

Supplemental Materials for Counting Bicycles, Scooters, and Skateboards in Tempe, AZ (Lemarchand, Salon, Jamme, and Czerniawski)

This document provides a 24-hour summary of our dataset, detailed information about which cameras were missing data, an aerial photo of Location 1 (our highest count location), and an illustration of using AI computer vision to streamline this method.

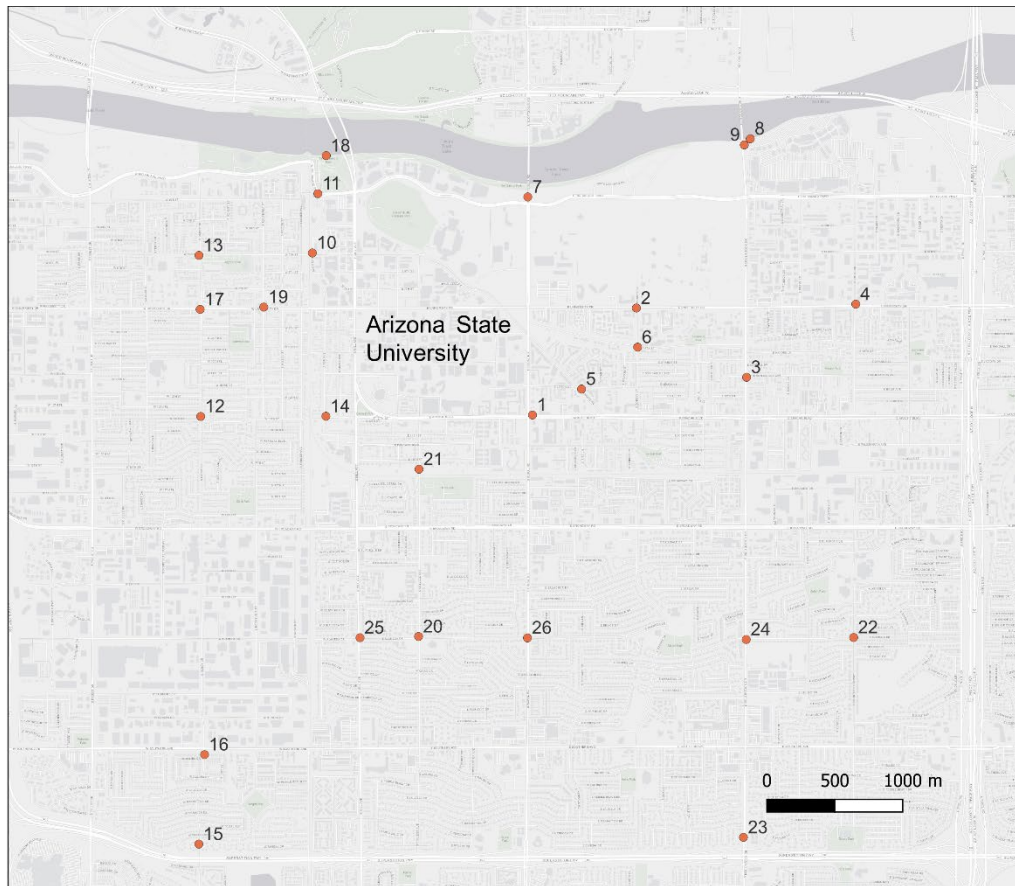


Figure SM-1: Camera Locations in Tempe with Location Numbers

The location numbers in the table on the following page correspond to the camera counting locations in Figure 1.

Table SM-1: 24-hour¹ Counts of Vulnerable Road Users by Camera Location in Tempe

Location #	Location Name	Bicycles	Scooters	Skateboards	Other	All	Partial Hours ²	Missing Hours
1	Apache & Rural	601	396	157	11	1165	10, 11, 13, 14, 15, 16	7, 8, 9, 12
2	Dorsey & University	139	109	9	3	260		
3	Don Carlos & McClintock	244	90	4	8	346	16, 17	
4	Smith & University	108	45	6	2	161		
5	Lemon & Terrace	391	241	94	10	736		
6	Dorsey & 8th	241	128	32	5	406		
7	Rural & Bridge	200	105	15	2	322	17, 21	18, 19, 20
8	Tempe Lake Path	259	46	8	22	335		
9	McClintock Bridge	78	15	1	3	97	21	
10	5th & Ash	308	172	46	12	538		
11	Ash & 1st	73	33	2	3	111		
12	Ash & 13th	219	52	33	4	308		
13	Hardy & 5th	169	60	31	3	263		
14	Hardy & 13th	189	52	17	4	262		
15	Hardy & 60	83	8	2	4	97		
16	Hardy & Southern	103	6	1	4	114		
17	Hardy & University	186	102	12	5	305	17, 19	18
18	Tempe Town Lake & RR Bridge	254	152	33	34	473	15, 20	16, 17, 18, 19
19	University & Roosevelt	185	57	11	5	258		
20	College & Alameda	375	29	5	5	414	22	
21	College & RR	689	131	66	13	899		
23	Country Club & Alameda	48	16	1	0	65		
24	McClintock & 60	144	39	3	1	187		
25	McClintock & Alameda	109	13	4	7	133		
26	Mill & Alameda	217	49	3	8	277	17	
Grand Total		5612	2146	596	178	8532		

¹ As noted in the right-most columns of Table SM-1, some cameras did not have full 24-hour counts.

² Partial hour counts have been extrapolated to estimate full hour counts, using the straightforward formula: Estimate = Partial Hour Count*(60/Minutes Counted). Missing hours are not estimated, so camera locations with missing hours are undercounted.



Figure SM-2: Aerial Photo of Location 1, Rural Road and Apache Boulevard (Google Maps, 2019)

Using AI-Enhanced Computer Vision

Today's AI-enhanced computer vision systems can cost-effectively process photos to identify and count cyclists and scooter riders. An important caveat, however, is that these systems still have difficulty discarding duplicate photos of the same riders, which often appeared in our project data.

Figures SM-3 through SM-5 illustrate that current AI models can recognize cyclists and scooters:

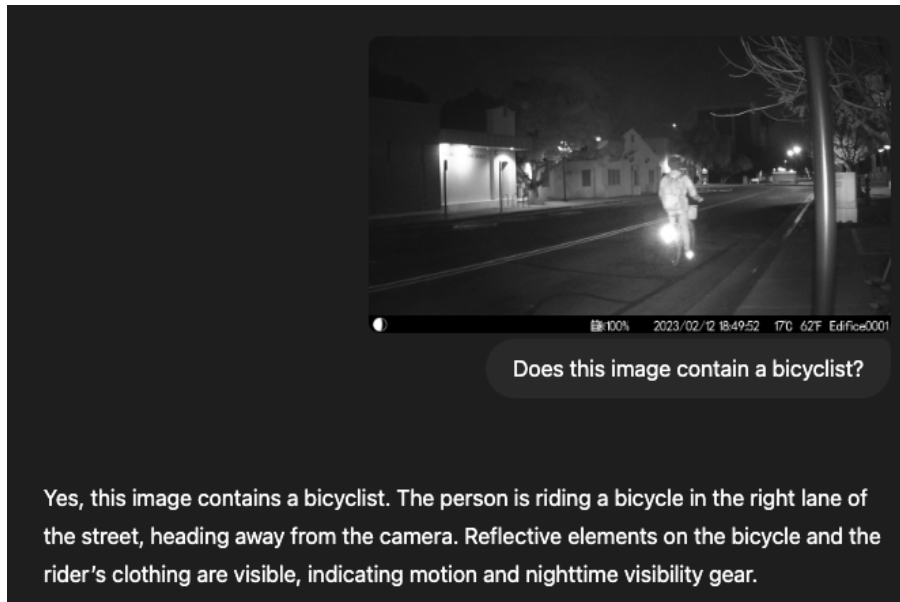


Figure SM-3: Gen AI Model Analysis of a Night Photo of a Cyclist

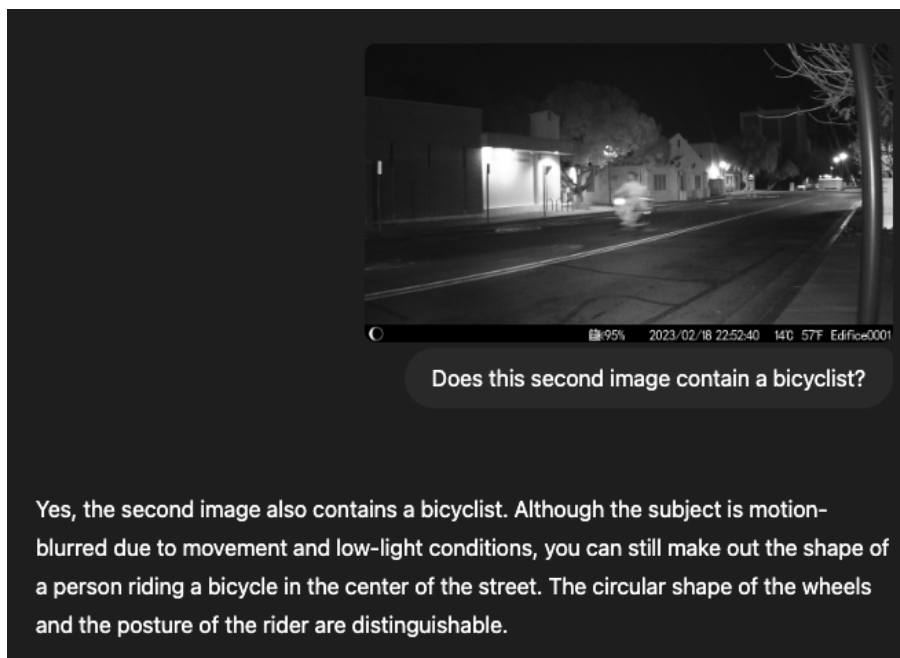


Figure SM-4: Gen AI Model Analysis of a Night Photo of a Blurry Cyclist

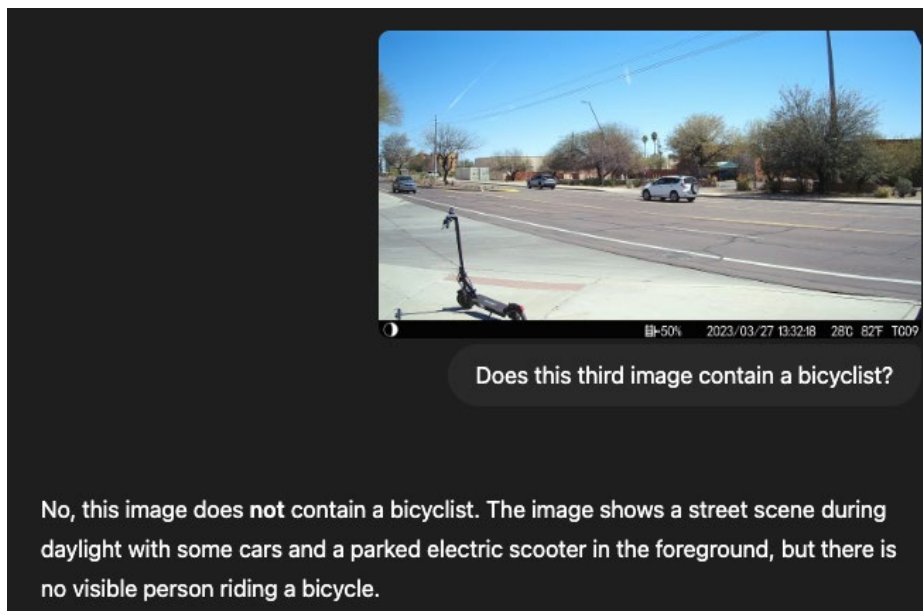


Figure SM-4: Gen AI Model Analysis of a Daytime Photo of a Parked E-Scooter

OpenAI offers automated image analysis through their API, which can be programmed with a prompt.

Sample Prompt
<p>You are part of an automated image analysis pipeline that monitors urban mobility. Given an image, identify all visible human travelers riding one of the following:</p> <ul style="list-style-type: none"> ● Bicycle ● Scooter (manual or electric) ● Skateboard (including longboards) <p>Output a JSON object with the number of detected travelers for each category. Only count travelers if the person and the transportation mode are both clearly visible and the person is actively riding it (e.g., not parked, abandoned, or standing next to it).</p> <p>Output Format:</p> <pre>{ "image_id": <int>, "bicyclists": <int>, "scooter_riders": <int>, "skateboarders": <int> }</pre> <p>Do not include any explanation or extra information—output the raw JSON object only.</p>

The cost of analyzing 300,000 images would be approximately \$180 dollars.

[Each image is treated as equivalent to 1500 tokens](#) Gpt-4.1-mini costs about [\\$ 0.40 for a million tokens](#).

Therefore, $300,000 \times 1500 \times (\$0.40 / 1,000,000) = \$180$

As noted above, further work would be required to eliminate double-counting of riders appearing in multiple photos.