Bee Counting Software.

While hive weight is a useful metric, it doesn't tell the whole story. Sometimes "mystery" weight curves raise more questions than they answer. Then, to really understand what is going on, a bee counter is needed. Here is one method applied to a 30 second video of Green Goddess taken on July 7, 2014 at 3:30 pm: http://hivetool.org/counter/beeTrack1_2.mp4

An early goal of HiveTool was to develop a counter. Several technologies have been examined, but focus has been on visual counters, using video cameras. For the last three years, we have experimented with camera enclosures and tested software and video formats to stream and record video from the hive.

This first attempt at counting:
1. Converts the image to gray scale then to black and white (binary). See Picture 2.
2. Filters to smooth the objects and remove noise (Picture 3).
3. Identifies the objects with area contours.
4. Tracks and count the objects (Picture 4).

This software was written in c++ using openCV. Open Computer Vision (openCV) is an open source software library of more than 2500 optimized classic and state-of-the-art computer vision and machine learning algorithms.
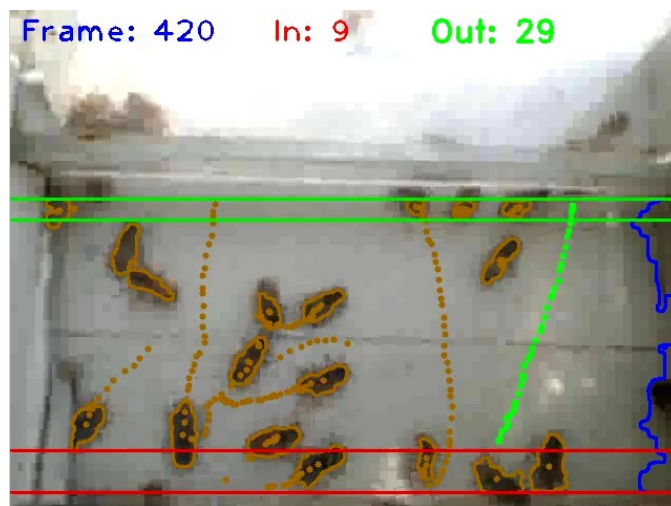
This has been possible thanks to work done by many others, including Campbell, Mummert, and Sukthankar, *Video Monitoring of Honey Bee Colonies at the Hive Entrance*[1], and Tom Goddard's[2] *Tracks* software.

This software is still very crude. The next step is to get the software into the hands of alpha testers, to solicit suggestions for different approaches, and to create a suite of videos of known bee activity in different conditions to use for testing and validating different approaches.
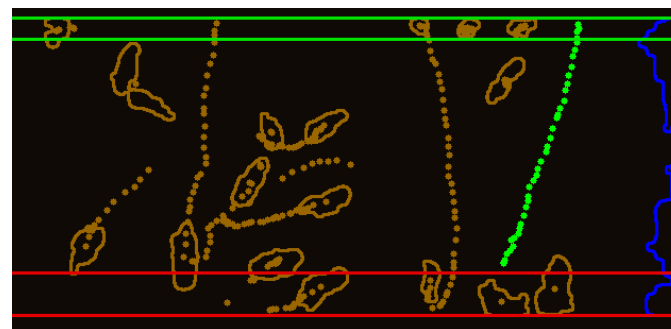

Picture 1: Bee counting at entrance of Green Goddess.

Picture 2: Image converted to black and white (binary).

Picture 3: Filter to smooth the objects and remove noise.

Picture 4: Contours and tracks without background.

More details of this approach are at http://hivetool.org/w/index.php?title=Bee_counter_software

1 http://homepages.inf.ed.ac.uk/rbf/VAIB08PAPERS/vaib9_mummert.pdf
2 http://sonic.net/~goddard/home/bees/bees.html