

Supplementary Materials: BeePIV: A Method to Measure *Apis Mellifera* Traffic with Particle Image Velocimetry in Videos

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Introduction

Our supplementary materials include three video sets that illustrate how BeePIV, the algorithm we describe and evaluate in our article, counts bee motions in videos with different levels of bee traffic. In the first stage (see Sections 3.3.1–3.3.5 in the article), BeePIV converts frames from bee traffic videos to particle motion frames with uniform white background. In the second stage, (see Sections 3.3.6 and 3.3.7 in the article), BeePIV applies PIV to these motion frames to compute particle displacement vector fields, classifies individual displacement vectors as incoming, outgoing, and lateral, and uses vector counts to measure incoming, outgoing, and lateral bee traffic.

We have prepared three video sets for the readers to appreciate how our algorithm processes bee traffic videos. Each set consists of three videos. The first video is an original raw video captured by our deployed BeePi electronic beehive monitoring system; the second video is the corresponding video that consists of the white background motion frames extracted from the first video; the third video is the video of displacement vectors extracted by PIV from each pair of consecutive white background frames from the second video. All computation is executed on a raspberry pi 3 model B v1.2 with four cores.

BeePIV Video Set 1

1. [beepiv_vid_0001.mp4](#) – original bee traffic video;
2. [beepiv_motion_particles_0001.mp4](#) – video made up of motion particle frames extracted from the original video [beepiv_vid_0001.mp4](#);
3. [beepiv_vector_fields_0001.mp4](#) – video made up frames with displacement vectors computed by PIV from every pair of consecutive motion particle frames in the video [beepiv_motion_particles_0001.mp4](#)

BeePIV Video Set 2

1. [beepiv_vid_0002.mp4](#) – original bee traffic video;
2. [beepiv_motion_particles_0002.mp4](#) – video made up of motion particle frames extracted from the original video [beepiv_vid_0002.mp4](#);
3. [beepiv_piv_vector_fields_0002.mp4](#) – video made up frames with displacement vectors computed by PIV from every pair of consecutive motion particle frames in the video [beepiv_motion_particles_0002.mp4](#).

BeePIV Video Set 3

1. [beepiv_vid_0003.mp4](#) – original bee traffic video;
2. [beepiv_motion_particles_0003.mp4](#) – video made up of motion particle frames extracted from the original video [beepiv_vid_0003.mp4](#);
3. [beepiv_piv_vector_fields_0003.mp4](#) – video made up frames with displacement vectors computed by PIV from every pair of consecutive motion particle frames in the second video [beepiv_motion_particles_0003.mp4](#).