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- Nama Penerbit: Multidisciplinary Digital Publishing Institute (MDPI)
- Judul: Optimization of Trash Identification on the House Compound Using a Convolutional Neural Network (CNN) and Sensor System
- Nama Penulis:
 1. Emil Naf'an (First Author sekaligus Koresponden Author)
 2. Riza Sulaiman
 3. Nazlena Mohamad Ali
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Manuscript ID: sensors-2056332
Title: Optimization of Identification Trash on The House Compound Using Convolutional Neural Network (CNN) and Sensor System
Authors: Emil Naf'an, Riza Sulaiman, Nazlena Mohamad Ali *

Received: 10 November 2022
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Title: Optimization of Identification Trash on The House Compound Using Convolutional Neural Network (CNN) and Sensor System
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Reviewer1

Journal Sensors (ISSN 1424-8220)
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 Type Article
 Title Optimization of Identification Trash on The House Compound Using Convolutional Neural Network (CNN) and Sensor System
 Authors Emil Nafan , Riza Sulaiman , Nazlena Mohamad Ali *
 Section Sensing and Imaging
 Abstract This study aims to optimize the object identification process, especially identifying trash in the house compound. Most object identification methods cannot distinguish whether the object is a real image (3D) or a photographic image on paper (2D). It will be a problem if the detected object is moved from one place to another. If the object is 2D, the robot's gripper only clamps empty objects. In this study, a Convolutional Neural Network (CNN) combination with a LiDAR (Light Detection and Ranging) sensor was carried out with an accuracy of ±2mm. After testing 11 types of trash on four CNN architectures (AlexNet, VGG16, GoogleNet, and ResNet18), the accuracy results are 80.5%, 95.6%, 98.3%, and 97.5%. This result is perfect for object identification. However, it needs to be optimized using a LiDAR sensor to determine the object in 3D or 2D. It will be ignored if the fast scanning process with the LiDAR sensor detects non-real (2D) trash. If Real (3D), the trash will be scanned in detail to determine the gripper's position in lifting the trash. The time efficiency generated by fast scanning is between 13.33% to 59.26% depending on the object's size. The larger the object, the greater the time efficiency obtained. In conclusion, optimization using a combination of CNN and LiDAR Sensors can identify trash objects correctly and determine whether the object is real (3D) or not (2D), so a decision may be made to move the trash from the detection location.

Author's Reply to the Review Report (Reviewer 1)

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Comments and Suggestions for Authors This paper proposes a technique to identify trash using CNN and a sensor system that consists of an IP camera and LiDAR sensor. The aim of the proposed technique is to distinguish real trash and trash printed on 2D paper. I have three main concerns about this paper.

1. Although this paper claims that the proposed technique tries to distinguish trash. However, the definition of trash in this paper is that if the target is an image printed on 2D paper, it is not trash;

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Comments and Suggestions for Authors

This paper proposes a technique to identify trash using CNN and a sensor system that consists of an IP camera and LIDAR sensor. The aim of the proposed technique is to distinguish real trash and trash printed on 2D paper. I have three main concerns about this paper.

1. Although this paper claims that the proposed technique tries to distinguish trash. However, the definition of trash in this paper is that if the target is an image printed on 2D paper, it is not trash; if the target is a 3D object, then it is trash. However, some 2D paper might also be trash in real life. Therefore, the proposed technique might not be useful in identifying trash in real life.
2. The proposed technique is a combination of existing techniques. For example, the modification of different CNNs is quite trivial and the pipeline in identifying trash and 3D objects is very straightforward.
3. The presentation of this paper should be improved. For example, some figures are screenshots that contain unrelated information, e.g., Fig. 3 (b), Fig. 14, 17, and 18. The image quality of Figure 14 is low. In Line 339, table 2 and table 3 should be table 3 and table 4. In Line 344, "the LIDAR sensor during the scanning process" should be "the LIDAR sensor during the scanning process". I recommend a careful revision of this paper.

Submission Date: 10 November 2022
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Reviewer2

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Comments and Suggestions for Authors

1. There are some grammar errors, please modify.
2. Page 10, lines 263 "Table 2 shows that the CNN GoogleNet architecture has the highest Validation Acc- 263 curacy value..." it is Table 3, not table 2.
3. The Figure 7 and 15 have a poor clarity quality, please modify.
4. "Ensemble of deep convolutional neural networks for automatic pavement crack detection and measurement" also uses the CNN, please make a comparison.
5. Please add the neural network calculation complexity (Parameters and FLOPs).
6. Fast Scanning and detailed Scanning should be demonstrated more details, you can draw a flowchart to express calculation process.

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Reviewer3

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Are the methods adequately described?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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Are the conclusions supported by the results?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments and Suggestions for Authors

- The authors did not present the details of the training options parameters of the CNN network. Did they use the default values or did they change some parameter values?
- A real photo of the display of household trash is shown in Figure 3. Figure 15 shows the classification of individual classes of trash. Does the presented model have the possibility of simultaneous classification of all classes of garbage shown in Figure 3? Please comment.
- Figure 15 does not show the reliability of the classification.
- Why the authors did not optimize the hyperparameters of the CNN network? Please comment.

Submission Date 10 November 2022
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KOMENTAR REVIEWER ROUND 2

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Journal Sensors (ISSN 1424-8220)
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 Type Article
 Title Optimization of Identification Trash on The House Compound Using Convolutional Neural Network (CNN) and Sensor System
 Authors Emil Nafan , Riza Sulaiman , Nazlena Mohamad Ali *
 Section Sensing and Imaging
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Comments and Suggestions for Authors

The Figure 16 have a poor clarity quality, please modify

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- Authors: Emil Naf'an, Riza Sulaiman, Nazlena Mohamad Ali *
- Received: 10 November 2022
- E-mails: p88912@siswa.ukm.edu.my, riza@ukm.edu.my, nazlena.ali@ukm.edu.my
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- Received: 10 November 2022
- E-mails: p88912@siswa.ukm.edu.my, riza@ukm.edu.my, nazlena.ali@ukm.edu.my
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We look forward to hearing from you.

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