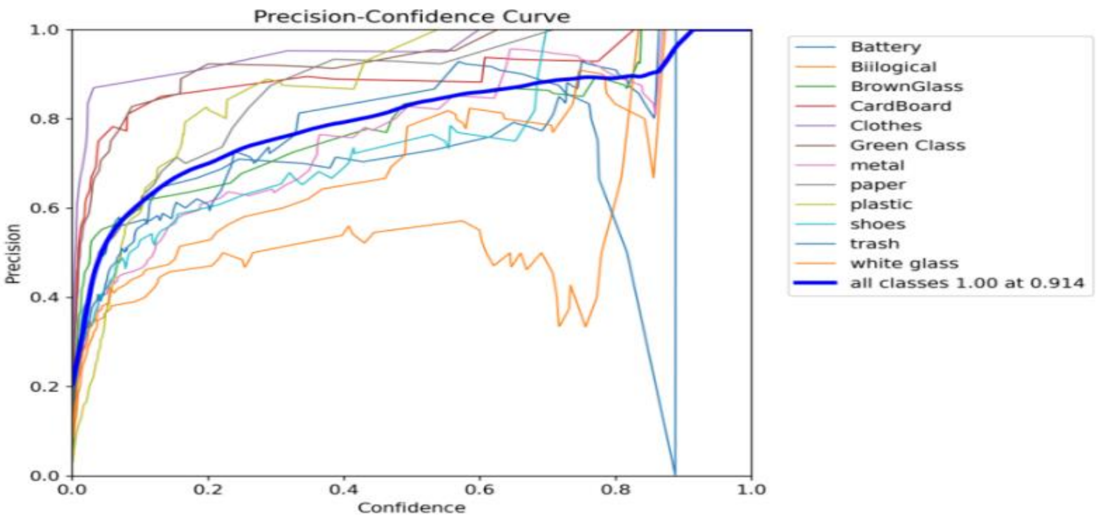

Fig. 1 precision-confidence curve

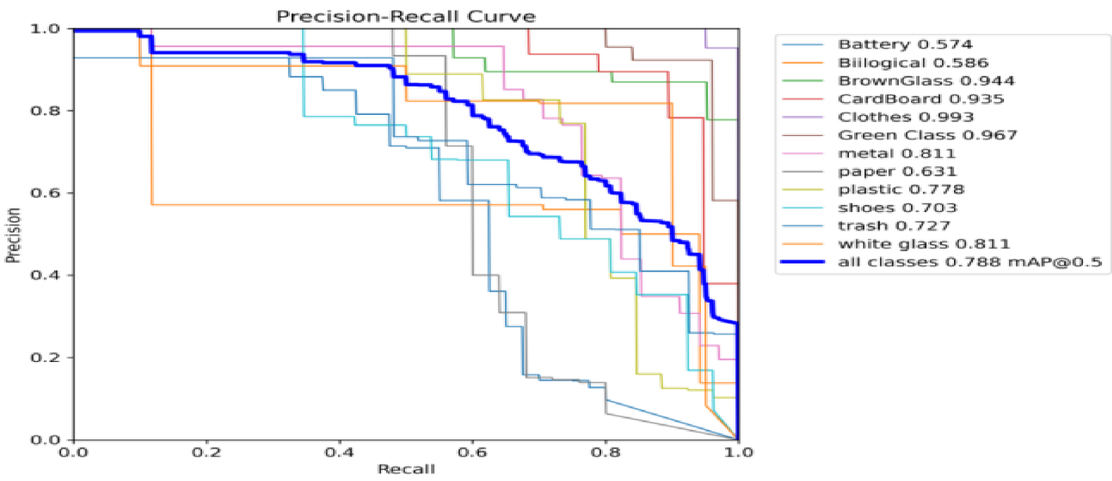

Fig. 2 Precision-Recall Curve

E. Testing: The model's performance was evaluated by testing it on a separate set of waste images, not seen during the training phase, to assess its accuracy in classifying waste types.

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F. RESULTS

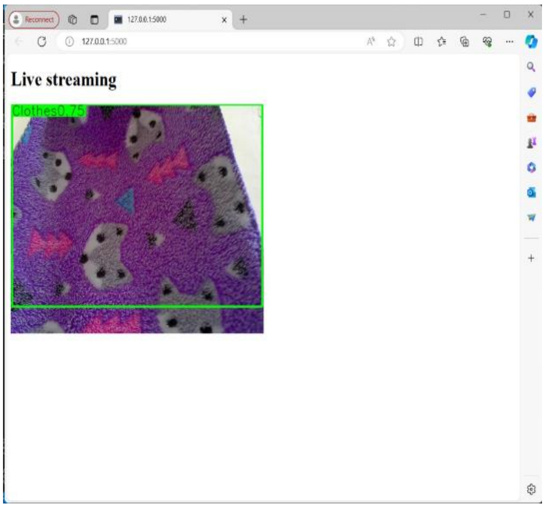

Fig. 3 Clothes

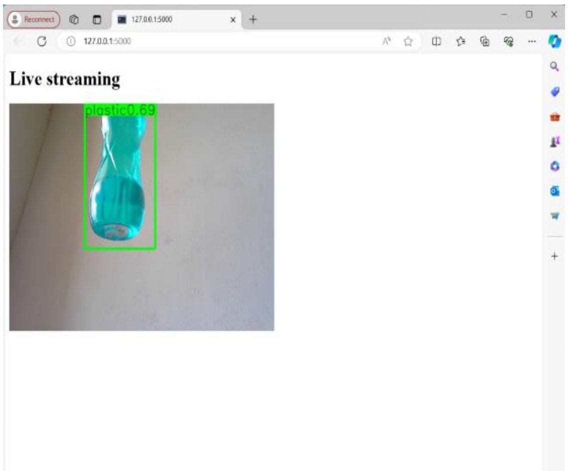

Fig. 4 Plastic

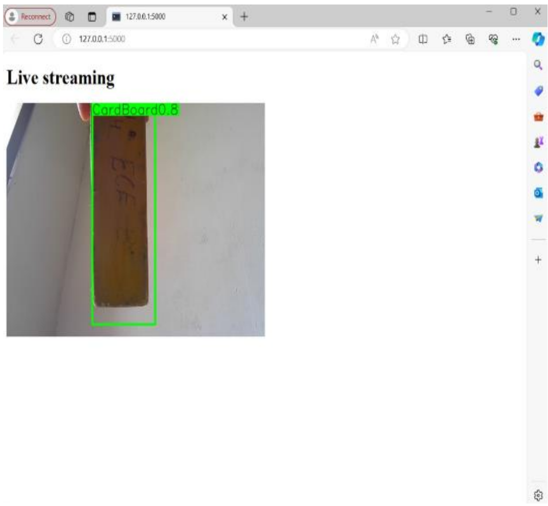

Fig. 5 Carboard

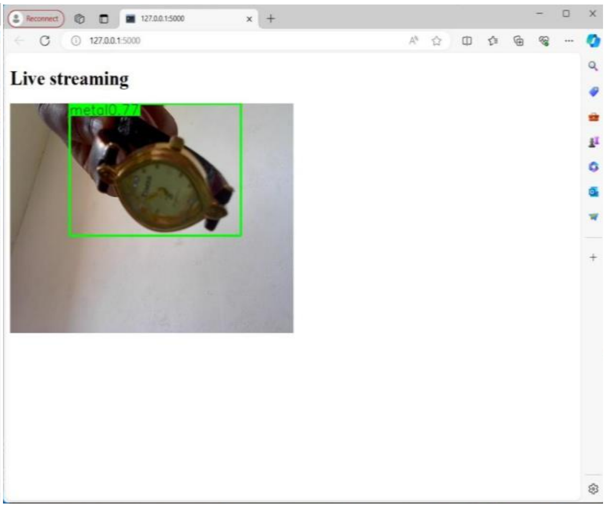

Fig. 6 Metal

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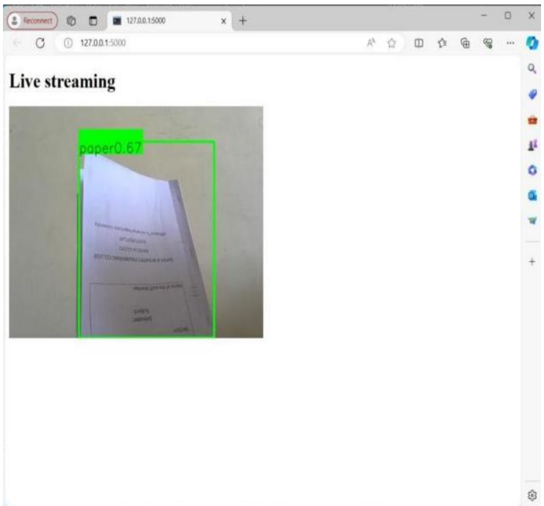

Fig. 7 Paper

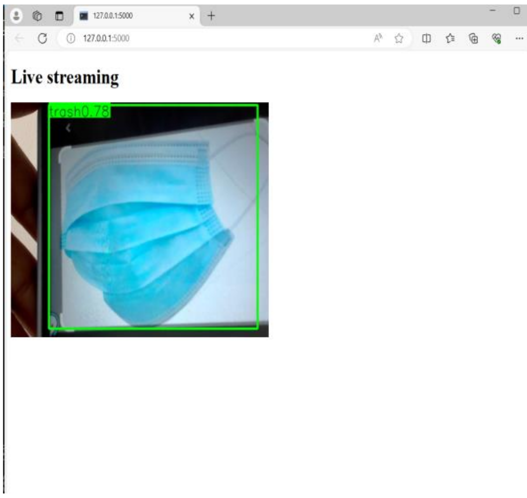

Fig. 8 trash

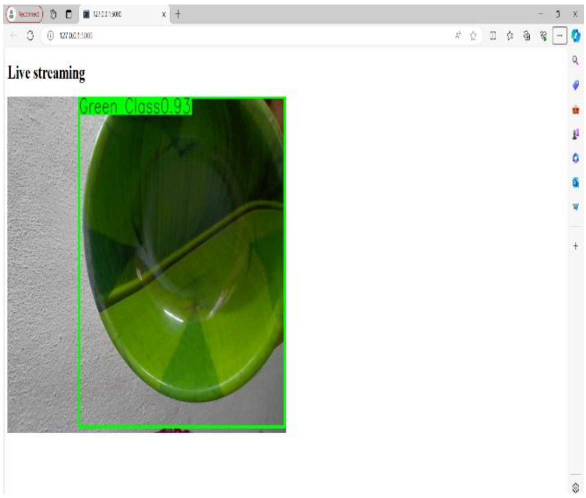

Fig. 9 Green glass

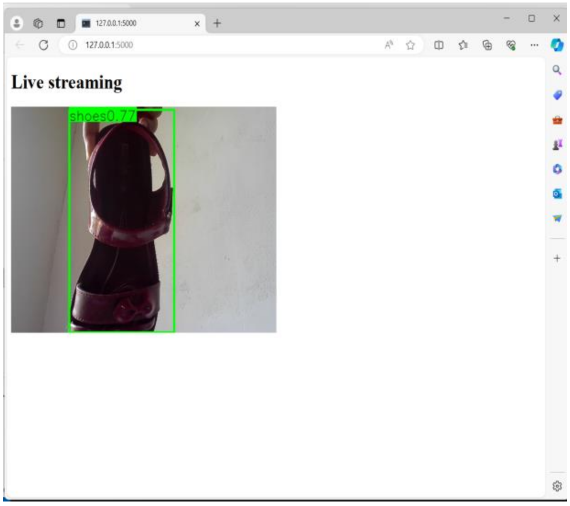

Fig. 10 Shoes

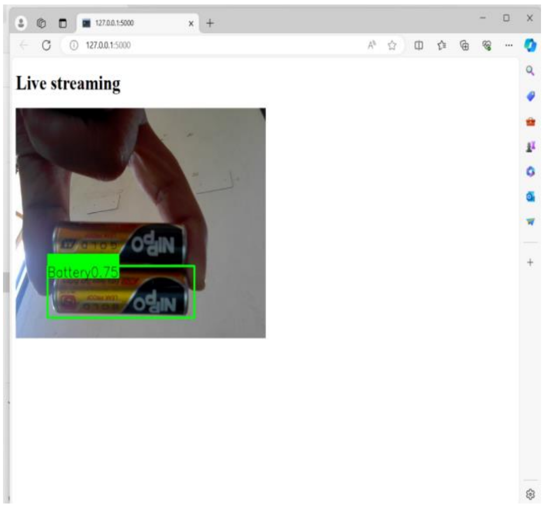

Fig. 11 Battery

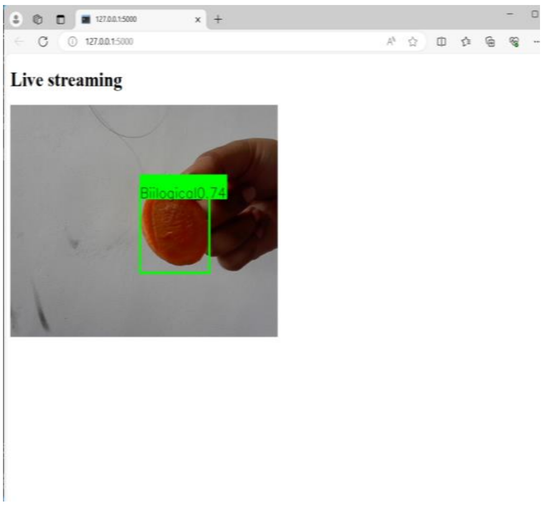

Fig. 12 biological

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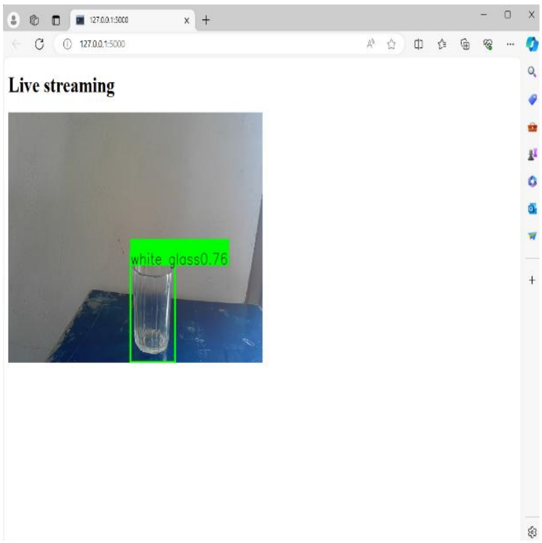

Fig. 13 White glass

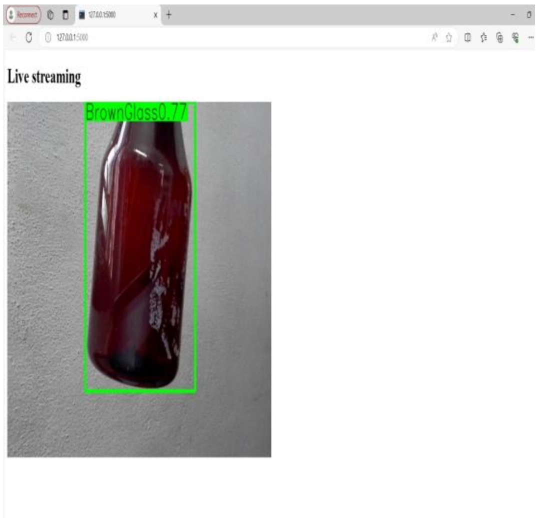

Fig. 14 Brown glass

IV. CONCLUSION

In conclusion, our project successfully utilized the YOLOv8 algorithm, a powerful convolutional neural network, to classify images of garbage into 12 distinct types: cardboard, paper, metal, green glass, brown glass, white glass, clothes, shoes, biological waste, plastic, batteries, trash. Through training on a data-set comprising these waste categories, the model demonstrated robust performance in accurately identifying and categorizing garbage items. Additionally, the YOLOv8 architecture enabled efficient real-time classification, making it a valuable tool for automated waste management systems. This implementation showcases the effectiveness of YOLOv8 in garbage classification, offering practical solutions for waste sorting and recycling initiatives.

REFERENCES

[1] D. Hoornweg and P. Bhada-Tata, “A Global Review of Solid Waste Management,” (2012) 1-116.
[2] Niehs.nih.gov, “Cancer and the Environment,” 46, 2018. [Online]. Available: https://www.niehs.nih.gov/health/materials/cancer_and_the_environment_508.pdf.
[3] N. Johansson and H. Corvellec, “Waste policies gone soft: An analysis of European and Swedish waste prevention plans,” Waste Manag., vol. 77, pp. 322–332, 77 (2018) 322-332.
[4] Y. Bengio, “Deep Learning,” Www, 2017, pp. 1-66.
[5] O. Kuchaiev and B. Ginsburg, “Factorization tricks for LSTM networks,” 2016 IEEE Conf. Comput. Vis. Pattern Recognit., 2017, pp. 1-6.
[6] R. C. O’Reilly, D. Wyatte, S. Herd, B. Mingus, and D. J. Jilk, “Recurrent processing during object recognition,” Front. Psychol.,4 (2013) 1-12.
[7] A. Krizhevsky, I. Sutskever, and G. E. Hinton, “ImageNet Classification with Deep Convolutional Neural Networks,” ImageNet Classif. with Deep Convolutional Neural Networks,, (2012) 1097–1105.
[8] K. Simonyan and A. Zisserman, “Very deep convolutional networks for large-scale image recognition,” Iclr, (2015) 1-14.
[9] M. D. Zeiler and R. Fergus, “Visualizing and Understanding Convolutional Networks arXiv:1311.2901v3 [cs.CV] 28 Nov 2013,” Comput. Vision–ECCV 2014, 8689 (2014) 818-833.
[10] M. Lin, Q. Chen, and S. Yan, “Network in Network,” arXiv Prepr. (2013) 10-20.

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