

Automated litter Objects Detection In Northern Ireland Streets Using Computer Vision



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Abstract

Clean street enhances Northern Ireland's attractiveness and has significantly impacted public health and the environment. Traditional street cleaning procedures entail street sweepers seeing several street images and manually determining whether the roadway needs cleaning. This system, meanwhile, requires a significant number of manual operations for the detection and assessment of street cleanliness, which results in a high expense for Northern Ireland city corporation. Many have researched litter classification and object detection techniques with various deep-learning models for classifying and detecting objects category in Images. To resolve our issues, we are using object detection models of Image AI in this paper to detect litter objects in the street images and rank the street cleanliness. Moreover, We can Automate the Manual determination of street cleaning.

Introduction

People want to be well, happy and allowed to live in a clean, welcoming environment. Northern Ireland, another name Ulster is a thrilling destination that is also relatively safe for travellers. Compared to the rest of the globe, Northern Ireland has one of the lowest crime rates. As part of the drive to make the cities cleaner, the municipal corporation takes several measures and engages sweepers to clean the streets and promote the city. Typically, public streets and sidewalks absorb rubbish deposits from illicit dumping, dirt, and dispersed litter, among other things. When the city cleaning service fails, it may have a detrimental influence on the city's tourism, image, and revenue. According to studies, if there is trash on the streets, people will not hesitate to dump more garbage. When the roads are clean, people are more likely to think very hard while tossing anything and not put trash on the streets. As a result, maintaining the city's cleanliness is a vital duty for the municipal corporation, as it will improve its reputation and generate more revenue for the Government. Various strategies have been employed in the previous years to keep Northern Ireland's streets clean. These approaches primarily concentrate on assessing street cleanliness and monitoring garbage. In past years a Block system was used to clean the city, in which distinct blocks separated each city. Each block had a few workers who were in charge of keeping the area clean during the day. All of the dirt on these streets is collected, put in particular metal dirt bins along the walkways, and removed by daytime workers. Cleaning machines took place after several years. They sweep the roads, sidewalks, and streets fast using the equipment and less labour.

Keep Northern Ireland Beautiful conducted a litter survey in Northern Ireland between June and August 2020. It is a charitable organization committed to making Northern Ireland a spotless, more Eco-friendly, and more sustainable state by improving environmental teaching in every school. They are ramping up public participation for societies in need and raising emissions regulations in places where people spend quality time. They Trained assessors from Keep Northern Ireland Beautiful to examine the local environmental quality of 990 individual

transects (neighbourhoods, roadways, and recreational places) across the 11 council districts. They covered around 30.8 miles throughout the survey. In this survey, they summarise the cleanliness of Northern Ireland and the most commonly observed types of litter in Northern Ireland. Also, the spending on street cleaning across Northern Ireland and the penalty for illegal litter dumping. Many nations and governments are now employing various ways to keep the streets clean and provide people with a healthy and perceptive way of life. A British Technology firm Litter-Cam suggested a concept to assist local governments and highway operators; the idea uses server-less cameras to identify trash whenever someone tosses rubbish on streets or highways. In March 2021, the first trial took place in Kent (a county in southeastern England). Litter-Cam can detect littering and process photographs using AI and computer vision. This information is then given to the Driver and Vehicle Licensing Agency so that a law enforcement agent can assess each entry. The litter-Cam will subsequently send a penalty notice to the vehicle's registered owner. Bournemouth, Christchurch, and Poole (BCP) in the United Kingdom designed a project to eliminate trash using drones. BCP municipality collaborates with the environmental organisation Hubbub to use drone data to inform bin location, street cleaning routines, and trash behavioural therapy activities. Using Ellipsis software, identify thrown litter items automatically and quickly characterise them by kind and characterise by kind and brand to build litter heatmaps from drone images. The BCP council, Hubbub, uses this information and suggestions to help each other and reduce litter. To handle the problem of garbage detection and classification, Xiujie Xu introduced a waste classification and identification approach based on transfer learning and a lightweight neural network. Basma Korchani and Kaouthar Sethom proposed an enhanced system for real-time litter identification for smart and healthy cities with the use of Deep Learning and computer vision algorithms. To automate street cleanliness, Wenrui Li and Bharat Bhushan created a real-time multi-level evaluation system integrating Mobile Networks, cloud computing, and deep learning. Even though many academics are working on litter detection and classification, most studies identify the types, which is a beautiful concept; nevertheless, these ideas do not make the municipal cleanliness service more independent. Along with these services, identifying trash objects is essential to make the cleanliness service self-sufficient. Current litter-detecting technologies, however, rely on human involvement. To assess if the roadway is unclean, clean-up personnel must manually record and identify each image. As a result, an ideal system should detect trash in each shot image automatically and reliably, without human interaction. This research focuses on offering Northern Ireland an automated method for detecting trash and monitoring street cleanliness. Using computer vision technologies, we create and construct a model. We utilised Image AI which is an open-source tool. Image AI is a Python package that allows us to build models that have self-contained Deep Learning (DL) and computer vision capabilities. Techniques such as Data Analysis (DA), Deep Learning (DL), and image pre-processing were applied. It must be able to process images despite having low computer resources. Following picture pre-processing, YOLOv3, a pre-trained weight model, is used to detect litter objects in an image. Also, we rank the street cleanliness with the help of these findings of the pre-trained model. Finally, when the Analysis process did it will automatically open Google Maps and

point out the street which has more litter and needs to be cleaned. The primary contribution of this work was as follows. This study identified a primary open-source data set to train the model, as the data set is the fundamental tool for developing the model. However, we constructed our data set using a Google street-view image down-loader and snapped some photos of Northern Ireland streets ourselves for testing purposes. For labelling the images, we use the LABELIMG tool. The following is the paper's structure: Section 2 introduces existing work in street cleaning evaluation, computer vision, and object detection. Section 3 presents the Methodology, which includes a block schematic diagram of the proposed model, data set preparation, pre-processing, model construction, and ranking of the street cleanliness for the proposed system, based on Image AI and a pre-trained deep learning model. The suggested model's findings have shown in Section 4. Finally, we give some closing remarks.