Brainlike, Inc.
1605 Sebring Hills Drive
Henderson, Nevada 89052

email: information@brainlike.com
website: http://www.brainlike.com/

Submerged Threat Detection and Engagement: an automatic mine detection use-case

In sea search and land search applications like the one shown in Figure 1 below, small objects like submerged mines must be found within gigabytes of imagery containing substantial object-like clutter. Every false alarm can be a costly, time-consuming distraction. Only one missed object can be much more costly.

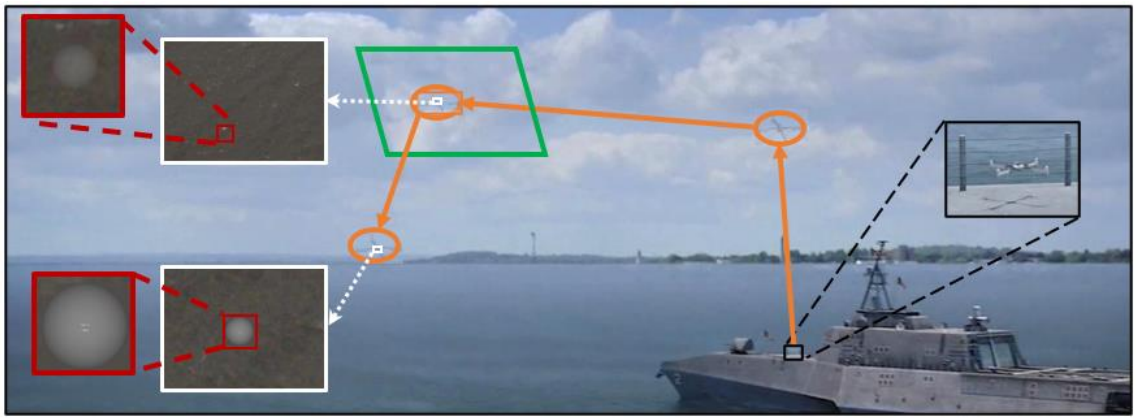

Figure 1. An Automatic Mine Detection Use-Case

Ordinarily, an operator views a search region via streamed video while a drone is flying over transacts, like those shown in Figure 2.. In the Figure 1 case and others like it, the operator may fail to see objects of interest in a sea of clutter. Alternatively, streamed video during transact searches can be sent to a remote server, which can detect an object automatically. Both alternatives require transmitting compressed, streamed video. Video compression reduces detection precision, making detections less likely and false alarms more likely.

The left side of Figure 2 shows frame locations and snapshot sequences for nine high resolution snapshots per transact as a drone traverses seven transacts. The right side of Figure 2 shows their target locations. Figure 3 shows the five automatic target detections that PixMin produced.

Detecting objects from full resolution imagery on-board increases precision. High resolution matters. For example, detecting all five submerged objects shown in Figure 5 below required matching the object-like template, shown in Figure 4 further below, to over 317 million template-sized boxes within a 100m × 100m search region. PixMin detected all five targets shown in Figure 3 with no false alarms using high resolution imagery. Getting nearly that level of precision with streamed imagery would be difficult, if not impossible.

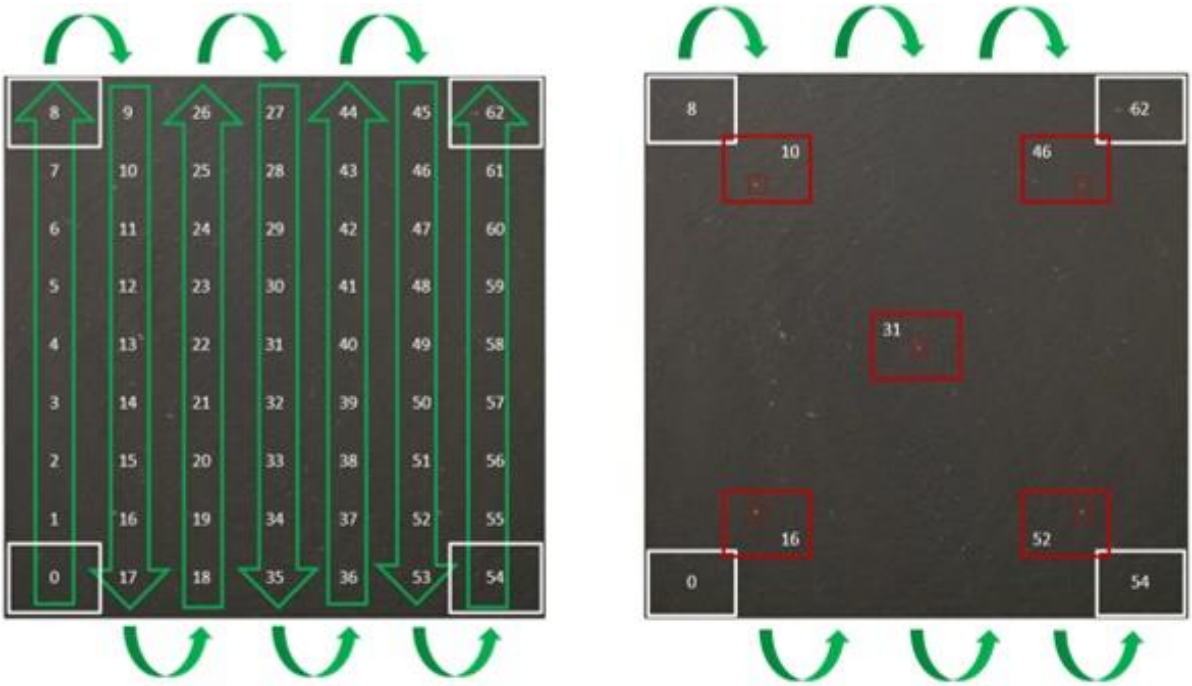

Figure 2. A Transact Search Layout for Maritime Sphere Detection

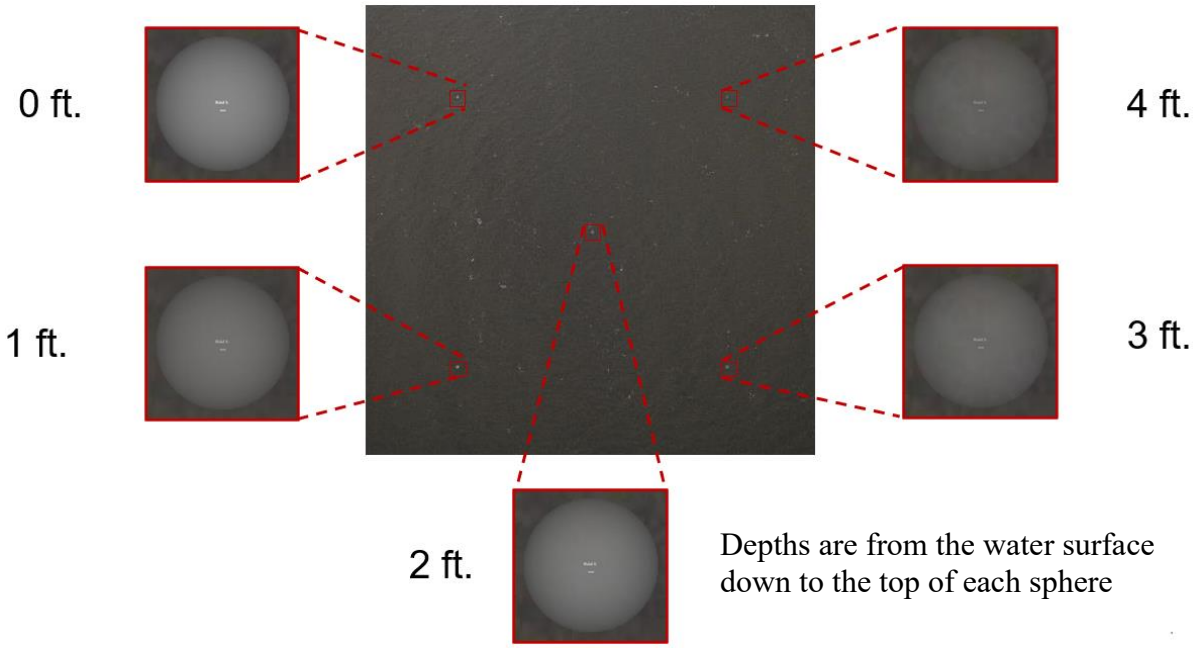

Figure 3. Automatic Sphere Detection within a 100m × 100m Region of Dark Water

Figure 4 shows the template that PixMin used to detect the objects in this case study. In this case, we built the template based on first principles underwater light attenuation. In other applications, we can use templates based on actual targets as well.

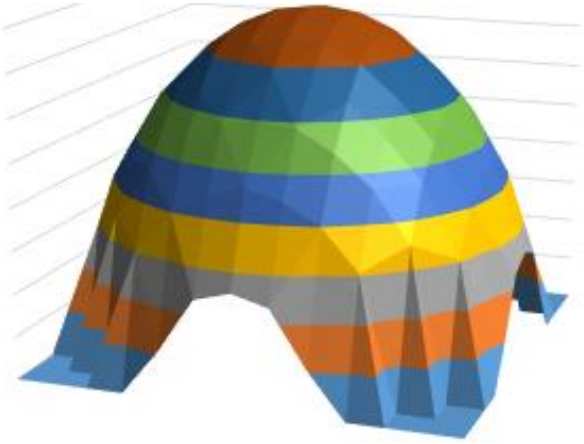

Figure 4. PixMin Sphere Detection Template

As shown earlier in Figure 1, automatic on-board event detection adds on-board triggered automatic descent capability. That way, once an event has been detected automatically, on-board descent enables going down for a closer look automatically. Figure 5 shows how going down for that closer look can clarify object details.

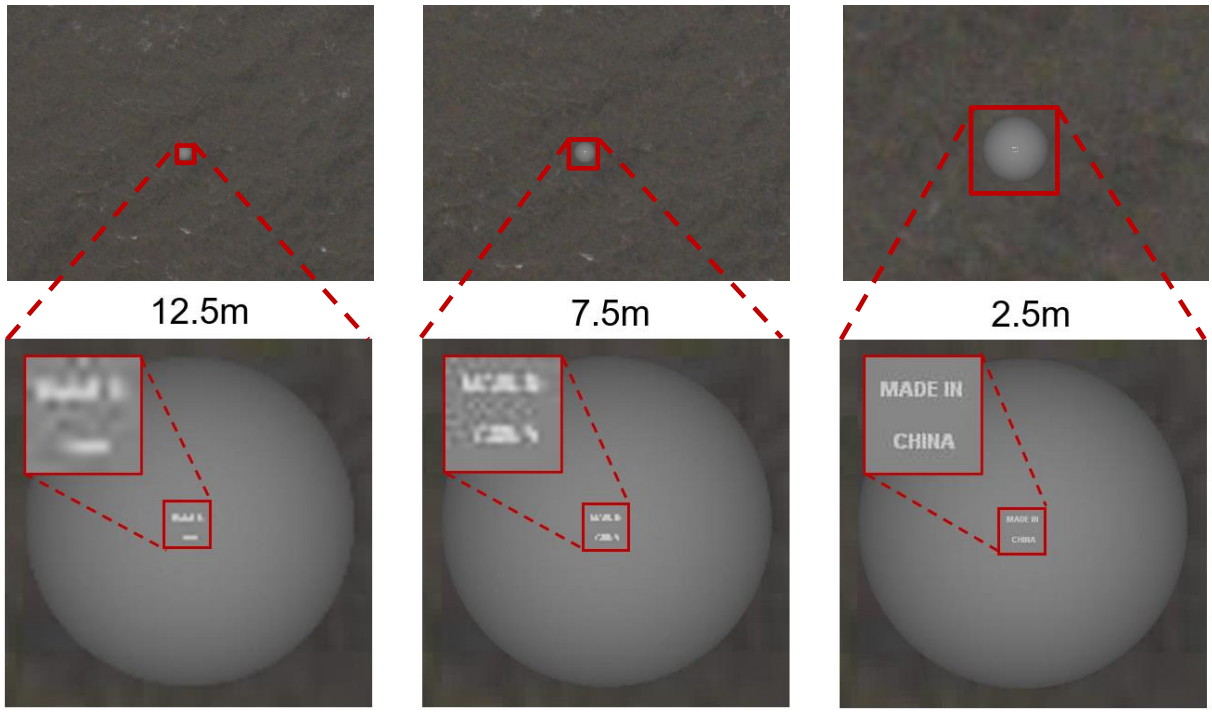

Figure 5. Object Appearances at Three Descent Altitudes

We, at Brainlike, stand ready to evaluate and deliver solutions for a broad variety of real-time, drone-based, aircraft-based, or satellite-based detect-and-engage applications, including but not limited to the following:

- Maritime or land-based object engagement following high-altitude alerts
- Perimeter surveillance and engagement
- Automatic inspection followed by immediate repair
- Unexploded ordnance detection followed by immediate target marking
- Maritime or land-based human search and rescue
- Wildlife or livestock search-and-rescue
- Commercial fish-sighting

For more information, feel free to contact us.