Case Study

**Computer Vision AI**
**Intel® Geti™ Platform**

# Naturalis and DIOPSIS Harness the Power of the Intel® Geti™ Platform to Overcome Data Challenges in Biodiversity Research

**With the Intel Geti platform, the DIOPSIS Consortium created an innovative AI-based insect monitoring method to better understand insect population declines and to help protect biodiversity.**

Naturalis Biodiversity Center

**Introducing Intel® Geti™ Platform**

The Intel Geti platform enables teams to rapidly develop effective computer vision models and accelerate business innovation with AI.

## The Challenge: Unsustainable Monitoring Methods

From crop pollination to serving as a food source for other organisms, insects play a vital role in our ecosystems. However, several studies have shown insect populations are declining at a concerning rate. A 2019 study found dramatic rates of decline may lead to the extinction of 40 percent of the world's insect species over the next few decades.[1] A study from 2017 found over a 75% decline in the number and diversity of insects in protected areas of Germany in just 27 years.[2]

To discover and address which pressures are most responsible for this decline, ecologists need an efficient way to continuously monitor insect populations over a long period of time. Traditional methods of manually counting and identifying insects are prohibitively expensive and labor intensive, which is how the new Intel® Geti™ platform combined with digital technologies comes into play.

The DIOPSIS Consortium was founded in 2018 to explore ways to automate monitoring. This collaboration between Naturalis Biodiversity Center, EIS Kenniscentrum Insecten, COSMONiO, Radboud University, and Faunabit led to the creation of DIOPSIS, a fully automated system that uses smart cameras and AI to photograph, identify, and track insects.

Specialized insect cameras were developed for this project, and 100 of them were deployed across natural, urban, and agricultural areas throughout the Netherlands. Images were captured every 10 seconds, 24 hours a day for 4 to 8 weeks per year, resulting in a dataset of more than 15 million images and tens of millions of individual insects.

Processing this extensive data set the traditional way was out of the question. Typically, an expert might detect and identify 500 specimens per day, at most. One season of data would take 20,000 days of expert processing, not including the time needed for measurements and biomass estimations. Finding a better processing method was crucial.

## The DIOPSIS Solution: Automated Monitoring Powered by the Intel Geti Platform

Prior to DIOPSIS, there were no existing models to automate continuous monitoring, requiring the team to develop their own. Three deep learning AI models for detecting and identifying insects, and estimating biomass were built from the ground up using the Intel Geti computer vision platform. This platform offers a user-friendly interface, enabling insect experts to perform the necessary model annotations without the assistance of expert AI professionals. Beyond offering AI-assisted mass annotations, the Intel Geti platform provides active learning and continuous retraining of the workload—ultimately reducing the bottlenecks insect experts commonly face.

Previous studies relied solely on biomass—that is, insects were collected and weighed, without any differentiation between species. The Intel Geti platform offers experts the ability to collect not only a larger volume of data, but also more types of data, including insect count, biomass estimates, and identification data.

The advanced features of the Intel Geti platform are incredibly important for these types of studies and have already proven useful in a preliminary study on godwits (migratory wading birds). These features enable experts to overcome substantial data challenges that make building AI models difficult: big unannotated data, noisy data, the vast amount of insect species, and a large imbalance in numbers between species of insects.

The software analyzes where insects are in a photo and distinguishes them from other objects in the image, such as mud, grass, and shadow. Once the insects are identified, their numbers can be easily counted. Insects that were observed in previous pictures or that remain on the screen for hours are only counted once.

The Intel Geti platform's specialized deep learning software looks at the photo and compares it with a large database of all kinds of insects annotated by specialists. It then provides insect identification along with estimated accuracy so that inaccurate identifications can be excluded.

## Results: An Integrated Solution for Insect Monitoring and Beyond

The use of the Intel Geti platform enabled DIOPSIS to achieve its goal: performing cost-efficient, large-scale continuous monitoring of insect populations, working with a dataset of more than 15 million images and tens of millions of individual insects.

Without the Intel Geti platform, building the necessary models would have involved cumbersome, costly feedback cycles between AI engineers and insect experts. The Intel Geti platform empowers insect experts to utilize their expertise by eliminating the need for specialized AI knowledge for annotation, ultimately streamlining the model development process.

The availability of an interactive AI platform that domain experts can use themselves also makes it much easier for a project such as DIOPSIS to build new or adapt existing models when the data changes due to differences in camera setup (e.g., screen color, lighting conditions, resolution, etc.). Similarly, it provides domain experts the opportunity to update the model more frequently than would be feasible if AI experts needed to be involved.

Moreover, the Intel Geti platform continuously retrains models and provides feedback about model quality, which reduces workloads for experts and allows them to focus on improving the aspects of the models that need the most attention.

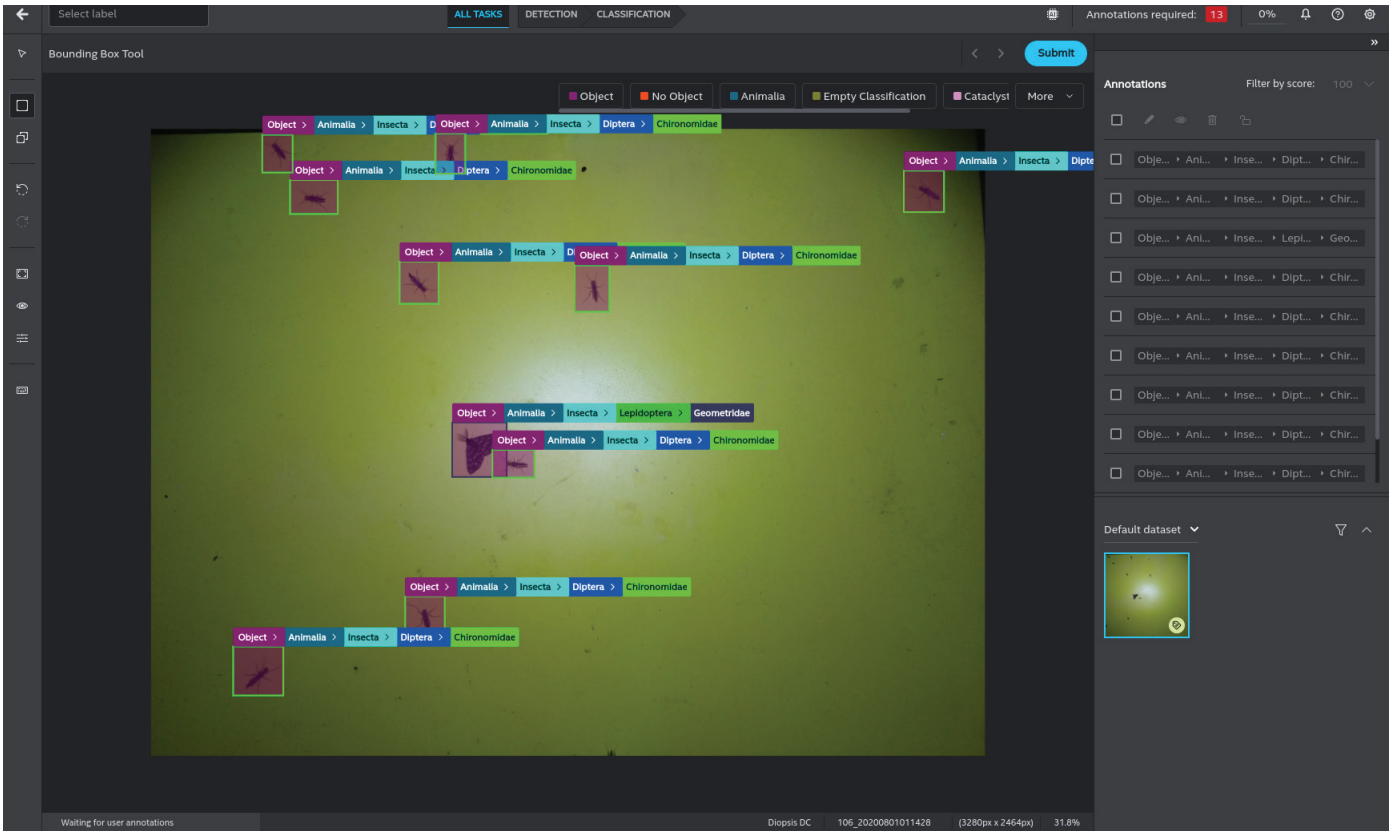



**Figure 1.** Insect identification in the Intel® Geti™ platform

The development of the smart camera and the use of AI to generate biodiversity data for insect monitoring resulted in substantial media exposure, both nationally and internationally. It has also raised interest from many other organizations looking for cost-effective and efficient solutions to scale insect monitoring. DIOPSIS has made Naturalis and EIS Kenniscentrum Insecten important partners for continuing initiatives.

*"DIOPSIS is an innovative tool and a powerful combination of hardware, software, data and AI aimed at providing insight in the trends of flying insects. The technical components of DIOPSIS form a basis for new applications for autonomous, smart nature monitoring tools as sensors become more available and AI becomes more intelligent. The key success factor remains, however, what we can learn from the data and what we do differently to support system earth."*

**- Chantal Huijbers DIOPSIS Project Leader, Naturalis Biodiversity Center**

## Conclusion: Advancing AI-driven Biodiversity Research

From model development and data collection to inference and analysis, the Intel Geti platform played a considerable role in DIOPSIS' success. The AI platform empowered DIOPSIS experts to efficiently and cost-effectively build custom specialized AI models to automate continuous monitoring, collect, identify, and analyze a vast amount of data and the right types of data.

Without the Intel Geti platform, developing the DIOPSIS solution would have been significantly more expensive and resulted in considerably longer development and inferencing timelines. The DIOPSIS project, empowered by the Intel Geti platform, has not only enabled biodiversity experts to take a big step forward in biodiversity monitoring, but has opened the door for other projects to harness the power of AI.

## Learn More

Find out how the Intel Geti platform can help your organization develop AI models.
geti.intel.com

## Additional Resources

To learn more about Naturalis and the DIOPSIS Project explore the following resources:

- The Naturalis Biodiversity Center Website
- The Naturalis DIOPSIS Project Page
- The DIOPSIS Website

Learn how additional Intel® technologies can help you build and deploy AI applications at scale.

- Intel® Distribution of OpenVINO™ Toolkit
- Intel® AI

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[1] Worldwide decline of the entomofauna: A review of its drivers, Biological Conservation Volume 232, April 2019, Pages 8 - 27

[2] More than 75 percent decline over 27 years in total flying insect biomass in protected areas, Hallmann CA, Sorg M, Jongejans E, Siepel H, Hofland N, et al., October 2017

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