Development of Optical Varroa Mite Detection on Bees With Neural Networks

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A predominant cause of mass bee deaths is the parasite varroa destructor, a mite harming bee populations and making them more vulnerable to virus infections which the parasite may contract as well. Effective treatment of varroa mites exists, but overtreatment and undertreatment both can lead to loss of the whole bee colony. To treat varroa effectively, the degree of infestation must be determined accurately. To improve precision and reduce latency of conventional varroa monitoring methods, we developed a device for the automized, real time, optical monitoring of varroa mites on live bees at the entrance to the beehive. Hence, we built a prototype that uses infrared light to create video footage of bees and mites. In the first step of the video analysis, a neural network recognizes the bees. This is followed by algorithmic tracking and then a second neural network detects the mite. We created all training datasets for the neural networks ourselves. Since our self-generated data sets were only very small, we first trained a neural network with a high sensitivity but low specificity. With this network, we were able to create a second much larger dataset by having our first neural network evaluate video footage and subsequently sort out all false positive "mites". This gave us a dataset that included many more Varroa mites. This enormous improvement allows us to reach a sensitivity of 94.2% and specificity of 82.6%. With our evaluation, the beekeeper can treat his hive correctly at an early stage, the bee is sustainably protected.

Awards Won:
Third Award of $1,000
Association for the Advancement of Artificial Intelligence: Honorable Mention (do not read aloud). Winners receive a student level membership. Information is included separately in the SAO Portal.
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