Poacher Detection through Machine Learning

"I think Highlighter is already the best system out there, and it is only going to get better. It provides the best false positive / false negative rate of what we've tried. False positives are a nuisance but false negatives can be fatal."

-Frank Ivan, Wildlife Protection Solutions

Person

Person

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WILDLIFE PROTECTION SOLUTIONS

Wildlife Protection Solutions (WPS) is an international non-profit organisation that provides technology to protect endangered species and ecosystems.

Recently WPS partnered with Silverpond to implement a solution to automate the detection of illegal poaching in wildlife conservation parks across three continents.

Using Silverpond's cloud-based machine learning platform Highlighter, WPS successfully automated the detection of illegal poaching activity. This helped the organisation increase efficiencies in their ongoing quest to end wildlife poaching.

Using technology to enhance conservation efforts

Based in Denver, Colorado, WPS uses technology to conserve endangered species and ecosystems globally.
WPS currently provides a fully integrated system for wildlife conservation parks to detect unwanted intruders on their properties. Motion detection cameras transmit images back to the WPS head office in real time. These images are then assessed by a team member and if evidence of people, vehicles or poaching is detected, the appropriate action is taken.
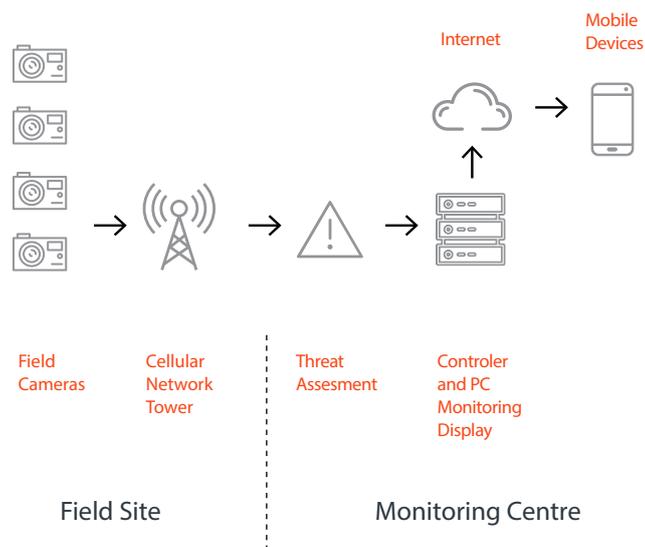

Fig 1: WPS threat detection process

The four-step implementation process

The need for automation

The requirement for team members to review each image manually was incredibly labour intensive, prompting WPS to look for a solution to streamline the process.

They tried off-the-shelf solutions OpenCV and Microsoft Azure, but found that the models generated an unacceptable rate of false negatives and false positives. This is because the images from which poachers would be detected were not typical and produced in a variety of different environments. For example, they could be taken during the day or night, and from a variety of angles and resolutions based on their placement in the field. These variations meant that off-the-shelf solutions produced inaccurate results.

A unique set of requirements

Given the nature and context of the images and the objects to be identified, WPS needed a solution that would enable them to train the model with their own unique data set.

WPS already had a well-developed system for capturing

Fig 2: Image captured from WPS field camera.

Fig 3: Highlighter's successful detection of a 'person' in the image which resulted in the detention of poachers

images, detecting threats and alerting park rangers. For Highlighter to be effective, it needed to seamlessly fit into the existing process. The technology also needed to alert Park Rangers to the threat of illegal activity as close to real time as possible (known as 'soft real time'). In addition, with Silverpond located in Australia, WPS located in the United States and the wildlife parks spanning three continents, the solution needed to be location independent and include virtual training and support.

To address the challenges WPS was facing to accurately automate their threat assessment process, the Highlighter team worked through a four-step implementation process:

Step 1: Understanding the challenges

The Highlighter team spent time with WPS to understand their unique challenges and requirements. From the consultation period, it became clear that the previous off-the-shelf solutions did not work due to the highly contextual nature of the images produced by the field cameras. The priority for the Highlighter team was to classify images of people and people-related objects, such as trucks and motorbikes. There was also a secondary requirement for various animals to be classified to allow the data to be used for future conservation efforts.

Step 2: Annotating the data

The raw data was then uploaded into Highlighter and with the assistance of virtual consultation, workshops and training materials, the WPS team was able to annotate the images, identifying people, vehicles and a range of wildlife.

Step 3: Training the deep learning model

With the data set of images now classified by WPS, the Highlighter team set about training the deep learning model. This resulted in a model that was able to easily recognise the classified subjects by quickly analysing each image.

Step 4: Evaluating the model

Once the model was complete, an evaluation process was conducted. The evaluation process allows for the effectiveness of the model to be tested by running new images through it.

While the teams were very pleased with the results, the evaluation indicated that additional annotations for some image classes were required, along with a new classification for 'antelope'.

Following these additions, the Highlighter API was implemented successfully into the WPS system.
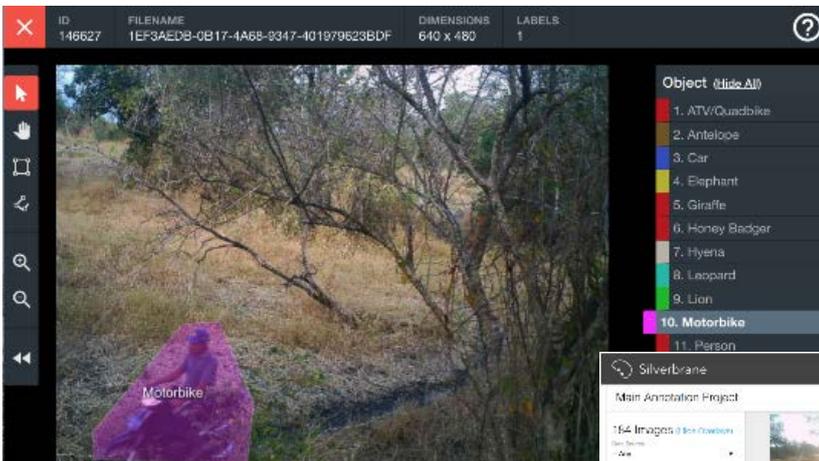
The results

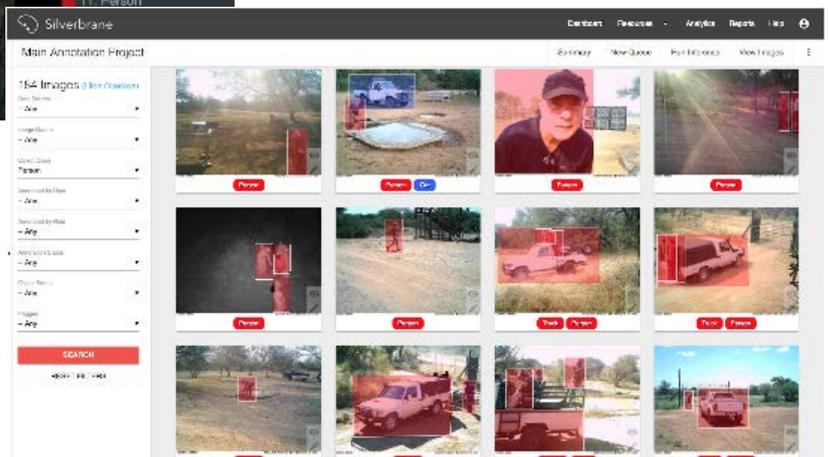Fig.4 Highlighter annotation interface

Fig.5 Reporting of annotation in Highlighter

The real test for Highlighter was once it was deployed unsupervised into the WPS threat assessment process. Within the first week, it detected two groups of poachers and sent alerts to Park Rangers, who were able to apprehend them. WPS was incredibly pleased to have achieved successful results so soon after implementation.

Prior to the implementation of Highlighter, WPS had a 40% detection rate. Current detection rates are now estimated by WPS to be 70-80%.

Fig 6. WPS field image after model successfully detects people through Highlighter, resulting in the detention of poachers

What's exciting to both teams is the model's ability to continually improve. The more images the model is trained to recognise, the higher the detection rates are likely to be. Just as with people, the model gets better the more times it performs a task.

Next steps

Following the successful implementation of Highlighter, WPS is now uploading all images from all conservation properties and using the classification system to trigger threat notifications to the property managers.

While the primary aim is to catch poachers and unwanted intruders, WPS is likely to use the wildlife data to assess animal numbers, health and travelling routes, further leveraging the application of Highlighter for wildlife conservation efforts.

"The system has greatly increased our capacity to identify and detect human intrusions at wildlife parks around the world. Prior to the implementation of Highlighter, our system was only able to detect humans about 40% of the time. I would estimate that we are now at a detection rate of about 70 to 80%. We expect this will only get better as we continue to train the system."

- The WPS team

About us

Silverpond is a Machine Learning and AI (Artificial Intelligence) company whose goal is to accelerate the adoption of AI. We do this through consulting services, educational workshops, community engagement and through our machine learning product - Highlighter.

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HighLighter