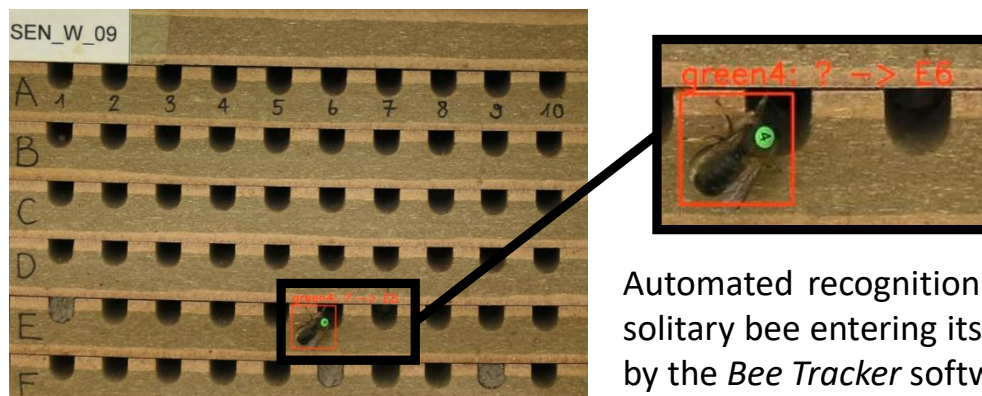


Bee Tracker – an open-source machine-learning based video analysis software for the assessment of nesting and foraging performance of cavity-nesting solitary bees

Anina Knauer, Johannes Gallmann and Matthias Albrecht

Background

How successful bees are at foraging and nesting can provide important information on bee health and is of interest for risk and impact assessment of environmental stressors. While radio-frequency identification (RFID) technology is an efficient tool increasingly used for the collection of behavioural data in social bee species such as honey bees, behavioural studies on solitary bees still largely depend on direct observations, which is very time-consuming.



Automated recognition of a solitary bee entering its nest by the *Bee Tracker* software.

Bee Tracker software

Bee Tracker is a novel software package for the automated analysis of foraging and nesting behaviour of numerous cavity-nesting solitary bees based on video recordings of nesting units. The software can detect bees that enter or leave their nest and recognize individual IDs on the bees' thorax as well as the IDs of their nests according to their positions in the nesting unit.

The software is able to identify each nest of each individual nesting bee, which enables measurement of individual-based measures of reproductive success. Moreover, the software can quantify nest recognition and flight duration. The success rate in measuring these parameters was 96% in the analysed videos.

Take-home message

The machine learning based software could be adapted to various experimental setups by training it to a representative set of videos. The software is provided free and open-source including the underlying Python code along with a user manual, which makes the software accessible to users who have no programming background.

The method presented enables the efficient collection of large amounts of data on cavity-nesting solitary bee species and represents a promising new tool for the monitoring and assessment of behaviour and reproductive success under laboratory, semi-field and field conditions.

Access to the full article: <https://doi.org/10.1002/ece3.8575>