

# Project Report

## Object Marking and Clustering

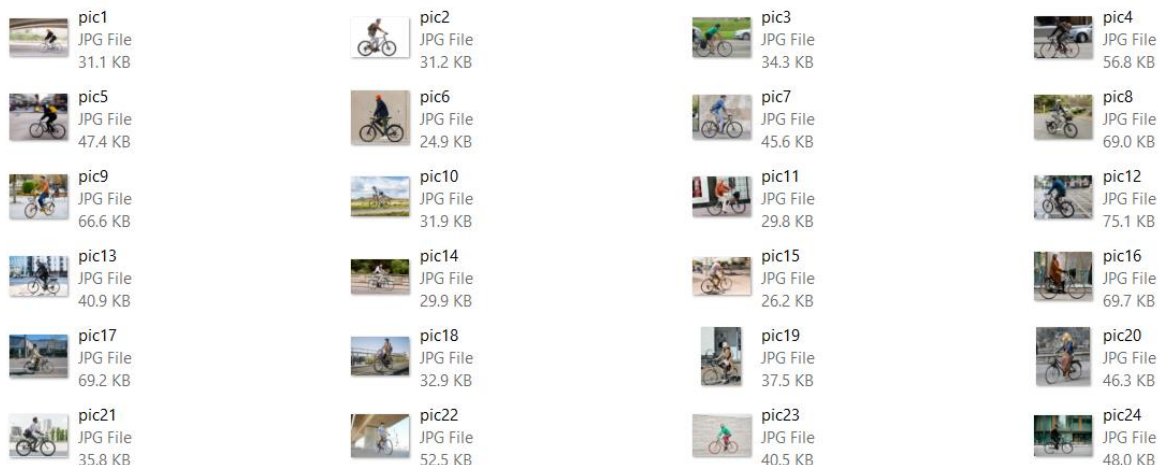
### 1. Introduction

This project involves processing a dataset of images related to cyclists. The objectives are to convert image formats, mark objects within the photos, and collect relevant data for analysis. And clustering. This report details the steps taken in the project, including image conversion, object marking, clustering, and data storage.

### 2. Image Collection and Conversion

#### 2.1 Image Collection

The dataset consists of images in various formats (specifically JPG, JPEG, and PNG). The first step is to gather all relevant images into a designated input folder, Cyclist\_dataset, which contains the original images to be processed.



#### 2.2 Image Format Conversion

All images are converted from original formats to BMP format to facilitate further processing. The BMP format is chosen due to its simplicity and wide compatibility with various image processing applications.

#### Procedure:

- A new output directory (Cyclist\_dataset\_bmp) is created to store the converted BMP images.
- Each image is opened and saved in BMP format while renamed sequentially (e.g., 1.bmp, 2.bmp, etc.). This allows for easy identification and tracking of the processed images.



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### 3. Object Marking and Information Collection

#### 3.1 Object Marking

After converting the images, the next step involves marking specific objects within each image. This is accomplished by defining bounding boxes around two selected objects per image, cycle and person.

#### 3.2 Data Collection

The coordinates (x, y) of the top-left corner of each bounding box, along with the width and height of the boxes, are recorded. This information is vital for analyzing the positions and sizes of the objects within the images.

```
rawdata/1.bmp 2 252 80 74 147 211 146 165 104
rawdata/10.bmp 2 167 51 113 315 107 182 336 254
rawdata/11.bmp 2 291 14 105 338 156 186 303 244
rawdata/2.bmp 2 144 62 83 146 122 113 151 106
rawdata/3.bmp 2 160 14 77 223 86 114 271 138
rawdata/4.bmp 2 183 4 118 324 67 167 395 217
rawdata/5.bmp 2 127 22 86 264 20 150 312 151
rawdata/6.bmp 2 199 18 172 368 61 198 434 238
rawdata/7.bmp 2 308 97 154 287 194 240 363 206
```

### 3.3 Clustering Analysis

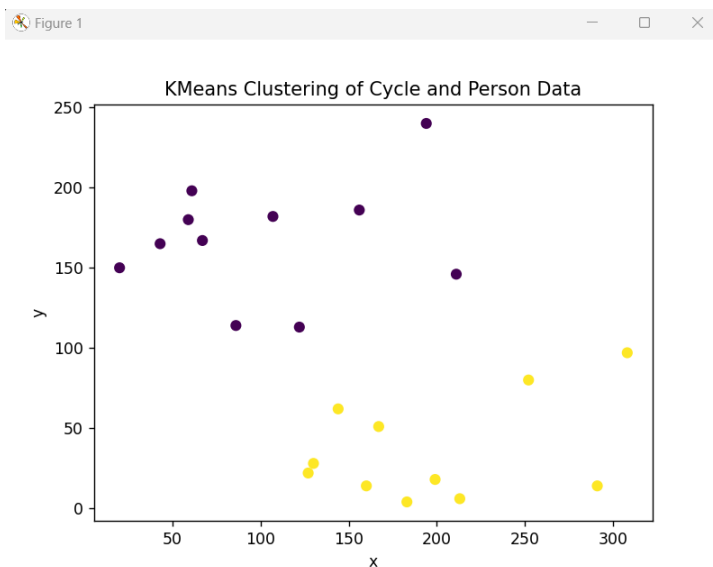
To analyze the distribution of the marked objects, KMeans clustering is applied to the collected bounding box data. This helps identify distinct clusters of objects based on their coordinates and sizes, facilitating further insights into the dataset.

Data Structure:

- A dataset is created to store the following attributes for each marked object:
  - image\_path: The name of the image file.
  - x: The x-coordinate of the top-left corner of the bounding box.
  - y: The y-coordinate of the top-left corner of the bounding box.
  - width: The width of the bounding box.
  - height: The height of the bounding box.
  - cluster: A classification label indicating the category of the object, based on clustering analysis.

### 3.4 Visualizing Clusters

The clusters formed during the KMeans analysis are visualized using a scatter plot. This plot displays the distribution of the marked objects in a two-dimensional space, categorized by their assigned cluster labels.



	x	y	width	height	cluster
0	199	18	172	368	1
1	308	97	154	287	1
2	130	28	98	264	1
3	213	6	129	342	1
4	211	146	165	104	0
5	107	182	336	254	0
6	156	186	303	244	0
7	122	113	151	106	0
8	252	80	74	147	1
9	167	51	113	315	1
10	291	14	105	338	1
11	144	62	83	146	1
12	86	114	271	138	0
13	67	167	395	217	0
14	20	150	312	151	0
15	61	198	434	238	0
16	194	240	363	206	0
17	43	165	285	143	0
18	59	180	410	198	0
19	160	14	77	223	1
20	183	4	118	324	1
21	127	22	86	264	1

## 4. Data Storage

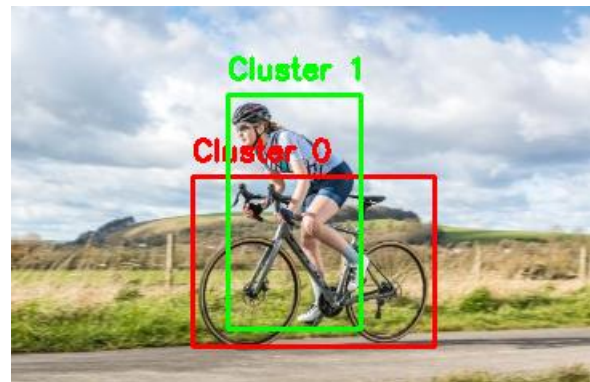
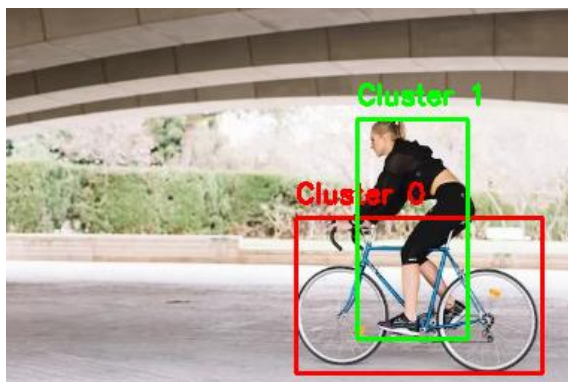
### 4.1 Saving Results

The marked object data, including the bounding box coordinates and cluster labels, is saved into a CSV file (bounding\_boxes\_file.csv). This file serves as a structured record of the processed data, facilitating future analysis and reference.

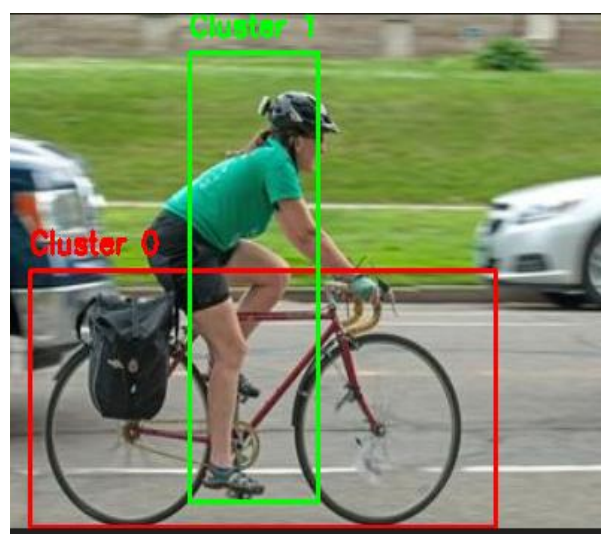
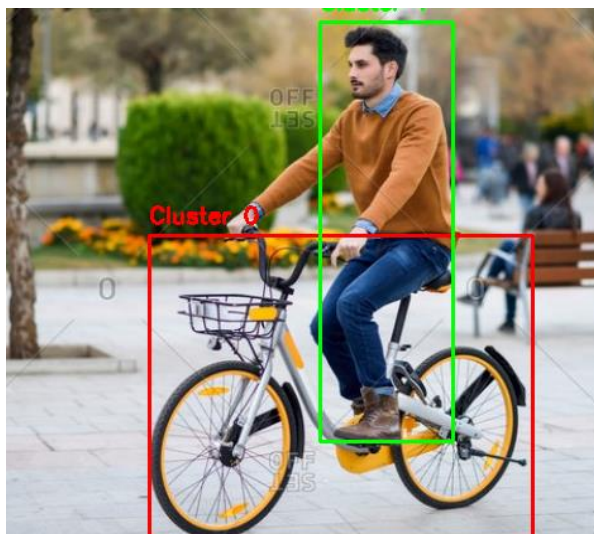
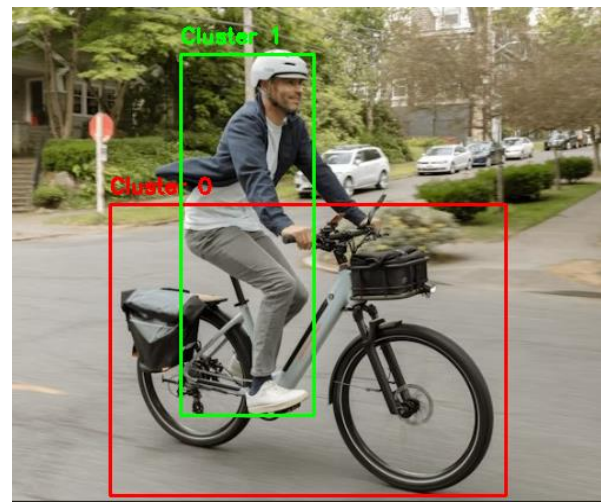
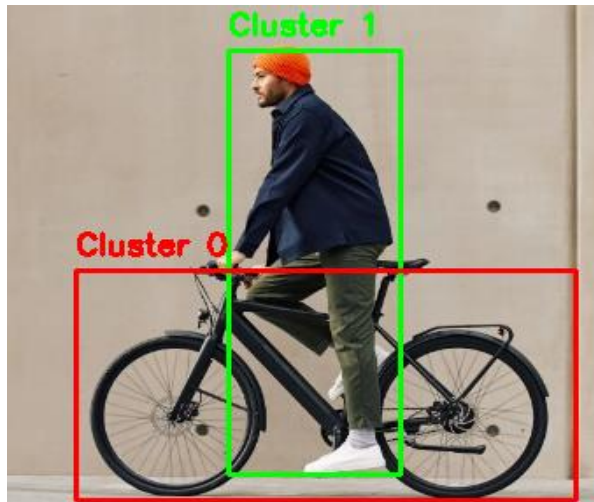
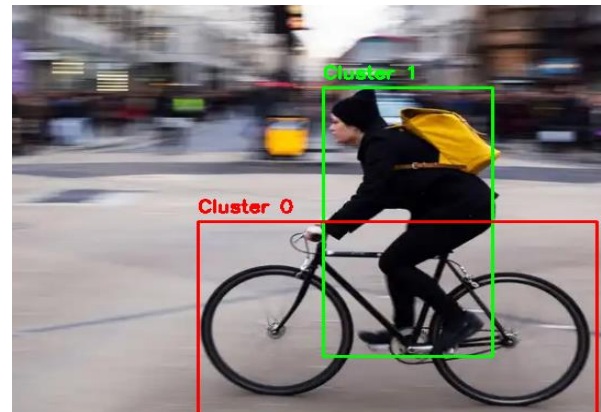
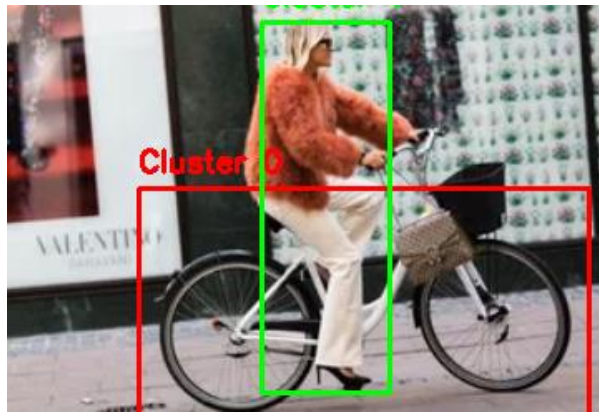
```
image_path,x,y,width,height,cluster
6.bmp,199,18,172,368,1
7.bmp,308,97,154,287,1
8.bmp,130,28,98,264,1
9.bmp,213,6,129,342,1
1.bmp,211,146,165,104,0
10.bmp,107,182,336,254,0
11.bmp,156,186,303,244,0
2.bmp,122,113,151,106,0
1.bmp,252,80,74,147,1
10.bmp,167,51,113,315,1
11.bmp,291,14,105,338,1
2.bmp,144,62,83,146,1
3.bmp,86,114,271,138,0
4.bmp,67,167,395,217,0
5.bmp,20,150,312,151,0
6.bmp,61,198,434,238,0
7.bmp,194,240,363,206,0
8.bmp,43,165,285,143,0
9.bmp,59,180,410,198,0
3.bmp,160,14,77,223,1
4.bmp,183,4,118,324,1
5.bmp,127,22,86,264,1
```

### 4.2 Output Images

The processed images, now annotated with bounding boxes, are saved in a separate output directory (output\_images). Each image retains its filename, ensuring easy access and identification.







## 5. Conclusion

This project successfully demonstrates a systematic approach to image processing, including format conversion, object marking, clustering analysis, and data storage.