

Improving the Quality of Collected Data for Machine Learning

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Abstract

As a student in the field of artificial intelligence, I am constantly reminded of the importance of clean and accurate data for successful models. In this project, I sought to improve the data collected by A. I. Whoo and Tanvir Rahman on individuals' activities, genders, and ages. I began by taking a sample of 100 individuals from the original dataset, which included information on over 600 people. I then manually watched the videos associated with each individual and added additional features, such as "hold" and "carry". I also added information on the individuals' accessories and divided the most dominant color of their clothing into "top color" and "bottom color" features. To further improve the data, I wrote a Python script that highlighted repeating rows and provided unique entries. This allowed me to easily identify and highlight duplicate entries, resulting in a more accurate and precise dataset. After applying hierarchical clustering to the improved dataset, I found that the top and bottom colors of individuals' clothing and their accessories were the most important features. This analysis allowed me to gain a better understanding of the data and led to an increase in the overall quality of the dataset by 5%. In conclusion, my work highlights the critical role that clean and accurate data plays in the success of machine learning and AI models. By improving the quality of the data, I was able to provide a better foundation for future model training.

Introduction

The success of machine learning and artificial intelligence depends heavily on the quality of the data used to train models. In order for a machine learning model to make

accurate predictions, it must be trained on a large and diverse set of data that represents the problem it is trying to solve. This data must be clean and free from errors, missing values, or other inconsistencies that could affect the model's performance. If the data is not clean, the model will be unable to learn from it effectively, and its predictions and decisions may be unreliable. Additionally, clean data is important for ensuring that a machine learning model is fair and unbiased. If the data used to train the model contains biases or stereotypes, the model may learn and perpetuate these biases, which could lead to discriminatory or unfair outcomes. Clean data is essential for building machine learning models that are fair and unbiased, and that can make reliable predictions and decisions. Overall, clean data is important for machine learning and artificial intelligence because it allows these systems to learn accurately and make reliable predictions and decisions. Clean data is the foundation of a successful machine learning model, and it is essential for building fair and unbiased systems.

In this paper, I describe my efforts to improve the data collected by A. I. Whoo and Tanvir Rahman on individuals' activities, genders, and ages. My work involved several key steps. First, I took a sample of 100 individuals from the original dataset, which included information on over 600 people. I then manually watched the videos associated with each individual and added additional features, such as "hold" and "carry". I also added information on the individuals' accessories and divided the most dominant color of their clothing into "top color" and "bottom color" features. To further improve the data, I wrote a Python script that highlighted repeating rows and provided unique entries. This allowed me to easily identify and highlight duplicate entries, resulting in a more accurate and precise dataset.

In the following sections, I describe data collection and improvement methods in more detail and discuss the implications of my findings for future machine learning and AI research. My work shows the importance of carefully curating and preprocessing data to ensure the success of machine learning and AI models.

Data Collection

Background

The data collection process in this case was carried out over the winter in various parks. The cameras were hidden in bushes in order to capture people without them being aware of it. The resulting video was then split into small segments of 30 seconds in which people could be seen. Any segments without people were deleted, and the remaining segments were manually reviewed by Tanvir, who entered the data into a Google Sheets document. This data included the person's age, gender, and activity, and was manually reviewed again to identify any instances where a person was captured on camera multiple times, which were highlighted in red(see figure below).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
31				34 cycling	2021_11_18.treesign.10_51_27.tr first		green cover		1 green	adult			female		
32				35 jogging	2021_11_18.treesign.10_54_30.tr first		blue, pink cover woman		1 blue	adult			female		
33				36 walking	2021_11_18.treesign.10_56_10.tr first		black cover with a dog aged man		1 black	old			male		
34				37 jogging	2021_11_18.treesign.11_01_48.tr first		white top woman		1 white	adult			male		
35				38 cycling	2021_11_18.treesign.11_01_48.tr first		black cover, white/black cycle		1 black	old			male		
36				39 cycling	2021_11_18.treesign.11_02_35.tr first		blue cover, black pants, black cyc		1 blue	old			female		
37				42 jogging	2021_11_18.treesign.11_11_00.tr first		white top, woman		1 ash	adult			female		
38				43 cycling	2021_11_18.treesign.11_16_34.tr first		white top, ash pants, black cycle		1 white	adult			male		
39				44 jogging	2021_11_18.treesign.11_20_22.tr first		white top aged man		1 white	old			male		
40				45 cycling	2021_11_18.treesign.11_24_54.tr first		blue cover, black cycle		1 blue	adult			male		
41				46 walking	2021_11_18.treesign.11_27_30.tr first		black cover woman		1 black	old			female		
42		44		47 jogging	2021_11_18.treesign.11_28_43.tr first		white top aged man		white	old			male		
43				48 jogging	2021_11_18.treesign.11_29_40.tr first		green top with a hat man		1 blue	adult			male		
44				49 cycling	2021_11_18.treesign.11_31_55.tr first		white top with helmet aged man, t		1 white	old			male		
45				50 cycling	2021_11_18.treesign.11_37_49.tr first		ash top, red bag, black cyc		1 ash	old			male		
46				51 walking	2021_11_18.treesign.11_48_18.tr first		family group		1 blue	old			female		
47				52 walking	2021_11_18.treesign.11_48_18.tr first		family group		1 pink	old			female		
48				53 walking	2021_11_18.treesign.11_49_27.tr first		couple		1 black	old			male		
49				54 walking	2021_11_18.treesign.11_49_27.tr first		couple		1 red	old			female		
50				55 cycling	2021_11_18.treesign.11_50_29.tr first		green cover, black cycle with helv		1 green	n/a			n/a		
51				56 cycling	2021_11_18.treesign.11_53_08.tr first		ash cover, with a hat motocycle		1 ash	old			male		
52				57 cycling	2021_11_18.treesign.11_56_05.tr first		black cover black cycle		1 black	old			male		
53		45		58 cycling	2021_11_18.treesign.11_56_05.tr first		blue cover black cycle		blue	adult			male		
54				59 cycling	2021_11_18.treesign.11_58_31.tr first		group lady		1 ash	old			female		
55				60 cycling	2021_11_18.treesign.11_58_31.tr first		group lady		1 ash	old			female		
56				61 jogging	2021_11_18.treesign.11_59_18.tr first		white top woman		1 white	adult			female		
57				62 cycling	2021_11_18.treesign.12_00_00.tr last		white top, red cap, lilac cycle		1 white	old			male		
58		51		63 walking	2021_11_18.treesign.12_01_42.tr last				blue	old			female		
59		52		64 walking	2021_11_18.treesign.12_01_42.tr last				pink	old			female		
60				65 jogging	2021_11_18.treesign.12_03_12.tr last		white top woman		1 white	adult			female		
61				66 walking	2021_11_18.treesign.12_07_18.tr last		couple aged		1 green	old			female		
62				67 walking	2021_11_18.treesign.12_07_18.tr last		couple aged		1 ash	old			male		
63				68 walking	2021_11_18.treesign.12_08_47.tr last		black top woman		1 black	adult			female		

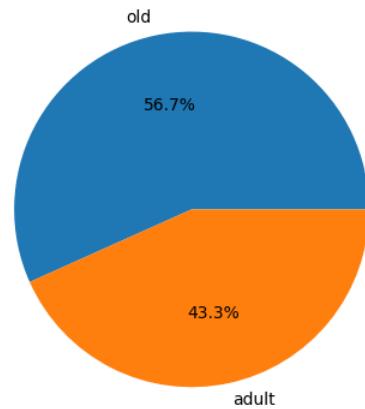
This data collection process is delicate for a number of reasons. Firstly, the use of hidden cameras raises ethical concerns about privacy and consent. It is important to ensure that people are not being recorded without their knowledge or permission, as this could violate their rights. Secondly, the manual entry of data introduces the potential for errors and inconsistencies, which could affect

the quality and reliability of the resulting data. Finally, the process of manually reviewing and labeling the data is labor-intensive and time-consuming, and is susceptible to bias and subjectivity. Overall, the data collection process in this case is delicate and requires careful consideration and attention to detail in order to ensure that the resulting data is high-quality and reliable.

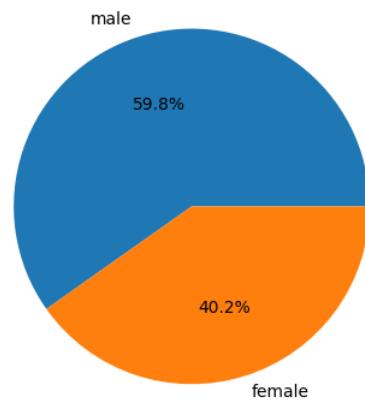
Demographics

(from sample of 100 observations)

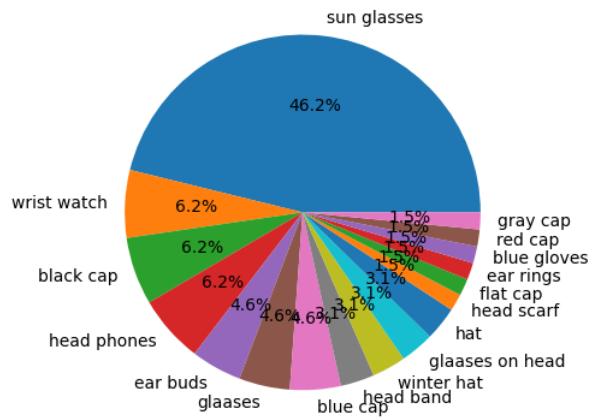
Observations in each age group



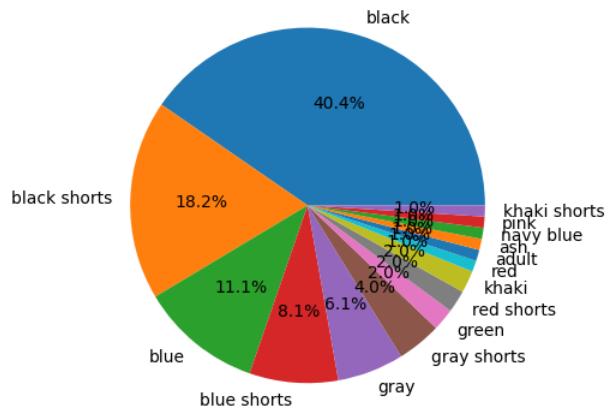
Observations in each gender



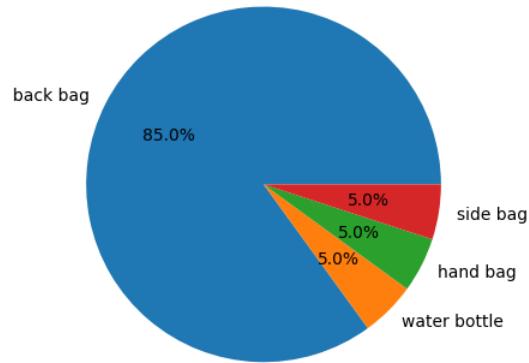
Observations in each Accessories



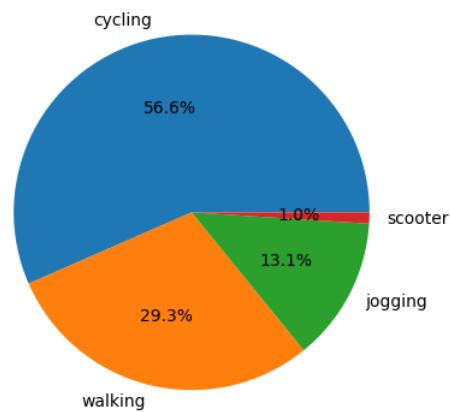
Observations in each Bottom color

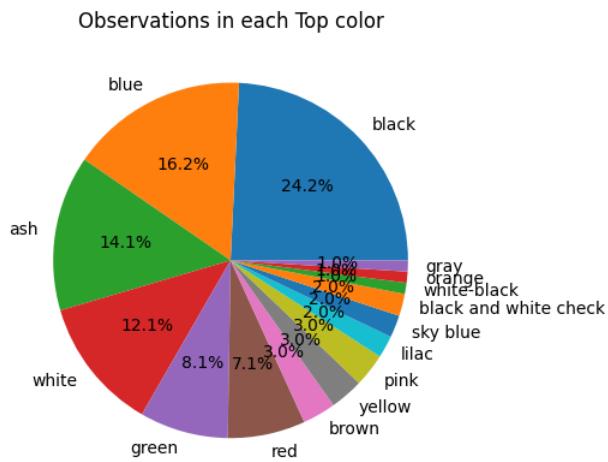
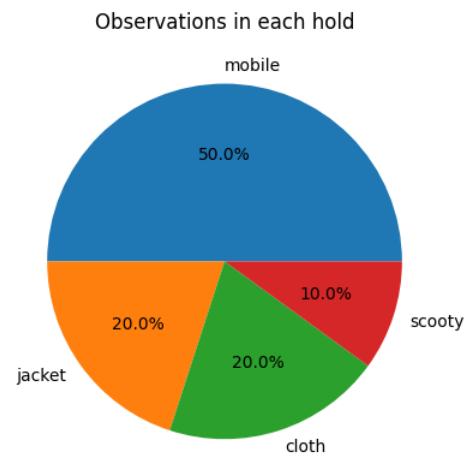


Observations in each carry



Observations in each activity





Method

In this study, I will be manually adding features to a dataset and comparing the results with a pre-existing dataset and ground truth observations. I will begin by watching videos related to each observation in the dataset and adding one feature at a time to see if it improves the accuracy of the data. I will then compare the results of this experiment with the dataset created by Tanvir, which was completed through manual ground checking.

Next, I will watch the video of the highlighted observations to double check the accuracy of the data. After this, I will add another feature to the dataset and compare the results with the previous results and Tanvir's dataset to determine the effectiveness of the added feature. I will continue this process, adding features and comparing results, until all relevant features have been added to the dataset.

Through this method, I hope to improve the accuracy of the dataset and gain a better understanding of the relationship between the added features and the observed phenomena. I believe that by carefully examining the data and comparing my results to existing datasets, I will be able to gain valuable insights into the nature of the phenomena under study.

Experiments

By conducting experiments, you can gain insights into the best ways to clean your data, which can help you improve the performance of your machine learning model. It can help you identify any issues or inconsistencies in your data, which can help you make informed decisions about how to preprocess your data before feeding it into your model. To investigate the error, I performed a series of experiments to evaluate the dataset. In each experiment, I varied a single factor while holding all other features constant. The features I considered were 'age group', 'Top color', 'sex', 'activity', 'accessories', 'carry', 'hold', 'Bottom color'.

Experiment 1:

Features: 'age group', 'Top color', 'sex', 'activity'

Highlighted Observations: [7, 21, 29, 34, 43, 45, 47, 53, 57, 58, 60, 62, 63, 64, 65, 68, 69, 70, 73, 74, 75, 76, 77, 78, 79, 80, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 95, 97, 99, 100, 101, 102, 103, 106]

Total Length: 45

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	treesign	duplicate	observation	activity	Unnamed: 5	hour	Description	Unnamed: 9	of People	Top color	bottom color	age group	speed	sex	accessories	carry	hold	
2																		
3				6 walking	2021_11_18_treesign.01	first	Two freinds brown shirt		1	brown	blue	adult		male	wrist watch			
4				7 walking	2021_11_18_treesign.01	first	Two freinds brown shirt		1	brown	blue	adult		male			mobile	
5				8 cycling	2021_11_18_treesign.01	first	black shirt, white/black		1	black	black	adult		male				
6				9 walking	2021_11_18_treesign.01	first	couple		1	white-black	red	old		female				
7				10 walking	2021_11_18_treesign.01	first	couple		1	blue	blue	old		male	sun glasses			
8				11 cycling	2021_11_18_treesign.01	first	couple		1	white	black	adult		male	sun glasses			
9				12 cycling	2021_11_18_treesign.01	first	couple		1	blue	black	adult		female		back bag		
10				14 jogging	2021_11_18_treesign.01	first	Green Tracksuit		1	green	black shorts	adult		male	winter hat			
11				15 walking	2021_11_18_treesign.01	first	magenta top woman		1	lilac	black	old		female	ear rings			
12				16 cycling	2021_11_18_treesign.01	first	unknown		1	black	adult							
13				17 walking	2021_11_18_treesign.01	first	blue top woman		1	sky blue	blue	old		female	sun glasses		mobile	
14				18 cycling	2021_11_18_treesign.01	first	white top off green pant		1	white	green	adult		female				
15				19 cycling	2021_11_18_treesign.01	first	ash cover, black cycle		1	ash	ash	adult		male	ear buds			
16				20 cycling	2021_11_18_treesign.01	first	black and yellow cover,		1	yellow	black	old		male	sun glasses			
17				24 cycling	2021_11_18_treesign.01	first	black cover, yellow cycle		1	black	black shorts	adult		male	glasses			
18				22.1 cycling	2021_11_18_treesign.09_26_5.58.trail	av1			1	green	black	old		male	sun glasses			
19				22.2 cycling	2021_11_18_treesign.05	first	green cover group		1	green	black shorts	adult		male	sun glasses	back bag		
20				23 cycling	2021_11_18_treesign.05	first	group		1	ash	black shorts	adult		female				
21				24 cycling	2021_11_18_treesign.05	first	group		1	black	black shorts	adult		female				
22				25 jogging	2021_11_18_treesign.11	first	navy blue top, woman		1	black	navy blue	adult		female	ear buds			
23				26 cycling	2021_11_18_treesign.11	first	orange cover, black cycle		1	orange	black shorts	adult		male				
24				27 cycling	2021_11_18_treesign.11	first	blue cover, black cycle		1	sky blue	black	adult		male	sun glasses			
25				28 jogging	2021_11_18_treesign.11	first	red top, woman		1	red	black shorts	old		female	sun glasses			
26				29 cycling	2021_11_18_treesign.11	first	black cover, black cycle		1	black	black	adult		male	head scarf	back bag		
27				30 scooter	2021_11_18_treesign.11	first	Matt, is that you?:D		1	black	blue	adult		male	winter hat	back bag	scooty	
28				31 cycling	2021_11_18_treesign.11	first	indigo cover, black cycle		1	blue	black	adult		male	sun glasses			
29				32 walking	2021_11_18_treesign.11	first	couple		1	black	blue shorts	adult		male	sun glasses			
30				33 walking	2021_11_18_treesign.11	first	couple		1	blue	black shorts	adult		female				
31			22.2	34 cycling	2021_11_18_treesign.11	first	green cover		1	green	black shorts	adult		male	sun glasses	back bag		
32				35 jogging	2021_11_18_treesign.11	first	blue, pink cover woman		1	blue	pink	adult		female	ear buds			
33				36 walking	2021_11_18_treesign.11	first	black cover with a dog a		1	black	black	old		male	flat cap			
34				37 jogging	2021_11_18_treesign.11	first	white top woman		1	white	blue	adult		male	sun glasses	water bottle		
35				38 cycling	2021_11_18_treesign.11	first	black cover, white/black		1	black	blue	old		male	sun glasses			
36				39 cycling	2021_11_18_treesign.11	first	blue cover, black pants,		1	blue	black	old		female				
37				42 jogging	2021_11_18_treesign.11	first	white top, woman		1	ash	blue shorts	adult		female		back bag		
38				43 cycling	2021_11_18_treesign.11	first	white top, ash pants, bl		1	white	blue	adult		male				
39				44 jogging	2021_11_18_treesign.11	first	white top aged man		1	white	blue shorts	old		male	head phones			
40				45 cycling	2021_11_18_treesign.11	first	blue cover, black cycle		1	blue	black	adult		male				
41				46 walking	2021_11_18_treesign.11	first	black cover woman		1	black	black	adult		female	blue cap			
42			44	47 jogging	2021_11_18_treesign.11	first	white top, aged man		1	white	blue shorts	old		male	head phones			
43				48 jogging	2021_11_18_treesign.11	first	green top with a hat mai		1	blue	blue	adult		male	head phones	mobile		
44				49 cycling	2021_11_18_treesign.11	first	white top with helmet a		1	white	gray shorts	old		male				
45				50 cycling	2021_11_18_treesign.11	first	ash top, red bag, black c		1	ash	blue shorts	old		male	sun glasses	back bag		
46				51 walking	2021_11_18_treesign.11	first	family group		1	black w	black	old		female	sun glasses	back bag	jacket	
47				52 walking	2021_11_18_treesign.11	first	family group		1	pink	black	old		female				
48				53 walking	2021_11_18_treesign.11	first	couple		1	black	red shorts	old		male	sun glasses			
49				54 walking	2021_11_18_treesign.11	first	couple		1	red	black shorts	old		female	wrist watch			
50				55 cycling	2021_11_18_treesign.11	first	green cover, black cycle		1	green	black							
51				56 cycling	2021_11_18_treesign.11	first	ash cover, with a ha mc		1	brown	blue	old		male	sun glasses			
52				57 cycling	2021_11_18_treesign.11	first	black cover black cycle		1	black	green	old		male	glasses			
53	disputed with 45			58 cycling	2021_11_18_treesign.11	first	blue cover black cycle		1	blue	black	adult		male	glasses			
54				59 cycling	2021_11_18_treesign.11	first	group lady		1	ash	gray	old		female	blue gloves	back bag		
55				60 cycling	2021_11_18_treesign.11	first	group lady		1	ash	gray	old		female	hand bag			
56				61 jogging	2021_11_18_treesign.11	first	white top woman		1	white	gray	adult		female				
57				62 cycling	2021_11_18_treesign.12	last	white top, red cap, illac		1	white	black	old		male	red cap			
58				63 walking	2021_11_18_treesign.12	last	black and w black		1	black	w black	old		female	sun glasses	back bag		
59				64 walking	2021_11_18_treesign.12	last	pink		1	pink	black	old		female		jacket		
60				65 jogging	2021_11_18_treesign.12	last	white top woman		1	white	blue shorts	adult		female	sun glasses			
61				66 walking	2021_11_18_treesign.12	last	couple aged		1	green	black shorts	old		female	sun glasses			
62				67 walking	2021_11_18_treesign.12	last	couple aged		1	ash	black	old		male	sun glasses			
63				68 walking	2021_11_18_treesign.12	last	black top woman		1	black	black	adult		female	head band	mobile		
64				69 cycling	2021_11_18_treesign.12	last	blue cover, black hat, ye		1	blue	black	adult		male	head phone	back bag		
65				70 cycling	2021_11_18_treesign.12	last	sin top, red back, black cycle		1	blue	blue shorts	old		male	sun glasses	back bag		
66				71 cycling	2021_11_18_treesign.12	last	couple		1	black	black shorts	old		female	back bag			

Experiment 2:

Features: 'age group', 'Top color', 'sex', 'activity', 'accessories'

Highlighted Observations: [34, 47, 63, 64, 70, 73, 75, 76, 77, 78, 79, 80, 84, 85, 86, 87, 88, 90, 92, 95, 101, 103, 106]

Total Length: 23

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
28			31	cycling	2021_11_18.ressign	1	first	indigo cover, black cyc	1	blue	black	adult	male	sun glasses					
29			32	walking	2021_11_18.ressign	1	first	couple	1	black	black	shorts adult	male	sun glasses					
30			33	walking	2021_11_18.ressign	1	first	couple	1	blue	black	shorts adult	female						
31		22.2	34	cycling	2021_11_18.ressign	1	first	green cover	1	black	black	shorts adult	male	sun glasses back bag					
32			35	jogging	2021_11_18.ressign	1	first	blue, pink cover woman	1	blue	pink	adult	female	ear buds					
33			36	walking	2021_11_18.ressign	1	first	black cover with a dog.	1	black	black	old	male	flat cap					
34			37	jogging	2021_11_18.ressign	1	first	white top woman	1	white	black	adult	male	sun glasses water bottle					
35			38	cycling	2021_11_18.ressign	1	first	black cover, white/blad	1	black	blue	old	male	sun glasses					
36			39	cycling	2021_11_18.ressign	1	first	blue cover, black pants	1	blue	black	old	female	back bag					
37			40	jogging	2021_11_18.ressign	1	first	white top, woman	1	ash	blue shorts adult	female							
38			41	cycling	2021_11_18.ressign	1	first	white top, ash pants, b	1	white	blue	adult	male						
39			42	jogging	2021_11_18.ressign	1	first	white top aged man	1	white	blue shorts old	male	head phones						
40			43	cycling	2021_11_18.ressign	1	first	blue cover, black cycle	1	blue	black	adult	male						
41			44	walking	2021_11_18.ressign	1	first	black cover woman	1	black	black	adult	female	blue cap					
42		44	45	jogging	2021_11_18.ressign	1	first	white top aged man	white	blue	blue shorts old	male	head phones						
43			46	cycling	2021_11_18.ressign	1	first	green top with a hat mi	1	blue	blue	adult	male	head phones	mobile				
44			47	walking	2021_11_18.ressign	1	first	white top with helmet.	1	white	gray shorts	old	male						
45			48	jogging	2021_11_18.ressign	1	first	ash top, red, bag, black	1	ash	blue shorts old	male	sun glasses back bag						
46			49	walking	2021_11_18.ressign	1	first	family group	1	black	v black	old	female	sun glasses back bag					
47			50	cycling	2021_11_18.ressign	1	first	family group	1	pink	black	old	female	jacket					
48			51	walking	2021_11_18.ressign	1	first	couple	1	black	red shorts	old	male	sun glasses					
49			52	cycling	2021_11_18.ressign	1	first	couple	1	red	black short old	female	wrist watch						
50			53	walking	2021_11_18.ressign	1	first	green cover, black cycle	1	green	black								
51			54	cycling	2021_11_18.ressign	1	first	ash cover, with a hat m	1	brown	blue	old	male	sun glasses					
52			55	walking	2021_11_18.ressign	1	first	black cover black cycle	1	black	green	old	male	glasses					
53			56	cycling	2021_11_18.ressign	1	first	blue cover black cycle	blue	black	adult	male	glasses						
54			57	walking	2021_11_18.ressign	1	first	group lady	1	ash	gray	old	female	blue gloves back bag					
55			58	cycling	2021_11_18.ressign	1	first	group lady	1	ash	gray	old	female	hand bag					
56			59	walking	2021_11_18.ressign	1	first	white top, red cap, illar	1	white	black	old	male	red cap					
57			60	cycling	2021_11_18.ressign	1	first	black and v black	black	v black	old	female	sun glasses back bag						
58			61	walking	2021_11_18.ressign	1	first	pink	black	black	old	female	jacket						
59			62	cycling	2021_11_18.ressign	1	first	white top woman	1	white	blue shorts old	female	sun glasses						
60			63	walking	2021_11_18.ressign	1	first	couple aged	1	green	black short old	female	sun glasses						
61			64	cycling	2021_11_18.ressign	1	first	couple aged	1	ash	black	old	male	sun glasses					
62			65	walking	2021_11_18.ressign	1	first	black top woman	1	black	black	adult	female	head band	mobile				
63			66	cycling	2021_11_18.ressign	1	first	blue cover, black hat, y	1	blue	black	adult	male	head phon back bag					
64			67	walking	2021_11_18.ressign	1	first	ash top, red, black, black cycle	ash	blue shorts old	male	sun glasses back bag							
65			68	cycling	2021_11_18.ressign	1	first	couple	1	black	black short old	female	back bag						
66			69	walking	2021_11_18.ressign	1	first	couple	1	gray	black old	male							
67			70	cycling	2021_11_18.ressign	1	first	blue top, blue hat, whi	1	blue	black	adult	female						
68			71	walking	2021_11_18.ressign	1	first	ash top, blue hat, black	1	ash	khaki short old	male	blue cap						
69			72	cycling	2021_11_18.ressign	1	first	black short, blue old	black	black	old	male	sun glasses back bag						
70			73	walking	2021_11_18.ressign	1	first	group aged man	1	ash	gray shorts	old	male	sun glasses back bag					
71			74	cycling	2021_11_18.ressign	1	first	ash top, blue, black, black	1	green	black	old	male	sun glasses back bag					
72			75	walking	2021_11_18.ressign	1	first	couple aged man	1	black	black	adult	female	blue cap					
73			76	cycling	2021_11_18.ressign	1	first	black top woman	1	black	black	adult	female	blue cap					
74			77	walking	2021_11_18.ressign	1	first	ash cover, green cycle	1	ash	black	adult	female						
75			78	cycling	2021_11_18.ressign	1	first	blue top, white helmet,	1	blue	black short old	female	back bag						
76			79	walking	2021_11_18.ressign	1	first	couple	1	white	blue old	male							
77			80	cycling	2021_11_18.ressign	1	first	couple	1	lilac	black	old	female						
78			81	walking	2021_11_18.ressign	1	first	red top, red, helmet, bli	1	red	black short	adult	female	sun glasses					
79			82	cycling	2021_11_18.ressign	1	first	black cover, black hat, i	1	black	black	old	male	black cap					
80			83	walking	2021_11_18.ressign	1	first	blue top, blue, hat, white/black cyc	blue	black short old	female	back bag							
81			84	cycling	2021_11_18.ressign	1	first	black top, white helmet	1	black	black short old	female							
82			85	walking	2021_11_18.ressign	1	first	blue top, blue, hat, white/black cyc	blue	black short old	female	wrist watch							
83			86	cycling	2021_11_18.ressign	1	first	couple	red	black short old	female	wrist watch							
84			87	walking	2021_11_18.ressign	1	first	black	red shorts	old	male	sun glasses							
85			88	cycling	2021_11_18.ressign	1	first	black	black	old	male	black cap							
86			89	walking	2021_11_18.ressign	1	first	green cover heavy cycle	1	green	black	old	male						
87			90	cycling	2021_11_18.ressign	1	first	white cover, white cyc	1	white	gray shorts	old	male						
88			91	walking	2021_11_18.ressign	1	first	black cover, black helm	1	black	black	old	male	black cap					
89			92	cycling	2021_11_18.ressign	1	first	yellow cover, white heli	1	yellow	black	old	male	sun glasses					
90			93	walking	2021_11_18.ressign	1	first	couple aged	1	black	gray	old	male	black cap					
91			94	cycling	2021_11_18.ressign	1	first	couple aged	1	ash	black	old	female	gray cap					
92			95	walking	2021_11_18.ressign	1	first	blue cover with a helmu	1	blue	black short adult	male							
93			96	cycling	2021_11_18.ressign	1	first	kissing couple	1	pink	black	adult	female	glasses on head					
94			97	walking	2021_11_18.ressign	1	first	kissing couple	1	black	black	adult	male	glasses on head					
95			98	cycling	2021_11_18.ressign	1	first	red cover aged man	1	red	blue shorts old	male	wrist watch						
96			99	walking	2021_11_18.ressign	1	first	couple	1	ash	gray	old	male						

Experiment 3:

Features: 'age group', 'Top color', 'sex', 'activity', 'carry'

Highlighted Observations: [7, 21, 34, 43, 45, 47, 53, 57, 58, 62, 63, 64, 65, 68, 70, 75, 77, 78, 79, 80, 83, 84, 86, 87, 88, 89, 90, 91, 92, 93, 95, 97, 99, 101, 102, 103, 106]

Total Length: 37

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	treesign	duplicate	observations	activity	Unnamed: 4	Unnamed: 5	hour	Description	Unnamed: 10	No of People	Top color	bottom color	age group	speed	sex	accessories	carry	hold	
2																			
3																			
4																			
5																			
6																			
7																			
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Experiment 4:

Features: 'age group', 'Top color', 'sex', 'activity', 'hold'

Highlighted Observations: [21, 29, 34, 43, 45, 47, 53, 57, 58, 60, 62, 63, 64, 65, 69, 70, 73, 74, 75, 76, 77, 78, 79, 80, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 95, 97, 99, 100, 101, 103, 106]

Total length: 42

Experiment 5:

Features: 'age group', 'Top color', 'sex', 'activity', 'Bottom color'

Highlighted Observations: [7, 29, 34, 45, 47, 58, 60, 63, 64, 68, 69, 70, 73, 76, 77, 84, 85, 86, 87, 88, 89, 90, 91, 92, 103, 106]

Total length: 26

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
treesign	duplicate	observation	activity	Unnamed: 4	Unnamed: 5	hour	Description	Unnamed: 9	o of People	Top color	Bottom color	age group	speed	sex	accessories	camy	hold	
3			6 walking	2021_11_18.treesign.1 first	Two friends brown shi	1	brown	blue	adult	male	wrist watch							
4	7 walking	2021_11_18.treesign.1 first	Two friends brown shi	1	brown	blue	adult	male	mobile									
5	8 cycling	2021_11_18.treesign.1 first	black shirt, white/blac	1	black	black	adult	male										
6	9 walking	2021_11_18.treesign.1 first	couple	1	white-black	red	old	female										
7	10 walking	2021_11_18.treesign.1 first	couple	1	blue	blue	old	male										
8	11 cycling	2021_11_18.treesign.1 first	couple	1	white	black	adult	male										
9	12 cycling	2021_11_18.treesign.1 first	couple	1	blue	black	adult	female										
10	14 jogging	2021_11_18.treesign.1 first	Green Tracksuit	1	green	black	short adult	male										
11	15 walking	2021_11_18.treesign.1 first	magenta top woman	1	lilac	black	old	female										
12	16 cycling	2021_11_18.treesign.1 first	unknown	1	black	adult												
13	17 walking	2021_11_18.treesign.1 first	blue top woman	1	sky blue	blue	old	female										
14	18 cycling	2021_11_18.treesign.1 first	white top off green par	1	white	green	adult	female										
15	19 cycling	2021_11_18.treesign.1 first	ash cover, black cyc	1	ash	ash	adult	male										
16	20 cycling	2021_11_18.treesign.1 first	black and yellow cover	1	yellow	black	old	male										
17	21 cycling	2021_11_18.treesign.1 first	black cover, yellow cyc	1	black	black	short adult	male										
18	22.1 cycling	2021_11_18.treesign.09_26_58 trail.av		1	green	black	old	male										
19	22.2 cycling	2021_11_18.treesign.1 first	green cover, group	1	green	black	short adult	male										
20	23 cycling	2021_11_18.treesign.1 first	group	1	ash	black	short adult	female										
21	24 cycling	2021_11_18.treesign.1 first	group	1	black	black	short adult	female										
22	25 jogging	2021_11_18.treesign.1 first	navy blue top, woman	1	black	navy blue	adult	female										
23	26 cycling	2021_11_18.treesign.1 first	orange cover, black cyc	1	orange	black	short adult	male										
24	27 cycling	2021_11_18.treesign.1 first	blue cover, black cyc	1	sky blue	black	adult	male										
25	28 jogging	2021_11_18.treesign.1 first	red top, woman	1	red	black	short old	female										
26	29 jogging	2021_11_18.treesign.1 first	black cover, black cyc	1	black	black	adult	male										
27	30 scooter	2021_11_18.treesign.1 first	Man is that you? :D	1	black	blue	adult	male										
28	31 cycling	2021_11_18.treesign.1 first	indigo cover, black cyc	1	blue	black	adult	male										
29	32 walking	2021_11_18.treesign.1 first	couple	1	black	blue	short adult	male										
30	33 walking	2021_11_18.treesign.1 first	couple	1	blue	black	short adult	female										
31	34 cycling	2021_11_18.treesign.1 first	green cover	1	green	black	short adult	male										
32	35 jogging	2021_11_18.treesign.1 first	blue pink cover womz	1	blue	pink	adult	female										
33	36 walking	2021_11_18.treesign.1 first	black cover with a dog	1	black	black	old	male										
34	37 jogging	2021_11_18.treesign.1 first	white top woman	1	white	blue	adult	male										
35	38 cycling	2021_11_18.treesign.1 first	black cover, white/blac	1	black	blue	old	male										
36	39 cycling	2021_11_18.treesign.1 first	blue cover, black pants	1	blue	black	old	female										
37	42 jogging	2021_11_18.treesign.1 first	white top, woman	1	ash	blue shorts	adult	female										
38	43 cycling	2021_11_18.treesign.1 first	white top, ash pants, t	1	white	blue	adult	male										
39	44 jogging	2021_11_18.treesign.1 first	white top aged man	1	white	blue shorts	old	male										
40	45 cycling	2021_11_18.treesign.1 first	blue cover, black cycle	1	blue	black	adult	male										
41	46 walking	2021_11_18.treesign.1 first	black cover woman	1	black	black	adult	female										
42	44 47 jogging	2021_11_18.treesign.1 first	white top aged man	1	white	blue shorts	old	male										
43	48 jogging	2021_11_18.treesign.1 first	green top with a hat m	1	blue	blue	adult	male										
44	49 cycling	2021_11_18.treesign.1 first	white top with helmet	1	white	gray shorts	old	male										
45	50 cycling	2021_11_18.treesign.1 first	ash top, red bag, black	1	ash	blue shorts	old	male										
46	51 walking	2021_11_18.treesign.1 first	family group	1	black and	black	old	female										
47	52 walking	2021_11_18.treesign.1 first	family group	1	pink	black	old	female								jacket		
48	53 walking	2021_11_18.treesign.1 first	couple	1	black	red short	old	male										
49	54 walking	2021_11_18.treesign.1 first	couple	1	red	black short	old	female								wrist watch		
50	55 cycling	2021_11_18.treesign.1 first	green cover, black cycle	1	green	black		male										
51	56 cycling	2021_11_18.treesign.1 first	ash cover, with a hat n	1	brown	blue	old	male										
52	57 cycling	2021_11_18.treesign.1 first	black cover black cycle	1	black	green	old	male								glasses		
53 disputed with 45	58 cycling	2021_11_18.treesign.1 first	blue cover black cycle	1	blue	black	adult	male								glasses		
54	59 jogging	2021_11_18.treesign.1 first	group lady	1	ash	gray	old	female								blue gloves	back bag	
55	60 cycling	2021_11_18.treesign.1 first	group lady	1	ash	gray	old	female								hand bag		
56	61 jogging	2021_11_18.treesign.1 first	white top woman	1	white	gray	adult	female										
57	62 cycling	2021_11_18.treesign.1 last	white top, red cap, lila	1	white	black	old	male								red cap		
58	63 walking	2021_11_18.treesign.1 last	black and	1	black	black	old	female								sun glassel	back bag	
59	64 walking	2021_11_18.treesign.1 last	pink	1	pink	black	old	female								jacket		
60	65 jogging	2021_11_18.treesign.1 last	white top woman	1	white	blue shorts	adult	female								sun glasses		
61	66 walking	2021_11_18.treesign.1 last	couple aged	1	green	black short	old	female								sun glasses		
62	67 walking	2021_11_18.treesign.1 last	couple aged	1	ash	black	old	male								sun glasses		
63	68 walking	2021_11_18.treesign.1 last	black top woman	1	black	black	adult	female								head band	mobile	
64	69 cycling	2021_11_18.treesign.1 last	blue cover, black hat, y	1	blue	black	adult	male								head phon	back bag	
65	70 cycling	2021_11_18.treesign.1 last	ash top, red back, black cycle	1	ash	blue shorts	old	male								sun glasses	back bag	
66	71 cycling	2021_11_18.treesign.1 last	couple	1	black	black short	old	female								back bag		

Experiment 6:

Features: 'age group', 'Top color', 'sex', 'activity', 'accessories', 'carry'

Highlighted Observations: [34, 47, 63, 64, 70, 75, 77, 78, 79, 80, 84, 86, 87, 88, 90, 92, 95, 103, 106]

Total length: 19

A1	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
61		66	walking	2021_11_18.treesign.iast			coupled aged		1 green	black short old		female	sun glasses					
62		67	walking	2021_11_18.treesign.iast			couple aged		1 ash	black	old		male	sun glasses				
63		68	walking	2021_11_18.treesign.iast			black top woman		1 black	black	adult		female	head band	mobile			
64		69	cycling	2021_11_18.treesign.iast			blue cover, black hat, y		1 blue	black	adult		male	head phone back bag				
65		50	70	cycling	2021_11_18.treesign.iast		ash top, red back, black cycle		ash	blue shorts old		male	sun glasses	back bag				
66		71	cycling	2021_11_18.treesign.iast			couple		1 black	black short	old		female		back bag			
67		72	cycling	2021_11_18.treesign.iast			couple		1 gray	black	old		male					
68		73	cycling	2021_11_18.treesign.iast			blue top, blue hat, whi		1 blue	black	adult		female					
69		74	cycling	2021_11_18.treesign.iast			ash top,blue hat, black		1 ash	khaki short	old		male	blue cap				
70		75	cycling	2021_11_18.treesign.iast			group aged man		1 ash	gray shorts	old		male	sun glasses	back bag			
71		76	cycling	2021_11_18.treesign.iast			group aged man		1 green	black	old		male	sun glasses	back bag			
72		46	77	walking	2021_11_18.treesign.iast		black top woman		black	black	adult		female	blue cap				
73		78	cycling	2021_11_18.treesign.iast			ash cover, green cycle		1 ash	black	adult		female					
74		79	cycling	2021_11_18.treesign.iast			blue top, white helmet		1 blue	black	short old		female		back bag			
75		80	cycling	2021_11_18.treesign.iast			couple		1 white	blue	old		male					
76		81	cycling	2021_11_18.treesign.iast			couple		1 lilac	black	old		female					
77		82	cycling	2021_11_18.treesign.iast			red top, red helmet, bli		1 red	black short	adult		female	sun glasses				
78		83	cycling	2021_11_18.treesign.iast			black cover, black hat, i		1 black	black	old		male	black cap				
79		79	84	cycling	2021_11_18.treesign.iast		blue top, blue hat, white/black cyc		black	short old			female		back bag			
80		85	cycling	2021_11_18.treesign.iast			black top, white helme		1 black	black short	old		female					
81		53	86	walking	2021_11_18.treesign.iast		couple		red	black short	old		female	wrist watch				
82		54	87	walking	2021_11_18.treesign.iast		couple		black	red shorts	old		male	sun glasses				
83		88	88	cycling	2021_11_18.treesign.iast		black		black	black	old		male	black cap				
84		89	cycling	2021_11_18.treesign.iast			green cover heavy cyc		1 green	black	old		male					
85		49	90	cycling	2021_11_18.treesign.iast		white cover, white cyc		1 white	gray shorts	old		male					
86		91	cycling	2021_11_18.treesign.iast			black cover, black helrn		1 black	black	old		male					
87		20	92	cycling	2021_11_18.treesign.iast		yellow cover, white hel		1 yellow	black	old		male	sun glasses				
88		93	walking	2021_11_18.treesign.iast			coupled aged		1 black	gray	old		male	black cap				
89		94	walking	2021_11_18.treesign.iast			coupled aged		1 ash	black	old		female	gray cap				
90		95	cycling	2021_11_18.treesign.iast			blue cover with a helm		1 blue	black short	adult		male					
91		96	walking	2021_11_18.treesign.iast			kissing couple		1 pink	black	adult		female	glasses on head				
92		97	walking	2021_11_18.treesign.iast			kissing couple		1 black	black	adult		male	glasses on head				
93		98	jogging	2021_11_18.treesign.iast			red cover aged man		1 red	blue shorts	old		male	wrist watch				
94		99	cycling	2021_11_18.treesign.iast			couple		1 ash	gray	old		male					
95		100	cycling	2021_11_18.treesign.iast			couple		1 black	black	old		female	sun glasses	side bag			
96		101	cycling	2021_11_18.treesign.iast			ash cover, black helmel		1 ash	black	old		male	sun glasses				
97		102	walking	2021_11_18.treesign.iast			blueish cover, round hi		1 blue	khaki	old		male	hat	cloth			
98		93	103	cycling	2021_11_18.treesign.iast		yellow cover, white helmet, black yellow		black	old			male	sun glasses				
99		104	walking	2021_11_18.treesign.iast			red top woman with a l		1 red	gray	adult		female	head band	mobile			
100		105	jogging	2021_11_18.treesign.iast			pink cover		1 red	gray shorts	adult		male	black cap				
101		102	106	walking	2021_11_18.treesign.iast		blueish cover, round hat, aged mar blue		khaki	old			male	hat	cloth			
102		107	cycling	2021_11_18.treesign.iast			red top, white helmet,		1 red		adult		female					
103		108	cycling	2021_11_18.treesign.iast			green cover, white helr		1 green		adult		male					
104		109.1	walking	2021_11_18.treesign.iast	38_38_21	group lady			1 blue		old		female					

Experiment 7:

Features: 'age group', 'Top color', 'sex', 'activity', 'accessories', 'carry', 'hold'

Highlighted Observations: [34, 47, 63, 64, 70, 75, 77, 78, 79, 80, 84, 86, 87, 88, 90, 92, 95, 103, 106]

Total length: 19

A1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
52		57	cycling	2021_11_18.treesign:.first		black cover, black helmet		1	black	green	old	male		sun glasses				
disputed with 45	58	cycling	2021_11_18.treesign:.first		blue cover, black cycle		blue	black	adult	male	glasses							
	59	cycling	2021_11_18.treesign:.first		group lady		1	ash	gray	old	female	blue gloves	back bag					
	60	cycling	2021_11_18.treesign:.first		group lady		1	ash	gray	old	female	hand bag						
	61	jogging	2021_11_18.treesign:.first		white top woman		1	white	gray	adult	female							
57	62	cycling	2021_11_18.treesign:.last		white top, red cap, illa		1	white	black	old	male	red cap						
58	51	63	walking	2021_11_18.treesign:.last		black and v black		black	black	old	female	sun glasses	back bag					
59	52	64	walking	2021_11_18.treesign:.last		pink	black	old	female			jacket						
60	65	66	jogging	2021_11_18.treesign:.last		white top woman		1	white	blue shorts	adult	female	sun glasses					
61	66	67	walking	2021_11_18.treesign:.last		couple aged		1	green	black short	old	female	sun glasses					
62	67	68	walking	2021_11_18.treesign:.last		couple aged		1	ash	black	old	male	sun glasses					
63	68	69	walking	2021_11_18.treesign:.last		black top woman		1	black	black	adult	female	head band	mobile				
64	69	70	cycling	2021_11_18.treesign:.last		blue cover, black hat, y		1	blue	black	adult	male	head phone	back bag				
65	50	70	cycling	2021_11_18.treesign:.last		ash top, red back, black cyc		ash	blue shorts	old	male	sun glasses	back bag					
66	71	72	cycling	2021_11_18.treesign:.last		couple		1	black	black short	old	female		back bag				
67	72	73	cycling	2021_11_18.treesign:.last		couple		1	gray	black	old	male						
68	73	74	cycling	2021_11_18.treesign:.last		blue top, blue hat, whi		1	blue	black	adult	female						
69	74	75	cycling	2021_11_18.treesign:.last		ash top, blue hat, black		1	ash	khaki short	old	male	blue cap					
70	75	76	cycling	2021_11_18.treesign:.last		group aged man		1	ash	gray shorts	old	male	sun glasses	back bag				
71	76	77	walking	2021_11_18.treesign:.last		black top woman		1	green	black	old	male	sun glasses	back bag				
72	46	78	cycling	2021_11_18.treesign:.last		ash cover, green cycle		1	black	black	adult	female	blue cap					
73	78	79	cycling	2021_11_18.treesign:.last		blue top, white helmet		1	blue	black short	old	female		back bag				
74	79	80	cycling	2021_11_18.treesign:.last		couple		1	white	blue	old	male						
75	80	81	cycling	2021_11_18.treesign:.last		couple		1	lilac	black	old	female						
76	81	82	cycling	2021_11_18.treesign:.last		red top, red helmet, bli		1	red	black short	adult	female	sun glasses					
77	82	83	cycling	2021_11_18.treesign:.last		black cover, black hat,		1	black	black	old	male	black cap					
78	83	84	cycling	2021_11_18.treesign:.last		blue top, blue hat, white/cyc blue			black short	old	female		back bag					
79	84	85	cycling	2021_11_18.treesign:.last		black top, white helme		1	black	black short	old	female						
80	85	86	cycling	2021_11_18.treesign:.last		black top, white hecyle		1	black	black	old	male						
81	86	87	walking	2021_11_18.treesign:.last		couple		red	black short	old	female	wrist watch						
82	87	88	walking	2021_11_18.treesign:.last		couple		black	red shorts	old	male	sun glasses						
83	88	89	cycling	2021_11_18.treesign:.last		black		black	black	old	male	black cap						
84	89	90	cycling	2021_11_18.treesign:.last		green cover heavy cyc		1	green	black	old	male						
85	90	91	cycling	2021_11_18.treesign:.last		white cover, white cyc		1	white	gray shorts	old	male						
86	91	92	cycling	2021_11_18.treesign:.last		black cover, black helmr		1	black	black	old	male						
87	92	93	cycling	2021_11_18.treesign:.last		yellow cover, white hel		1	yellow	black	old	male	sun glasses					
88	93	94	walking	2021_11_18.treesign:.last		couple aged		1	black	gray	old	male	black cap					
89	94	95	walking	2021_11_18.treesign:.last		couple aged		1	ash	black	old	female	gray cap					
90	95	96	cycling	2021_11_18.treesign:.last		blue cover with a helm		1	blue	black short	adult	male						
91	96	97	cycling	2021_11_18.treesign:.last		kissing couple		1	pink	black	adult	female	glasses on head					
92	97	98	cycling	2021_11_18.treesign:.last		kissing couple		1	black	black	adult	male	glasses on head					
93	98	99	jogging	2021_11_18.treesign:.last		red cover aged man		1	red	blue shorts	old	male	wrist watch					
94	99	100	cycling	2021_11_18.treesign:.last		couple		1	ash	gray	old	male						
95	100	101	cycling	2021_11_18.treesign:.last		black		1	black	black	old	male						

Experiment 8:

Features: 'age group', 'Top color', 'sex', 'activity', 'accessories', 'carry', 'hold',
'Bottom color'

Highlighted Observations: [34, 47, 63, 64, 70, 77, 84, 86, 87, 88, 90, 92, 103, 106]

Total length: 14

Results

I found that there was a significant difference between the results of the first and eighth experiments. In the first experiment, there were 45 highlighted observations in the dataset, but this number decreased to just 14 in the eighth experiment. In the first experiment, I recorded 31 errors, but in the eighth experiment, there were no errors. I ground checked these results to ensure their accuracy.

These results suggest that adding features to the dataset greatly improves its accuracy and reduces the number of errors. By carefully examining the data and adding relevant features, I was able to greatly improve the quality of the dataset by 5% and gain valuable insights into the phenomena under study.

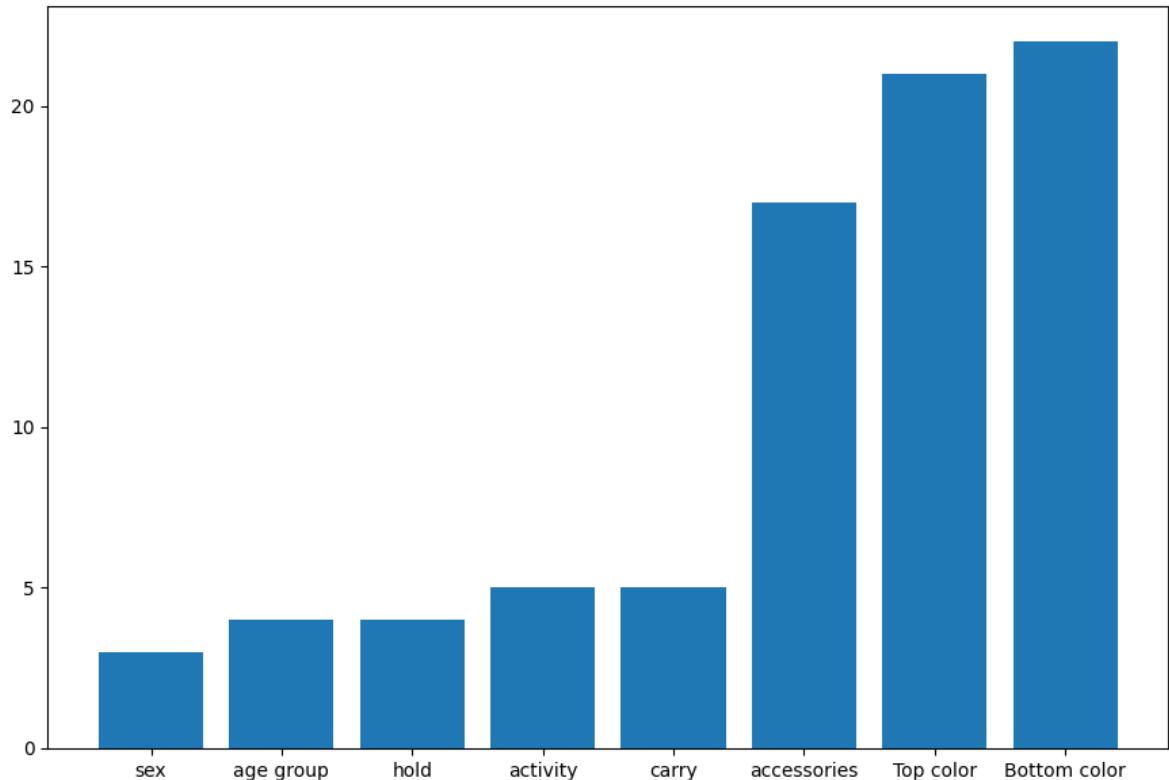
Most Important Feature

Hierarchical clustering is a technique that groups similar items together in a hierarchy, based on their similarity. It is useful for understanding the structure of a dataset and identifying patterns and relationships within the data. In the case of new dataset, hierarchical clustering allowed us to identify the most important features and how they contribute to the overall structure of the data. It is a flexible technique that can be applied to datasets of varying sizes and complexity. It does not require the user to specify the number of clusters in advance, and can handle missing or incomplete data. This makes it a useful tool for exploring and understanding complex datasets, such as our new dataset with multiple features.

Hierarchical clustering is an important step in analyzing my new dataset, after doing hierarchical clustering on my new dataset, which includes the features of top color,

bottom color, hold, accessories, and carry, I found that the most important features are top color, bottom color, and accessories. These features provide the most information about the items in the dataset and are useful for differentiating them from one another.

Most Important Features (Heririachal Clustering Method)



The least important feature in our dataset is the sex feature, as it provides the least amount of information and does not help differentiate the items. One option I have considered is removing the hold feature from the dataset to simplify it and make it easier to work with. Alternatively, I could keep the hold feature but give it less weight when performing the hierarchical clustering. This would allow it to still be taken into account, but not as heavily as the more important features.

Possible Next steps:

The work described in this paper has laid the groundwork for future research on the importance of clean and accurate data for machine learning and AI models. There are several potential directions for future research in this area.

In the future, it may be possible to automate the process of adding features to the dataset, such as using computer vision algorithms to automatically identify objects in the videos and extract information about them. This could greatly streamline the data curation process and make it easier to keep the dataset up-to-date and accurate. Additionally, the improved dataset could be integrated into a Google Sheets document, allowing for easier collaboration and sharing of the data among researchers.

Another potential direction for future research is to continue improving the data used in this study. As more data becomes available, it can be added to the dataset and carefully preprocessed to ensure that it is clean and accurate. This will allow for more comprehensive analysis and a better understanding of the factors that contribute to the success of machine learning and AI models.

Another potential direction for future research is to explore the use of different machine learning and AI techniques on the improved dataset. For example, different algorithms or model architectures could be tested to see how they perform on the improved data. This could provide insight into the most effective methods for training machine learning and AI models on clean and accurate data.

Finally, future research could also focus on the broader implications of clean and accurate data for machine learning and AI. This could include examining the ethical and societal implications of using machine learning and AI, and exploring ways to ensure

that these systems are fair and unbiased. This could involve developing new methods for detecting and mitigating biases in data, or developing strategies for ensuring that machine learning and AI systems are transparent and accountable.

Conclusion

In conclusion, the work described in this paper demonstrates the critical role that clean and accurate data plays in the success of machine learning and AI models. By manually curating a sample of the data collected by A. I. Whoo and Tanvir Rahman and adding additional features, the overall quality of the dataset was improved by 5%. Hierarchical clustering analysis showed that the top and bottom colors of individuals' clothing and their accessories were the most important features. This work highlights the importance of carefully curating and preprocessing data for machine learning and AI research, and provides a foundation for future model training.

It is also important to note that the data cleaning and curation process is not a one-time effort, but rather an ongoing process that is essential for ensuring the success of machine learning and AI models. As new data becomes available, it must be carefully reviewed and preprocessed to ensure that it is clean and accurate. This can be a time-consuming and labor-intensive process, but it is necessary to ensure that machine learning and AI models are able to learn and make reliable predictions and decisions. The importance of clean and accurate data cannot be overstated, and it is essential for the success of machine learning and AI models.