A Novel Implementation of Machine Learning in Smart Waste Management Systems

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Waste pollution, driven by improper recycling practices, remains a pressing environmental issue that humans continually struggle to manage effectively. Building on last year's project, which demonstrated the feasibility of machine learning in waste identification and sorting, this continuation project developed and tested a functional physical prototype of an intelligent waste-sorting system. After making improvements to the algorithm code through the implementation of color and orientation shifting hyperparameters and increased image diversity, we were able to achieve a recycling accuracy of 94.57%, a nearly 10% increase from last year's model. Compared to the recycling habits observed at our school campus, our model recycling is 30% more accurate. In other words, if, out of 100 items, school students could correctly recycle 55, our model would correctly recycle 95. This large increase holds massive implications: recycling can be done more efficiently, recycling can be done more effectively, and waste pollution would decrease. The physical prototype was tested in two settings for a whole day: a school environment and a corporate business setting. The system was deployed alongside traditional trash and recycling bins, and its sorting accuracy was recorded and compared to that of the control bins. Results indicated the system's potential for significantly improving waste-sorting accuracy. We saw a 96% recycling accuracy in the small business and a 96.5% recycling accuracy at our school campus. The outcomes suggest that such intelligent systems can contribute to reducing human error in recycling processes and improving environmental sustainability, which would overall reduce costs and strain on recycling centers' efforts to fix humans' mistakes.

Awards Won: