

Mobile Application for Varroa Mite Detection

Degree programme: BSc in Computer Science | Specialisation: Computer Perception and Virtual Reality

Thesis advisor: Prof. Dr. Olivier Biberstein

Expert: Reto Mettler (ASPARAGUS ENGINEERING AG)

The survival of honeybee colonies is of great importance for world agriculture, especially because of its role as a pollinator. VarroApp is an autonomous Java-Android mobile application able to detect and count the number of Varroa, an infectious mite of the bees, on a control board. It relies on tools offered by Computer Vision and the OpenCV library to assist the beekeepers in an initially manual and tedious work.

Threats on bees colonies

According to the statistics of members of the **Verein deutschschweizerischer und rätoromanischer Bienenfreunde**, the number of bees colonies in Switzerland has decreased by 40% since 1985, resulting in the cessation of activity of around 20% of beekeepers, stunned by unexplained colonies losses. A key factor is an Asian parasite of the bee, Varroa Destructor, which kills the larvae and weakens the adults. The recommended treatment (volatile treatment with formic acid or thymol) causes stress for the colony. Its application must therefore be optimized by a quick detection of increases in the parasites population. The infestation level is estimated by manually counting the dead Varroa fallen on a control board placed on the bottom of the beehive.

Project goals

The aim of this thesis is to automate the process of counting Varroa by means of a mobile application. The female parasitic individual is oval in shape, measures between 1.1mm and 1.7mm with a reddish-brown color. It must be distinguished from the multiple plant waste and pollen on the control board. The classification is made on the basis of snapshots taken with a minimum 12Mpx built-in smartphone camera. If a deep-learning approach is quite valid to solve this classification, we target here an autonomous, data-base-free mobile application.

Varroa Classification

The classification pipeline was first tested in Python and then ported to Java-Android. The OpenCV library is used for the many Computer Vision tools it offers. The picture is binarized using a threshold on the Varroa hue. Opening, Closing and Blob Detection functions are applied to the binary image to attenuate noise, then Hough-Transform is used to detect circles on the image, our potential Varroa. If an ellipses detection would be more efficient, the computing power needed is too high for a smartphone processor.

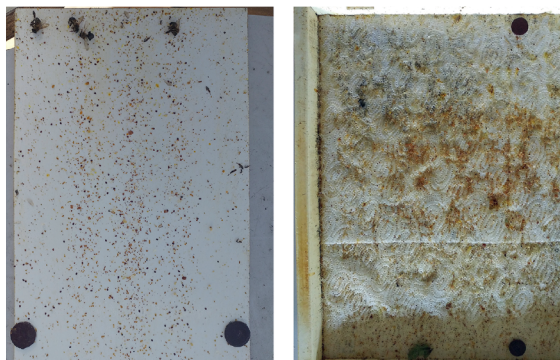
Application development

In the early stages of the agile development process, it became apparent that the size of the Varroa relatively to the size of the control board and the limited camera resolution did not provide an acceptable classification quality. Four successive shots assembled with a Stitching function allow to raise the resolution. From the user point of view, the whole process remains direct and intuitive. The number of options and actions required are reduced to a minimum for quick feeling and result.

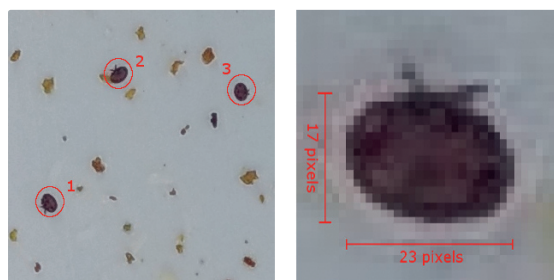


Loïc Charrière

loic.charriere@bluewin.ch



Different states of control board cleanliness



Detection of the parasite on the control board