

## **Drone Camera “Triage” for Efficient Wildlife Protection: A Desert Tortoise Protection Use Case \***

Drone-based desert tortoise detection could complement or replace ground-based alternatives if drone imagery could cover more ground at lower cost. For that reason, [Clark County Nevada Desert Conservation Program](#) (DCP), funded a project to evaluate drone-based benefits relative to ground-based alternatives. The drones produced airborne imagery covering about 3 km<sup>2</sup> within the [Boulder City Conservation Easement](#) (BCCE), as shown on the next page by the red rectangle in Figure (a). Imagery resolution was limited to 1 cm/pixel [GSD](#) in order to get comparable coverage to ground surveys currently funded by DCP.

Since tortoises are hard to see at 1 cm GSD, we used a novel image collection and analysis process. The process computes pixel level differences between closely aligned images covering the same ground on different flights. Resulting pixel differences can readily show where a tortoise was present on one day but not on the other day. Pixel alignment required the drone imagery to cover the same region on two consecutive days. On each day, about 10,000 photos were taken and then combined to produce about 300 [orthomosaic tiles](#) as shown in Figure (b) below. Within each of the tiles like the one shown in Figure (c), we examined sub-image “chips” to find those covering desert tortoises like the one shown in Figure (d).



Observers can look for desert tortoises on the ground; they can look for tortoises within images manually; or they can look for them with the aid of image “triage” tools like [PixMin™](#). In this evaluation, we found the following:

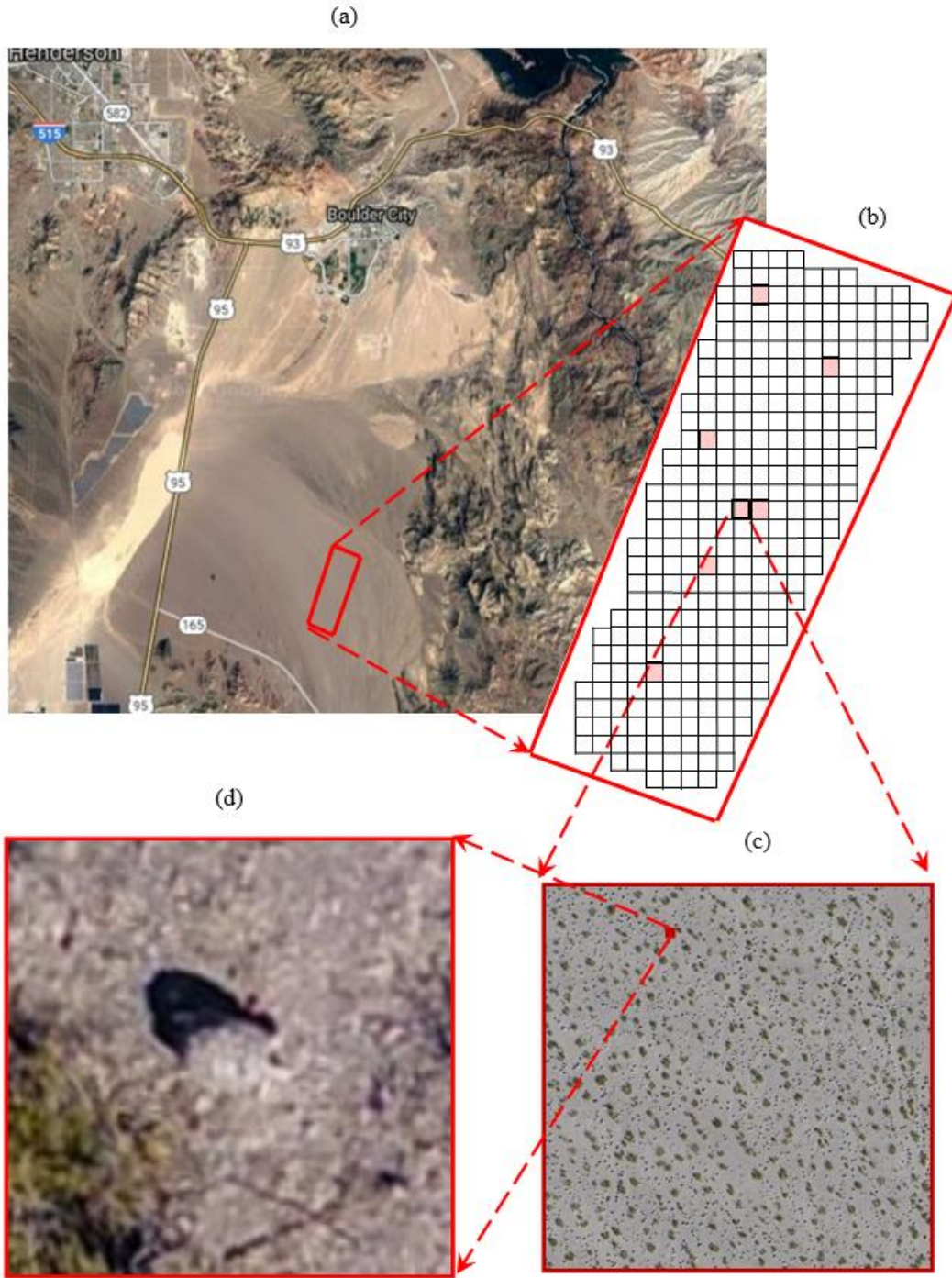
- Ground-based DCP observers take an entire season to cover about 17 km<sup>2</sup> of desert, at substantial cost.
- Drones can cover either the same ground at much lower cost or six times as much ground at the same cost.
- Looking through all images unaided would be very tedious, taking many person-weeks to complete.
- When aided by PixMin™ triage, a single observer found all (two of!) the desert tortoises that were known to be above ground during the flights, taking about an hour to do so.

To give a sense of the scales involved, a desert tortoise covers about one ten-millionth of the ground that DCP observers scan in a single season — about the same ground that drones could cover twice in less than a week. Looking through all that drone imagery unaided would require looking over all ten million sub-images. When run on conventional computers, [PixMin™](#) can triage all of that imagery and observers can validate all triaged sub-images in a few hours.

Processing improvements underway will enable [PixMin™](#) triage to take place in the field, immediately after drones have landed. Field biologists will then be able to visit, examine, and

tag the tortoises on the spot. Brainlike is making these improvements with a view toward implementing immediate detections on aircraft and on any variety of other remote sensors. That way, PixMin can view resulting images on the spot and transmit resulting detections right away.

For more information on how Brainlike can help you meet these and other image processing needs, feel free to contact us.



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