CV Dataset Collection Report 2023: Report

Dataset Collection Of Common Objects Within Campus

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Contents

1 Executive Summary

In the pursuit of advancing computer vision and image processing technologies, the process of collecting and manipulating datasets related to objects found in a university environment plays a crucial role. This executive summary provides an overview of the key steps and considerations involved in this process.

The primary purpose of collecting such datasets is to facilitate research, development, and education in fields like computer vision, machine learning, and image processing. These datasets serve as foundational resources for creating and testing algorithms that can identify, manipulate, and understand objects and scenes within a university setting.

The scope of the dataset collection encompasses a wide range of objects and environments commonly encountered in a university, including classrooms boards, gym items, CPUs, projectors, wires and various academic materials. This comprehensive approach ensures the versatility and applicability of the functions applied on the dataset.

Datasets must capture diverse objects, scenes, and scenarios to ensure the robustness of algorithms across various real-world situations. High-resolution images are preferred to capture fine details and nuances. Furthermore, a substantial number of images are collected to train and evaluate algorithms effectively, reflecting the diversity of university objects. Images incorporate different lighting conditions, perspectives, and object placements to challenge the adaptability of the applied functions. Once the dataset was assembled, a range of image processing operations are applied such as transformation, color adjustment, bitwise operations, filtering etc.

The process of collecting and applying image processing techniques to university environment objects is a multidisciplinary endeavor that drives innovation in computer vision and related fields. Robust datasets and advanced algorithms are foundational to the development of technologies that can enhance security, automate tasks, and improve the understanding of complex environments.

2 Task Distribution

GROUP #01 Task: Common objects dataset collection within campus.

Members	Classes	Roles						
Emaan Siddiqui	snooker balls					Programming	8	
Farzan Ansari	cpus					Presentation	2	
Manahil Fatima	wires					Report	3	
Alishba Subhani	gym items							
Hamza Sameer	projectors							
Anas Ahmed	room names							
Anmol Zehrah	boards							
Mannahil Miftah	air conditioner							
Usman Yaqoob	markers							
Haiqa Sheraz	chairs							
Lohit Ashwa	tables							
Sondos Suhail	bags							
Fahad Zahid	monitors							

Members	Roles	Tasks
Farzan Ansari		EDA, color spaces, dataframes
Manahil Fatima		Visualize, resize, histogram equalization
Alishba Subhani		blur, crop, bitwise, gray scale
Hamza Sameer		transformations
Anas Ahmed		color adjustment, gamma correction
Haiqa Sheraz		summary stats
Lohit Ashwa		blending, pixel values
Fahad Zahid		threshold, rotation
Emaan Siddiqui		Report (Contribution of Dataset + Intended Audience + Data Usage and Application + Data License and Acknowledgements + Conclusion)
Anmol Zehrah		Report (Executive Summary + Introduction + Data Collection Process)
Mannahil Miftah		Report (Dataset Description + Dataset Statistics + Data Examples)
Usman Yaqoob		presentation (content+presenter)
Sondos Suhail		presentation (content+presenter)

3 Contributions of Dataset

This dataset is a valuable resource for a wide range of applications within the university setting, offering several key contributions:

1. Diversity of Object Classes: Our dataset covers a diverse set of object classes, reflecting the myriad objects commonly found on university campuses. This diversity ensures its applicability to various tasks and research areas.

2. Image Consistency: We collected 25 images for each object class, ensuring that the dataset maintains a consistent and comprehensive representation of each object type.The dataset has undergone rigorous data cleaning and preprocessing to ensure data quality and accuracy. This consistency aids in training and evaluation across different machine learning and computer vision applications.

3. University Relevance: The dataset's focus on objects prevalent within the university context makes it particularly relevant for addressing challenges specific to educational institutions. It can support tasks such as campus monitoring, inventory management, classroom automation, and more.

4. Machine Learning and Computer Vision: Researchers and developers can leverage this dataset for machine learning and computer vision projects, including object detection, classification, segmentation, and recognition. It serves as a suitable benchmark for evaluating the performance of algorithms in real-world scenarios.

5. Educational and Research Applications: The dataset can be instrumental in academic research, allowing scholars to explore various aspects of object recognition and scene analysis within university environments. It can also serve as an educational resource for students studying computer vision and related fields.

We anticipate that this dataset will find applications in a wide range of projects, from enhancing campus security to advancing the state of the art in computer vision and machine learning.

4 Intended Audience

This dataset of common university objects serves researchers, educators, and administrators, enabling research in computer vision, educational applications, and practical solutions like inventory management and smart campuses, fostering innovation and efficiency within academic institutions.

5 Acknowledgments

We would like to express our sincere gratitude to FAST NUCES for granting us permission to capture images of various objects within the campus premises.

6 Introduction

6.1 Motivation for the Dataset Collection

The motivation for the dataset collection related to objects found in a university environment and applying various image processing operations is multifaceted. Firstly, the rapid progress in computer vision, machine learning, and image processing technologies has created opportunities for automation and insights from visual data. Applying functionalities in real-world settings, like university campuses, is crucial for their practical application. Secondly, educational and research institutions are hubs of innovation, and providing researchers and students with comprehensive datasets allows them to explore and experiment with cutting-edge techniques, fostering educational and research progress. Lastly, the dataset's relevance extends to enhancing security and automation within universities, encompassing applications such as campus surveillance, access control, inventory management, and resource optimization.

6.2 Objectives and Goals of the Dataset

The primary objectives behind creating this dataset collection are to serve as a resource that addresses several critical needs in the fields of computer vision, image processing, and machine learning. Firstly, it functions as a foundational resource for researchers and developers, offering real-world scenarios to develop and test cutting-edge technologies. Secondly, it empowers educational institutions by providing valuable teaching tools for computer vision and image processing, allowing students to gain practical experience with state-of-the-art techniques. Additionally, it facilitates benchmarking and evaluation of algorithms in a controlled environment, enabling the comparison of different approaches. Lastly, the dataset's practical applications extend to enhancing security, optimizing resources, and automating administrative tasks within a university setting, ultimately contributing to the efficiency and safety of campus operations.

6.3 Importance and Relevance of the Dataset

The importance and relevance of this dataset collection in the context of university environments and image processing operations are crucial and impactful. Firstly, it holds real-world utility by enabling the development of algorithms and technologies tailored to the dynamic and diverse university settings, with applications extending beyond research to encompass enhanced security, optimized resource management, and improved campus operations. Secondly, it has a profound educational impact by equipping institutions with a practical tool for hands-on training in computer vision and image processing, aligning students with the skills demanded by emerging fields. Moreover, this dataset serves as an innovation catalyst, fostering research and experimentation, and encouraging the creation of novel solutions that benefit not only universities but society at large. Lastly, it promotes interdisciplinary collaboration, bridging academia and industry to apply cutting-edge technologies effectively in practical settings. This dataset collection significantly contributes to technological advancement, education, and the overall enhancement of university operations and security.

7 Dataset Description

7.1 Description

Our comprehensive dataset includes a wide range of common objects often encountered within the university environment. This diversified collection has been carefully chosen to contain a wide range of object classes, each of which is important in the context of university life. The dataset's goal is to provide a rich and representative resource for study, analysis, and computer vision applications by providing a comprehensive perspective of the items that occupy educational institutions. It tries to meet the varied character of items found in the academic context by encompassing such variety, from necessary classroom furniture like chairs and tables to specialist equipment like projectors and air conditioners.

7.2 Features of Dataset

1. Object Class: The dataset comprises a total of 13 object classes which are as follows:
   (a) Chairs
   (b) Bags
   (c) Air Conditioners
   (d) Snooker Balls
   (e) Projectors
   (f) Gym Items
   (g) Tables
   (h) Monitors
   (i) CPUs
   (j) Wires
   (k) Markers
   (l) Boards
   (m) Room Names
2. Object Image: Each object class is represented by 25 or more high quality images in .jpg or .jpeg format.
3. Image Size: The images in the collection were originally of varied sizes and resolutions. A resizing operation was done on each image after preprocessing to guarantee uniformity and consistency in processing. The resize function was specifically used to standardize all photos to a set size of 400x400 pixels. This procedure guarantees that all photos in the dataset have the same dimensions, making them suitable for further analysis and tasks.

7.3 Preprocessing

In preparing the dataset for analysis or computer vision tasks, the preprocessing step involved creating a structured data representation which is DataFrame. The contents of dataframe are:

1. Path: This column stores the file path of each image which provides the location of the image within the dataset directory.

2. Filename: This column contains the file names of images.

3. Label: This column is included in order to assign a specific class to each image, indicating the type of common object that the image represents.

The DataFrame generation is an important preprocessing step since it organizes the dataset into a tabular format. This format structure simplifies data management, and makes it easy to perform data analysis, computer vision and other tasks.

8 Data Collection Process

The data collection process for a dataset related to objects found in a university environment and the application of image processing operations typically involves several steps:

8.1 Data Sources

Images are collected from various sources within the university campus. Using mobile phone cameras, all the group members captured images of their assigned objects ranging from boards, gym items, CPUs, projectors, snooker balls to air conditioners, monitors and other objects.

8.2 Methodology

1. **Image Capture:** High-resolution images are captured using appropriate equipment, taking into account factors like lighting conditions, angles, and camera settings to ensure data quality.

2. **Pre-processing:** Images are preprocessed to ensure consistency and quality. This involves resizing, color correction, noise reduction, and other enhancements to improve the overall dataset quality.

3. **Applying Functionalities:** Various functions and operations are applied to all the images such as transformation, bitwise operations, thresholding and others.

8.3 Tools and Technologies

1. Mobile Phone Cameras

2. Jupyter Notebook

3. Google Drive

4. Google Colab

5. Python Libraries

8.4 Ethical Measures

Transparency in data collection, processing, and usage is essential. Users of the dataset are aware of how the data was collected and for what purposes it was used. Furthermore, permissions were taken by staff members to collect images of different objects.

9 Dataset Usage and Applications

1. Object Recognition and Tracking: Develop object recognition and tracking systems for security and asset management.

2. Inventory Management: Create efficient inventory systems to track resources and assets within university.

3. Smart Campus Solutions: Implement smart solutions like automated room booking and energy management.

4. Research in Computer Vision: Advance computer vision research for object recognition and scene analysis.

5. Education and Training: Use it for teaching computer vision and AI concepts in educational settings.

6. Prototyping and Product Development: Accelerate product development for campus-related innovations.

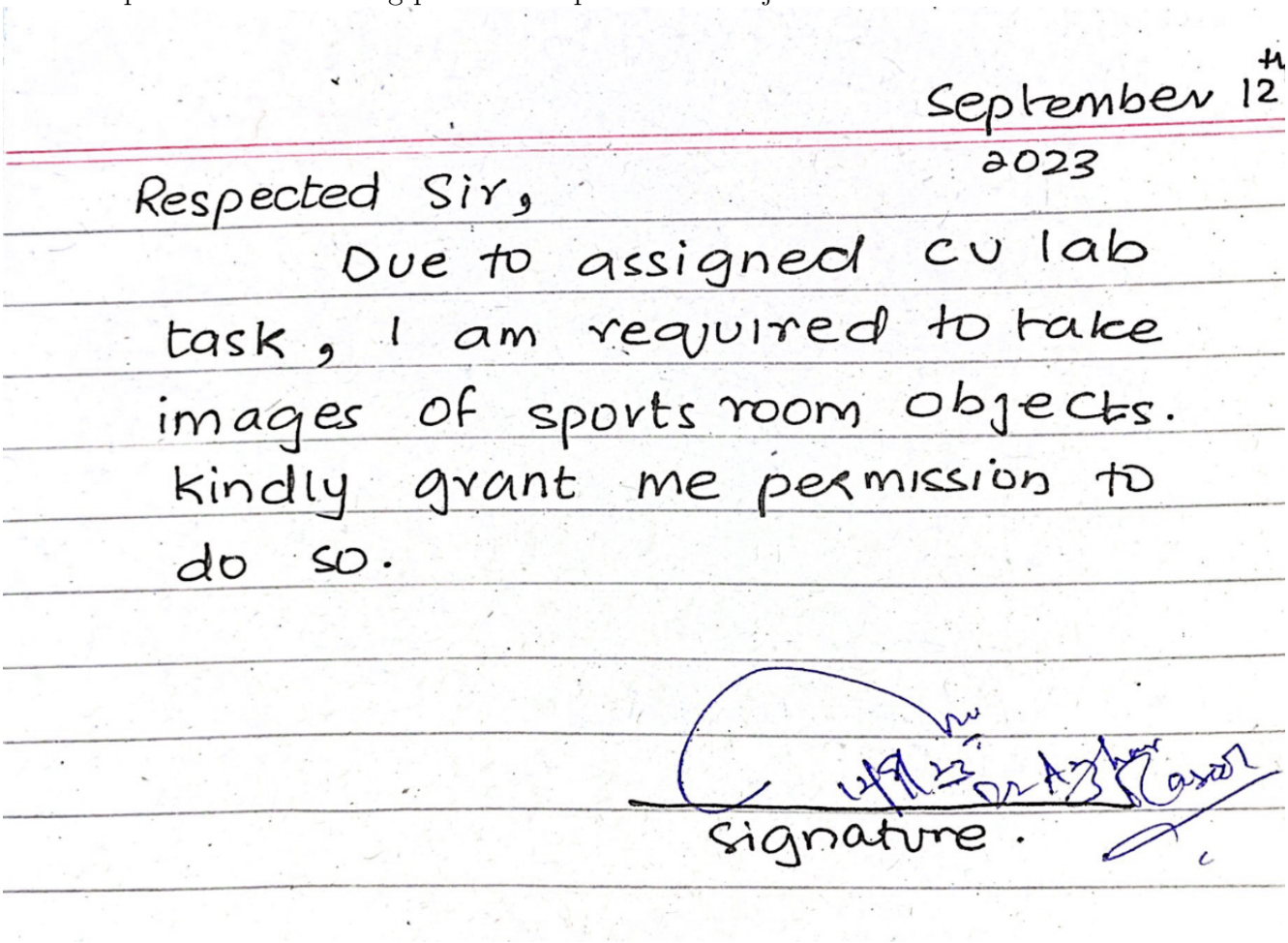
7. Data Analytics and Space Utilization: Analyze space utilization to optimize resource allocation.

8. Security Enhancements: Develop security systems for threat detection and response.

The dataset we collected will be used for object detection using computer vision.

10 Data License and Terms of Use

We took permission for taking pictures of sports room objects.



September 12th
2023

Respected Sir,

Due to assigned cv lab task, I am required to take images of sports room objects. kindly grant me permission to do so.

Signature.

11 Dataset Statistics

Objects	Samples
Chairs	25
Bags	26
Air Conditioners	30
Snooker Balls	29
Projectors	25
Gym Items	27
Tables	29
Monitors	25
CPUs	27
Wires	29
Markers	25
Boards	30
Room Names	25

Table 1: Number of Samples

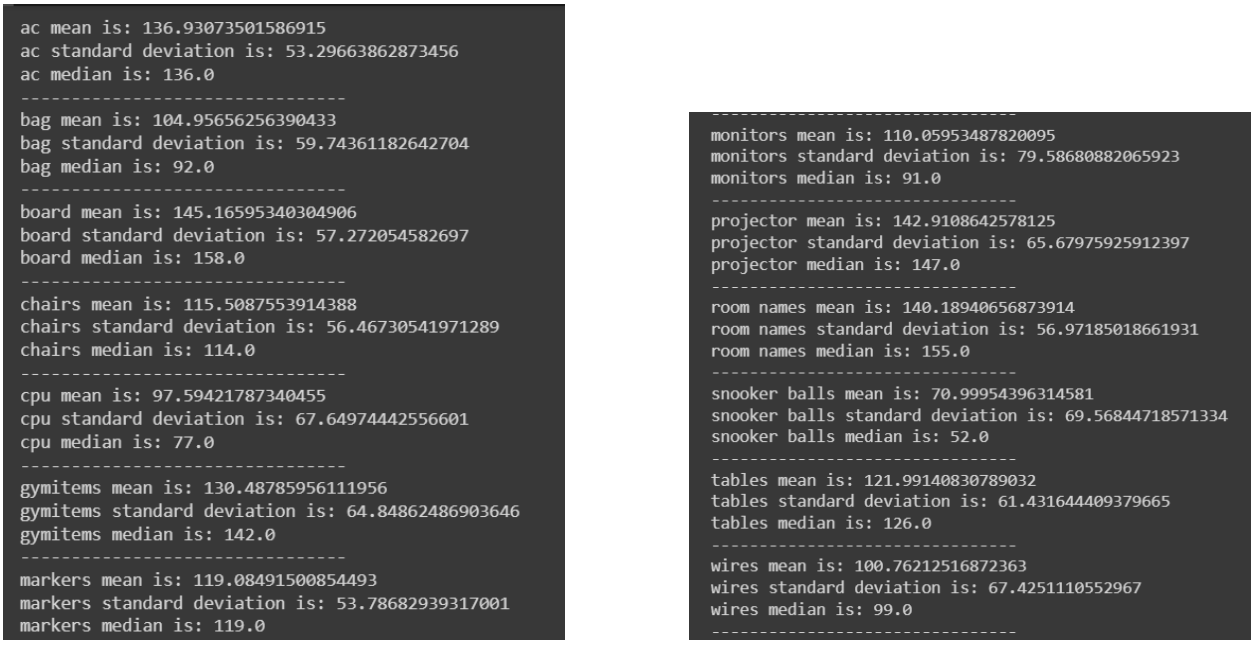


Figure 1: Statistics

12 Data Examples

(a) Air Conditioner

(b) Table

(c) Chair

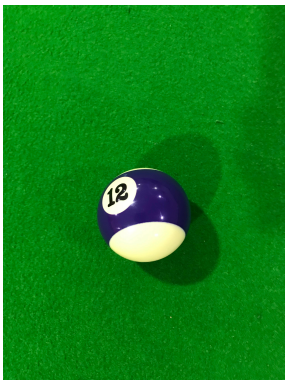
(d) Room Name

(e) Marker

(f) Wire

(a) CPU

(b) Monitor



(c) Snooker Ball

(d) Gym Item

(a) Bag

(b) Board

(c) Projector

13 Conclusion

In summary, this dataset of common university objects offers a valuable resource for research, innovation, and practical applications within academic institutions. With its diverse object classes and potential use cases in computer vision, education, and campus management, it holds the promise of advancing technology and enhancing the efficiency and quality of university operations.

14 References

CV Lab manuals.