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Review on Development of E-Waste Management System

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Abstract: ***Today, the advancement of technology has the power to change everyone's life. Although this innovation is beneficial, it creates serious effects on human health and environmental health. One of the main reasons for this is "e-waste" resulting from electronic products. With the use of electronic products all over the world, the amount of "e-waste" or e-waste has also increased and this has now become a serious problem. Improper disposal of e-waste has become an environmental and public health problem as it now accounts for the largest portion of water litter in the world's cities. Therefore, correct classification and management of e-waste requires the recovery of important information about waste. These growing wastes are hard in nature and rich in metals such as neodymium, indium, palladium, tantalum, platinum, gold, silver, lead and copper, which can be recovered from discards and brought back to the earth. Production cycle and daily use. In this project, a deep learning model is used to identify e-waste and general waste using image processing. The design model, on the other hand, selects the waste with good accuracy and takes less time. Wastes are divided into two groups according to the amount or value in the waste. By using this model effectively, we can solve e-waste management problems, improve recycling and contribute to environmental sustainability.***

Keywords: E-waste management, IoT, Machine Learning, Image Processing, smart green city etc.

I. INTRODUCTION

A smart city is an advanced ecosystem that integrates information and communications technology (ICT) to improve environmental safety and citizens' quality of life. Smart city applications, including personal and home services such as remote patient care and utilities, as well as solutions such as smart grids, traffic management and waste management, help create a smart and safe city. E-Waste - Also known as e-waste; Electronic waste that is no longer needed and is no longer functional or usable. E-waste has an impact on the environment. Every year, millions of tons of electronic waste are thrown into landfills, and some of it ends up in rivers and oceans. E-waste emits toxic substances such as mercury, lead, cadmium, PCBs, benzene and dioxins, damaging soil and water bodies, threatening water and air quality, and harming human health and the environment. In this context, e-waste, which is one of the most important problems regarding the use of smart cities, negatively affects human and environmental health, making this field an important research area. Today, rapid advances in technology and increasing consumer demand have caused many electronic products to reach the end of their useful life after a period of use. E-waste is the abbreviation for electronic waste. This term applies to waste electrical equipment or electrical equipment that can no longer be used due to malfunction, repair or lack of spare parts, or equipment that is no longer used to do good work.

II. PROBLEM IDENTIFICATION

E-waste is one of the largest sources of waste in the world. Studies show that India produces approximately 3.3 million tonnes of e-waste every year and total e-waste generation is expected to reach 4.8 tonnes by 2011. In developing countries, WEEE accounts for 1% of all waste and this amount is expected to increase. grow. This rate will be reduced to 2% by 2010. Two major problems with WEEE production include bulk e-waste and environmental waste. TRAI report shows that there were approximately 113.26 million new mobile users in 2008, with an average of 9.5 million new users per month. The cellular market grew from 168.11 million in 2003-2004 to 261.97 million in 2007-2008. In 2006, the growth rate of microwave ovens and air conditioners was around 25%. From 2006 to 2007, refrigerator sales reached 4.2 million units and production increased by 17% compared to the previous year. Washing machines, which had previously experienced slow growth, recorded moderate growth in 2006. Color TV (CTV) sales tripled compared to 2007. Only about 19,000 tonnes of all e-waste are recycled, or 95% of waste. Repetition of crime. E-waste includes precious metals such as silver, gold and copper, as well as metals that benefit from renewable energy.

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This process includes the destruction of e-waste and the elimination of valuable items that could harm the environment and health by making these activities illegal. This is a bad idea because it shows the severity of the problem in the industry, considering how much energy is produced and the products are toxic and unprofitable. The content of iron, copper, aluminum, gold and other metals in e-waste is more than 60%, plastic is about 30%, and pollution is only about 2.70%. Since recycling and extraction are criminally illegal, very important and dangerous processes are used to process and extract recycled materials from e-waste.

III. OBJECTIVES

The primary objective of this project is to create an online E-waste management system that is user-friendly, accessible, and effective in promoting sustainable waste management practices.

1) Design a online waste management system using machine learning
2) To detect the E waste and classify into normal waste and E waste.
3) To implementation of an IoT- and cloud-based waste management system
4) To test the output results after implementing machine learning model.
5) To minimize the cost of installation and operation providing higher reliability.
6) Combine all this system to make E-waste management more precise, which will help to provide maximise collection to any industry or place.

IV. LITERATURE SURVEY

Most of the waste management information that can be found in the literature recommends the use of smart devices or bins, prioritizing IoT-based recycling and sorting devices such as glass, bottles and plastic.

Abba and Light [1] describe the design and implementation of an IoT-based Arduino microcontroller with ultrasonic sensors. The main purpose of this system is to measure the amount of waste accumulated in different areas. It constantly monitors the status of the bin and displays a message such as "full", "half full" or "black" on the LCD panel. Simultaneously, the microcontroller sends level data to the central web server system, which graphically displays the level for effective remote monitoring by authorities and end users.

Haque et al. [14] proposed a garbage collection system that monitors garbage in a specific area and can detect garbage that needs to be disposed of at the end of each collection cycle. It includes instant humidity and temperature detection, odor, condition monitoring and waste level monitoring. Data is sent to the IoT cloud via WiFi for analysis and storage. Based on these parameters, the system determines which boxes are ready for collection. It shows the best garbage collection method using Google APIs. Additionally, customers can view data in real-time using Thingspeak private channels.

Anjanappa et al. [4] developed a smart bin that can separate waste into biodegradable and non-biodegradable materials. The system uses components such as the NodeMCU microcontroller, artificial intelligence modeling using CNN technology, and the ESP32 camera. The ESP32 camera captures images of garbage thrown into the trash bin and sends it to the cloud, allowing it to be analyzed by an artificial intelligence model. Using this prediction, the NodeMCU module activates the motor connected to the top of the base, opening the waste section. When the container is full, the ultrasonic sensor on the lid detects the distance and sends notifications when necessary, using ThingSpeak software.

Al Duhayyim et al. [2] The remaining sections will focus on what has been published in the literature on smart e-material management. Researchers working on waste management in general have developed many methods; However, e-food is still an unsolved problem and what is important now is to monitor the status of e-waste, that is, products. Several articles introduced the concept of e-food. AEOIDLSWM technology is ready. A new approach combining artificial intelligence with the development of deep learning models to promote sustainable waste management in the IoT environment. The technology uses IoT-based camera sensors to capture images of waste, which are then processed by a microcontroller and CNN modules trained for different types of waste (cardboard, glass, metal, paper, plastic and waste) are used for distribution. The garbage classification process was improved with a feature extractor based on the residual network (ResNet) model and optimized using an AEO-based hyperparameter optimizer.

Kang et al. [19] developed an intelligent collection system for e-waste recycling and management in Malaysia. They developed a smart e-product container that uses ultrasonic sensors to measure the value of e-products in the home. They store it in Google Firebase, a cloud-based database system. A backend server was created to schedule collectors to collect e-waste when the bin volume reaches a certain level. They have also developed a mobile application that end users from the public can use to dispose of e-waste at home.

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Singh et al. [32] provide an IoT-based aggregation vendor machine (CVM) as part of their e-edge management solution. In order to use the system, users must first register and receive a QR code containing all personal information. Customers throw their e-waste into the CVM by scanning the QR code. The model uses ultrasonic sensors to measure the CVM's capacity and alert authorities when certain thresholds are exceeded. Collectors collect e-waste, transport it to recycling centers and issue invoices. The project uses the Arduino Uno platform to connect sensors and collect sensor data.

Ali et al. [3] developed an intelligent electronic waste tracking system based on the Internet of Things, which uses the KY-026 flame sensor and DS18B20 temperature sensor to monitor the status of electronic waste. The system also uses an HC-SR04 ultrasonic sensor to measure debris levels. The input signal is processed by the Raspberry Pi 3 microprocessor, which also makes the output. Additionally, administrators can use ThingSpeak as an IoT platform to review and visualize collected data.

Ramya et al. [26] presents a method to manage e-waste to identify it on the IoT cloud platform. E-waste images are collected by IoT nodes and stored in cloud data storage on the IoT cloud platform. Using the Fractional Horse Group Gas Optimization (FrHHGO) algorithm for routing, images are sent from the cloud to the central station for e-waste. For e-waste classification, quality features are extracted, refined, and combined with Shepherd Convolutional Neural Network (ShCNN) and Fractional Henry Gas Optimization (FHGO) based on Horse Herd Optimization Algorithm (HOA).

Fajana et al. [9] Demonstration of an Internet of Things (IoT) system with ultrasonic sensors for real-time monitoring of e-food product levels. They use machine learning and artificial neural network (GAN) to identify e-waste. They then use a magnetic separator to separate the metal and plastic from the e-waste. This approach allows for recycling, including turning plastic into biochar and metal into solar cells that can be used to produce biofuel. Additionally, the system uses a cloud-based platform for data analysis.

Madhav et al. [31] proposed a mobile device that can use transfer learning to identify household waste. This is a feature added to existing city garbage trucks, allowing them to drive on their own while taking photographs of garbage at the collection point. The robot uses deep learning to identify e-waste, making it more accurate than the Modified ResNet 50 network. It then separates them using arm-based lifting and storage mechanisms. After collecting all the garbage, the robot returns to the truck and puts the garbage in a special place.

Sampedro et al. [29] YOLOv4 reported a smart electronic device that can identify different types of e-waste such as batteries, chargers, and smartphones using object detection model and Raspberry Pi 3. Credit the user's e-wallet. Since all changes are saved to the server, administrators can use the administrative dashboard to monitor consumption and determine when e-materials need to be collected. GSM and WIFI modules assist in accounting and monitoring.

Rani et al. [27] Smart campus mobile e-inventory management solution based on the Internet of Things. The system uses the Single Shot Multi-Box Detector Lite-MobileNet-v2 model (learned from the Microsoft Common Objects in Context dataset) to identify waste objects in images using the Raspberry Pi 3 microcontroller. The tool also collects e-waste and the percentage of each container. Tracking data is stored on the cloud platform and streamed through an interactive mobile application designed specifically for Android smartphones.

V. PROPOSED SYSTEM

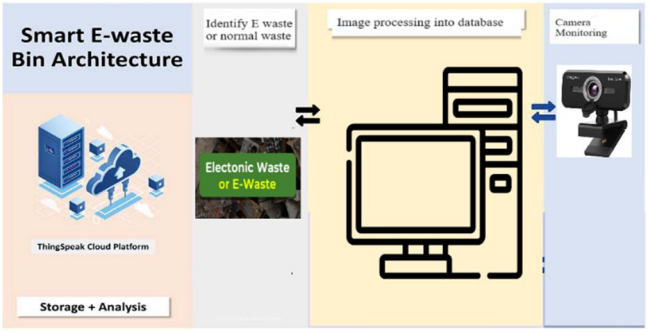

Fig. 1. Block Diagram of system

With the help of the offering, users will have an easy way to send requests and provide information to administrators whenever and wherever they want.

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The plan does not require physical work and saves a lot of time. After installing the camera, customers can send photos of areas that need physical cleaning. Image fields will be combined to manage file uploads. We will use server-side validation to ensure that the submitted data meets the requirements. The displayed images will be analyzed and trained machine learning will be used to determine the type of e-waste. By integrating learning models, automatic waste classification will be possible.

A. Advantages of Preparation Process

1) Menu driver
2) Eliminate manual intervention whenever possible
3) No error correction site
4) Online error correction tool
5) Secure environment
6) Two to ensure It is possible to generate instant reports throughout the day
7) Manage security.

VI. FLOW DIAGRAM

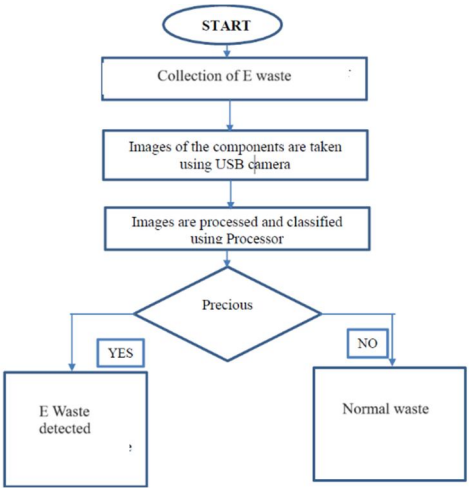

Fig. 1. Flow Diagram of system

VII. ADVANTAGES

1) *Improved Accuracy:* Machine learning algorithms can learn complex patterns and characteristics of data and achieve higher accuracy in detecting and classifying e-waste than the ever-present traditional methods.
2) *Efficiency:* Searching for e-products using technology can reduce the time and effort required for classification and analysis, thus increasing efficiency.
3) *Cost Efficiency:* While initial development may require investment, in the long run automating the discovery of e-materials through machine learning can reduce analysis and labor costs associated with analysis.
4) *Scalability:* Machine learning models can be trained on large data sets and easily scaled to handle increasing amounts of e-commerce, making them suitable for both small and large-scale management applications.
5) *Real-time Monitoring:* Machine learning-based e-waste can monitor the flow in real-time, allowing timely interventions and decisions to improve the system's standard waste management.
6) *Customization and Adaptability:* Machine learning models can be customized and tailored to specific wastewaters, environments and needs, providing greater flexibility and optimization.
7) *Environmental Impact:* Machine learning can help reduce the environmental impact of e-waste disposal and recycling by improving the efficiency and accuracy of e-waste and distribution.

Overall, applying machine learning to e-waste can provide many benefits, including improving the accuracy, efficiency, productivity and environmental sustainability of waste management.

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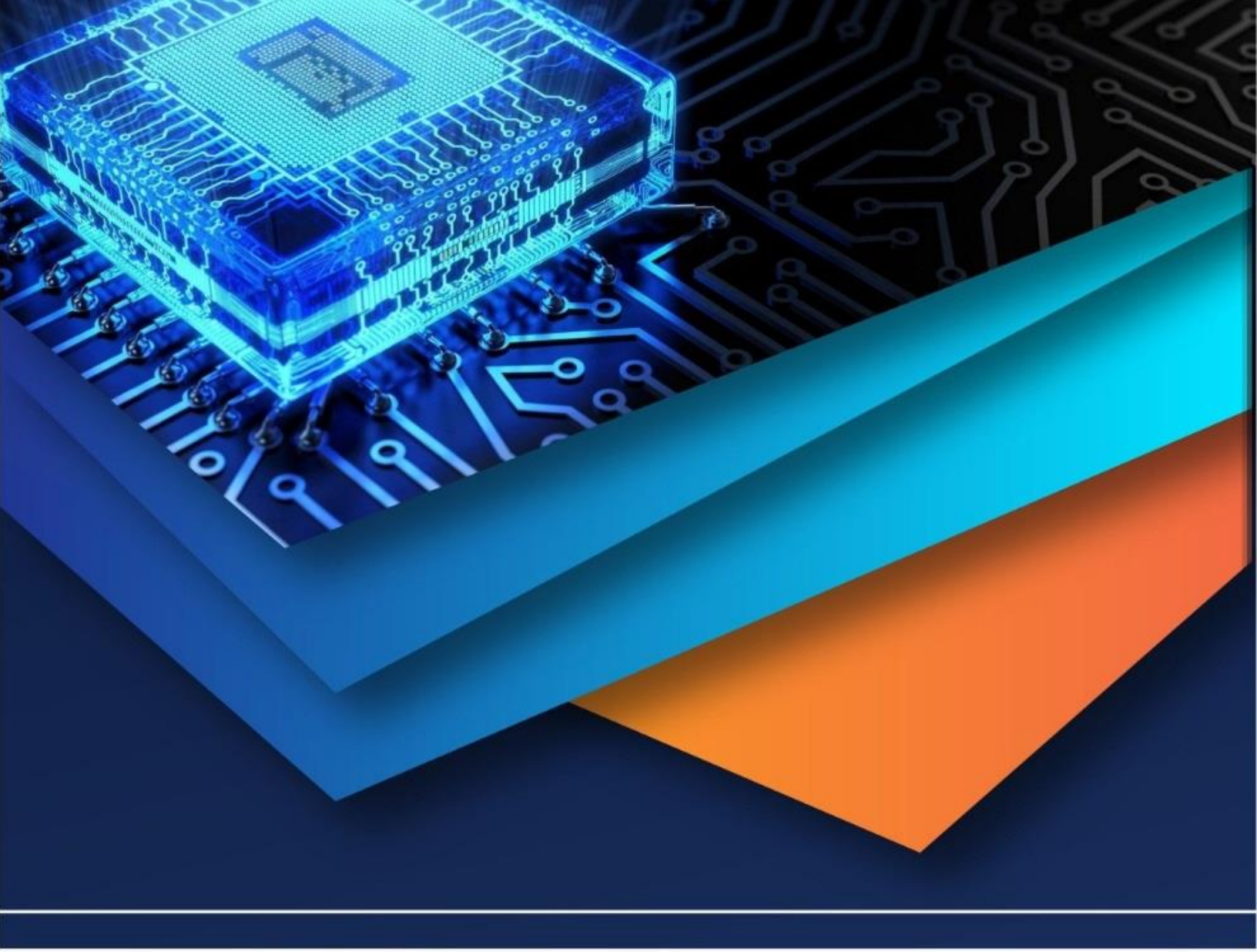
VIII. CONCLUSION

The development and application of e-waste using machine learning holds great promise for e-waste management-related issues. Using machine learning algorithms such as convolutional neural networks (CNN) and support vector machines (SVM), the system can identify and classify different types of e-waste in real time. This automation reduces reliance on manual deployment, reduces the risk of human error, and ensures consistent workflow. The benefits of using machine learning to implement e-waste detection are not limited to efficiency but also include environmental safety and cost savings. The system supports the principles of recycling, resource recovery and business environment by identifying and separating valuable products from the e-waste stream.

REFERENCES

[1] S. Abba and C.I. Light, IoT-based framework for smart waste monitoring and control system: A case study for smart cities, in: 7th International Electronic Conference on Sensors and Applications, MDPI, 2020, p. 90. doi:10.3390/ecsa-7-08224.
[2] M. Al Duhayyim, H.G. Mohamed, M. Aljebreen et al., Artificial ecosystem-based optimization with an improved deep learning model for IoT-assisted sustainable waste management. Sustainability **14** (2022), 11704. doi:10.3390/su141811704.
[3] N.A.L. Ali, R. Ramly, A.A.B. Sajak and R. Alrawashdeh, IoT e-waste monitoring system to support smart city initiatives, International Journal of Integrated Engineering **13** (2021), 1–9.
[4] C. Anjanappa, S. Parameshwara, M.K. Vishwanath et al., AI and IoT based garbage classification for the smart city using ESP32 cam, IJHS **6** (2022), 4575–4585. doi:10.53730/ijhs.v6nS3.6905.
[5] Y.-H. Chen, R. Sarokin, J. Lee et al., Speed is all you need: On-device acceleration of large diffusion models via GPU-aware optimizations, in: Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition, 2023, pp. 4650–4654.
[6] U. Cisco, Cisco annual internet report (2018–2023) white paper, 2021. 2020. Acessado em 10.
[7] T. Diwan, G. Anirudh and J.V. Tembhurne, Object detection using YOLO: Challenges, architectural successors, datasets and applications, Multimed Tools Appl **82** (2023), 9243–9275. doi:10.1007/s11042-022-13644-y.
[8] B. Dorsemaine, J.-P. Gaulier, J.-P. Wary et al., Internet of Things: A definition & taxonomy, in: 2015 9th International Conference on Next Generation Mobile Applications, Services and Technologies, IEEE, Cambridge, United Kingdom, 2015, pp. 72–77. doi:10.1109/NGMAST.2015.71.
[9] M. Farjana, A.B. Fahad, S.E. Alam and M.M. Islam, An IoT- and cloud-based e-waste management system for resource reclamation with a data-driven decision-making process, IoT **4** (2023), 202–220. doi:10.3390/iot4030011.
[10] File download/data transfer time calculator. https://www.meridianoutpost.com/resources/etools/calculators/calculator-file-download-time.php. Accessed 18 Feb 2022.
[11] V. Forti, C.P. Baldé, R. Kuehr and G. Bel, The global e-waste monitor 2020. United Nations University (UNU), International Telecommunication Union (ITU) & International Solid Waste Association (ISWA), Bonn/Geneva/Rotterdam, 2020, pp. 1–120.
[12] J. Gubbi, R. Buyya, S. Marusic and M. Palaniswami, Internet of Things (IoT): A vision, architectural elements, and future directions, Future Generation Computer Systems **29** (2013), 1645–1660. doi:10.1016/j.future.2013.01.010.
[13] S. Han, F. Ren, C. Wu et al., Using the TensorFlow deep neural network to classify mainland China visitor behaviours in Hong Kong from check-in data, IJGI **7** (2018), 158. doi:10.3390/ijgi7040158.
[14] K.F. Haque, R. Zabin, K. Yelamarthi et al., An IoT based efficient waste collection system with smart bins, in: 2020 IEEE 6th World Forum on Internet of Things (WF-IoT), IEEE, New Orleans, LA, USA, 2020, pp. 1–5.
[15] Y. Huang, H. Hu and C. Chen, Robustness of on-device models: Adversarial attack to deep learning models on Android apps, in: 2021 IEEE/ACM 43rd International Conference on Software Engineering: Software Engineering in Practice (ICSE-SEIP), IEEE, Madrid, ES, 2021, pp. 101–110.
[16] I.M.S.K. Ilankoon, Y. Ghorbani, M.N. Chong et al., E-waste in the international context – A review of trade flows, regulations, hazards, waste management strategies and technologies for value recovery, Waste Management **82** (2018), 258–275. doi:10.1016/j.wasman.2018. 10.018.
[17] International e-waste day: 57.4M tonnes expected in 2021 | WEEE Forum, 2021. https://weee-forum.org/ws_news/international-e-wasteday- 2021/. Accessed 15 Feb 2022.
[18] G. Jocher, A. Chaurasia and J. Qiu, YOLO by Ultralytics, 2023.
[19] K.D. Kang, H. Kang, I.M.S.K. Ilankoon and C.Y. Chong, Electronic waste collection systems using Internet of Things (IoT): Household electronic waste management in Malaysia, Journal of Cleaner Production **252** (2020), 119801. doi:10.1016/j.jclepro.2019.119801.
[20] R. Kunst, L. Avila, E. Pignaton et al., Improving network resources allocation in smart cities video surveillance, Computer Networks **134** (2018), 228–244. doi:10.1016/j.comnet.2018.01.042.
[21] T. Liang, J. Glossner, L.Wang et al., Pruning and quantization for deep neural network acceleration: A survey, Neurocomputing **461** (2021), 370–403. doi:10.1016/j.neucom.2021.07.045.
[22] Y. Mehmood, F. Ahmad, I. Yaqoob et al., Internet-of-Things-based smart cities: Recent advances and challenges, IEEE Commun Mag **55** (2017), 16–24. doi:10.1109/MCOM.2017.1600514.
[23] P. Moral, Á. García-Martín, M. Escudero-Viñolo et al., Towards automatic waste containers management in cities via computer vision: Containers localization and geo-positioning in city maps, Waste Management **152** (2022), 59–68. doi:10.1016/j.wasman.2022.08.007.
[24] G. Nguyen, S. Dlugolinsky, M. Bobák et al., Machine learning and deep learning frameworks and libraries for large-scale data mining: A survey, Artif Intell Rev **52** (2019), 77–124. doi:10.1007/s10462-018-09679-z.
[25] K. O'Shea and R. Nash, An introduction to convolutional neural networks, 2015. doi:10.48550/ARXIV.1511.08458.



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