Drone / Trail Camera Monitoring: Conservation Survey Opportunities

Bob Jannarone and the Brainlike Team

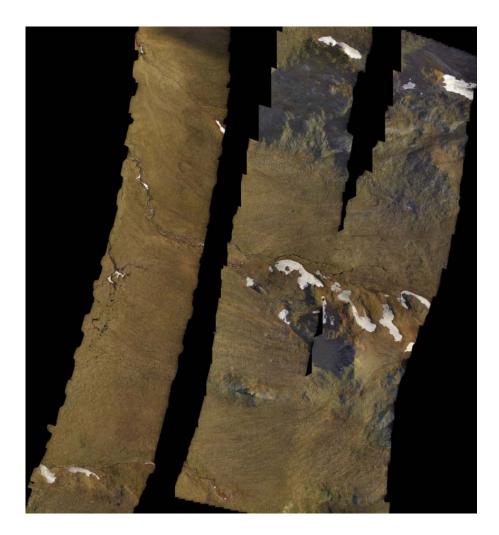
Presented at the 2017 MSCP Symposium August 28, 2017







Can you find caribou in this "orthomosaic?"

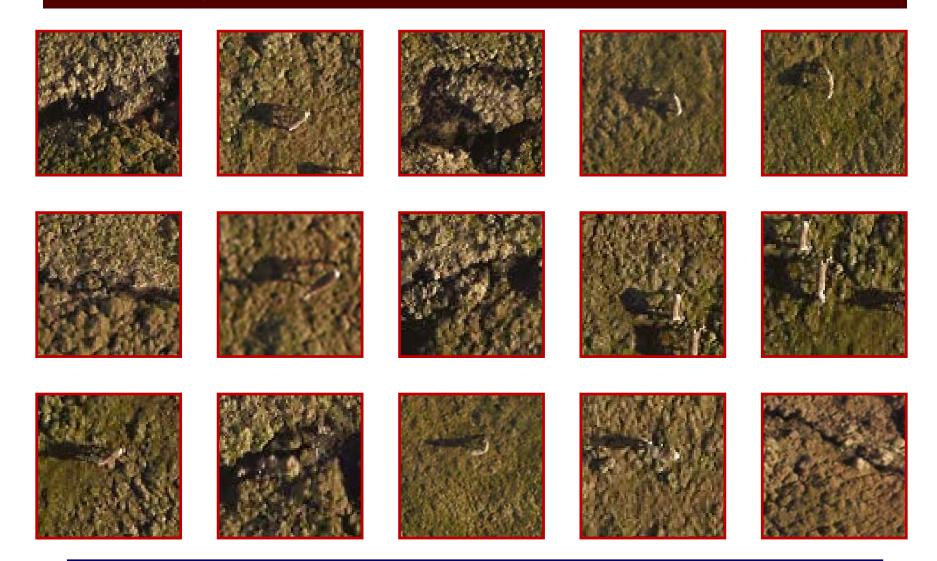








Can you find them in these "chips?"









Can you identify them in these chips?











Caribou Image: detail location



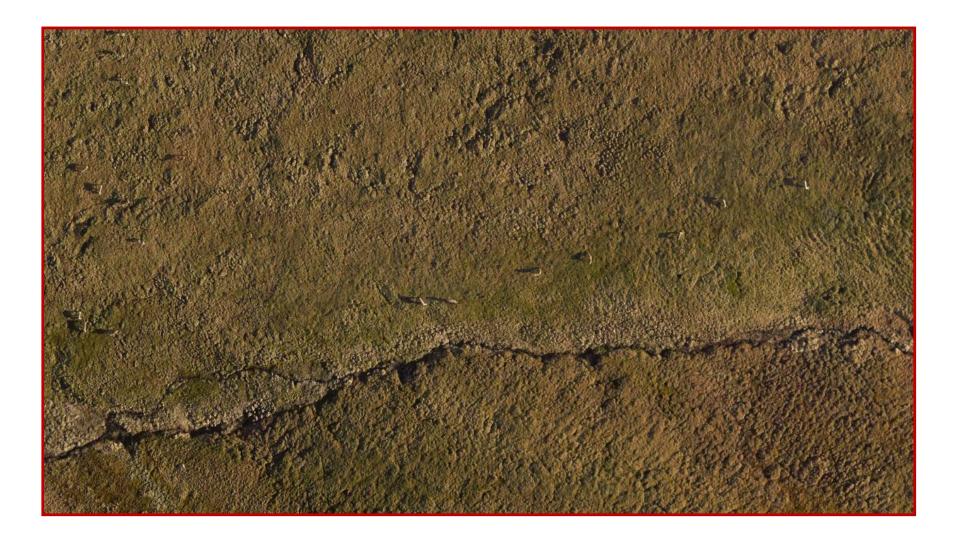
Area of Detail (next slide)







Caribou Image: detail









Caribou Detection: "alert map"









iPhone 6S Data Capture

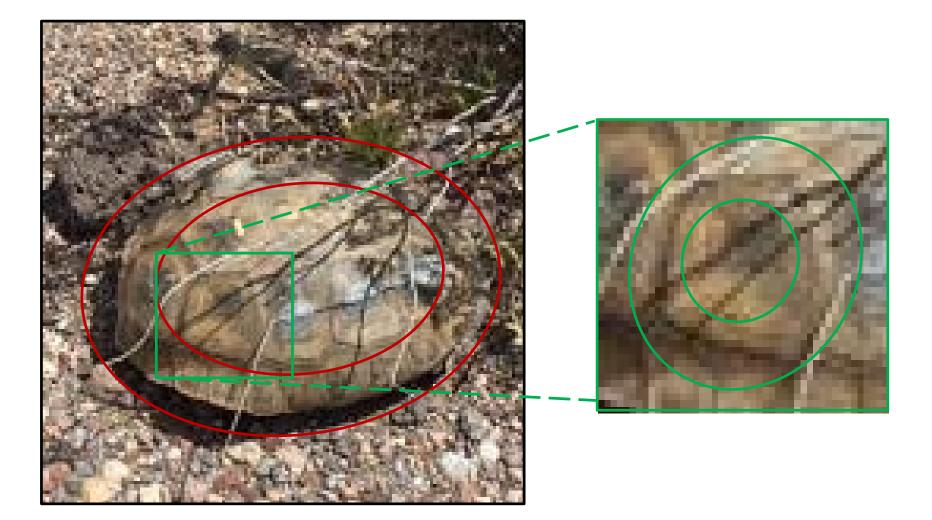








Under a Burr Sage Brush

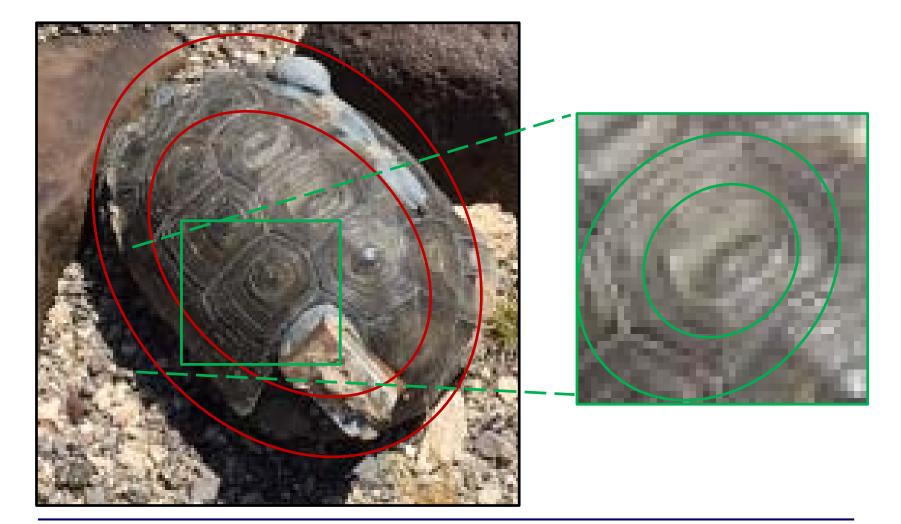


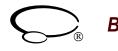






On the Rocks

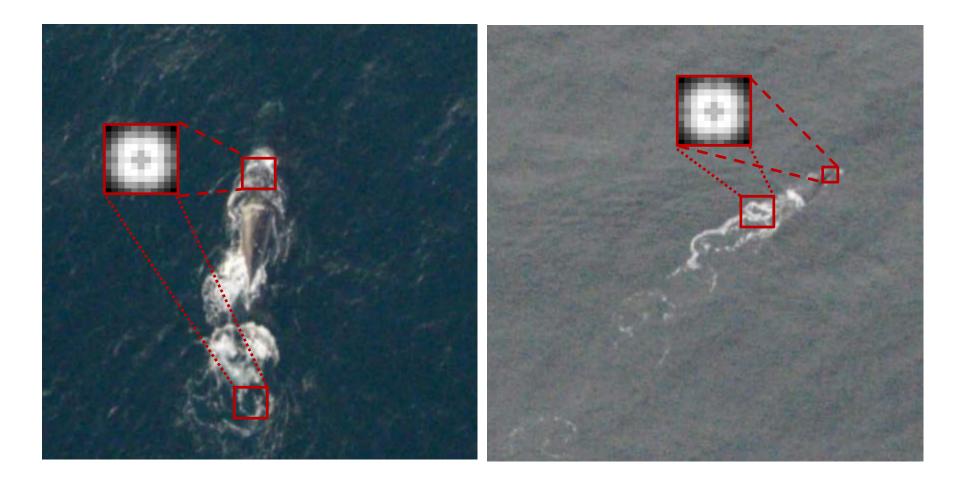








Template Matching Approach









Drone / Camera Planning

	A E	3 C	D	E	E	F	G	Н	1	J	К		L	М		N	0
1																	
2									_								_
3 4				Camer	a/len	is focal le	ength (mm)*	55					•	s per pixel):		0.06	
				Camer	a ser	sor row	length (mm)	23.5		Ground left-right coverage per image (ft)						28	
5	Camera sensor column height (mm): 15.6 Ground front-back coverage per image (ft): 19																
6				Came	ra ro	w resolut	tion (pixels)	6000		Groun	d coverag	e per o	daily fli	ght (acres)		169	
7	Camera column resolution (pixels): 4000 Ground coverage per daily flight (miles ²): 0.26																
8	Raw bits / pixel: 12 Chip width (inches): 33.6																
9	Frame rate (frames/sec): 1 Image overlap (%): 2.5									2.5							
10			Color co	des													
11		Inp	ut:				Altitude (m)	20		Tria	iged obser	rvatior	n time p	er day (hr):		8.0	
12	Inter	im (not show	n):		G	round sp	eed (Km/hr)	20			Field	d obse	rvation	time (wks):	:	168	
13		Outp	ut:		Fli	ight time	per day (hr)	4									
14										Auto-	triage con	nputin	g rate p	er day (hr):	:	16.0	
15			Transmi	ission/u	pload	d rate (me	gabits/sec)	25		F	Raw data i	upload	d time p	er day (hr):		46.1	
16	Triage processing rate (secs/image/processor): 16 Chip upload time per day (hr): 1.4																
17	Number of processors: 4 Chip data rate (raw megabits/sec): 8.6																
18	Triaged chip columns and rows: 600																
19									_		0	bserve	er labo	r reduction:	9	9.9%	
20			Field	d observa	ation	rate (run	ning ft/sec)	1									
21					C	hips per	image (avg)	2									
22			Triage-a	assisted	detec	tion rate	(secs/chip)	: 1									
23				Obser	rver h	nourly con	mpensation	\$20			Annua	al Retu	irn on li	nvestment:	\$1	34,414	
24									_								-
25		* This flig	ght/camera	a scenari	io wa	s configu	ired to comp	oare field o	bserve	er labor ra	ates with o	observ	er labo	r rates that	t could l	be expect	ed
26		from dr	one-based	l image c	aptu	re and au	tomated im	age triage.	The co	ompariso	n is based	d on fie	eld obse	ervers walk	ing at a	verage	
27		rates of	f 1 ft/sec w	hile sca	nnine	z 10 m. wi	ide swaths.	The flight/	camer	a scenari	o was set	to cov	er the s	ame swath	with a	drone.	

rates of 1 ft/sec while scanning 10 m. wide swaths. The flight/camera scenario was set to cover the same swath with a drone, while the drone captures still images with pixel resolutions that could enable comparable detection rates. The overall coverage was set to about the same amount that current field observers cover in a season. Camera specs correspond to a Sony a6000.



28

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"Small" Sample Dataset

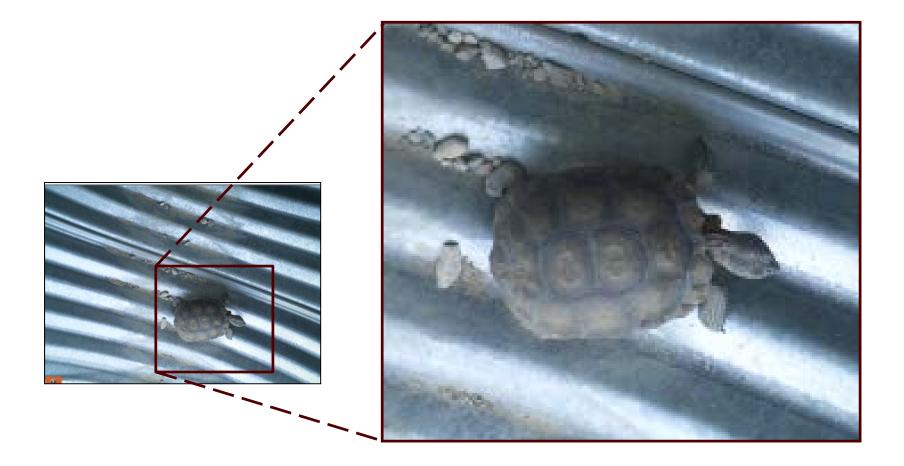
EK003824.J	EK003825.J	EK003826.J	EK003827.J	EK003828.J	EK003829.J	EK003830.J	EK003831.J	EK003832.J	EK003833.J	EK003834.J	EK003835.J	EK003836.J
PG												
EK003837.J	EK003838.J	EK003839.J	EK003840.J	EK003841.J	EK003842.J	EK003843.J	EK003844.J	EK003845.J	EK003846.J	EK003847.J	EK003848.J	EK003849.J
PG												
EK003850.J	EK003851.J	EK003852.J	EK003853.J	EK003854.J	EK003855.J	EK003856.J	EK003857.J	EK003858.J	EK003859.J	EK003860.J	EK003861.J	EK003862.J
PG												
EK003863.J	EK003864.J	EK003865.J	EK003866.J	EK003867.J	EK003868.J	EK003869.J	EK003870.J	EK003871.J	EK003872.J	EK003873.J	EK003874.J	EK003875.J
PG												
EK003876.J	EK003877.J	EK003878.J	EK003879.J	EK003880.J	EK003881.J	EK003882.J	EK003883.J	EK003884.J	EK003885.J	EK003886.J	EK003887.J	EK003888.J
PG												
EK003889,J	EK003890.J	EK003891.J	EK003892.J	EK003893.J	EK003894.J	EK003895.J	EK003896.J	EK003897.J	EK003898.J	EK003899.J	EK003900.J	EK003901.J
PG												
EK003902,J	EK003903,J	EK003904,J	EK003905.J	EK003906.J	EK003907.J	EK003908,J	EK003909.J	EK003910.J	EK003911.J	EK003912.J	EK003913.J	EK003914.J
PG												
EK003915.J	EK003916.J	EK003917.J	EK003918.J	EK003919.J	EK003920.J	EK003921.J	EK003922.J	EK003923.J				







"Small" Dataset Target









Automatic "Triage" Value

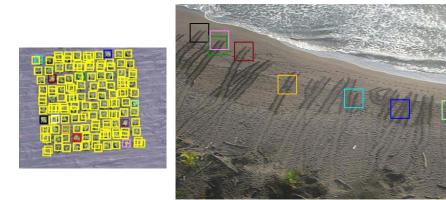
Critical Needs	Automatic Triage Solutions						
Reduced detection workload	Independent validation showed that auto-adaptive triage reduced detection workload by 99%.						
Faster remote turnaround	Automatic detection enables fast, actionable pos flight or in-flight decision-making.						
Faster information delivery	Remote automatic event detection speeds information uploading / transmission.						
Better detection precision	Automatic detection of full resolution images produces sharper pixels than real-time inspection of compressed video images.						
Lower delivery cost; higher ROI	Easy-to-use analyst development kits will enable affordable analysis and integration.						







Commercializing will improve precision/price.



- Equipment inspection
- Wildlife monitoring
- Other event detection
- Event measurement
- Encroachment detection





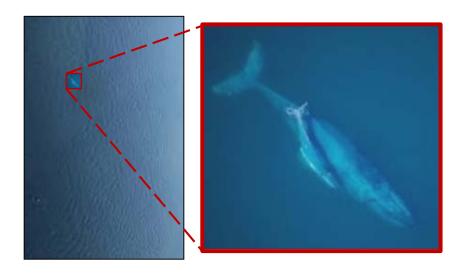








Real-time "Pull" will improve precision/price.



On-board vision (integration pending):

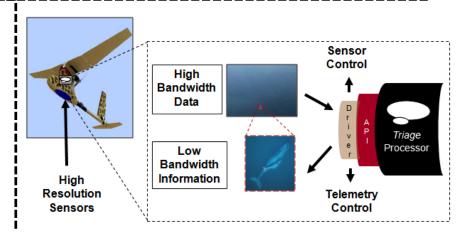
- General-purpose event detection
- Fully automated triage upstream of telemetry
- On-board, real-time processing
- Full resolution, triaged "chip" transmission
- Small packet size / Low SWaP profile
- Rapid configuration / deployment

Post-flight version: Highlights event locations to simplify manual detection from airborne images within a vertical domain

Post-flight operational status:

- Locates most targets automatically
- Reduces analysis time by over 90%
- Processes 10,000 images in four hours
- Focuses on marine mammal RGB data









Driverless Car Mapping Challenge





MOJAVEMAX.COM



Mapping Solution Demonstration

