Beehive Traffic

3D Vision Project Proposal
Supervised by: Sattler Torsten
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GROUP MEMBERS

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I. DESCRIPTION OF THE PROJECT

One problem a beekeeper can encounter during spring, is the sudden swarming of his bees. They do so to find a new location for their colony.

In this project we want to count the number of bees that enter and leave the hive at any particular time, to be able to detect such a bee swarming. Using a GoPro camera, we will take several short videos and apply background subtraction followed by segmentation using OpenCV to recognize the bees. To track the path of the bees in 3D, we will use COLMAP.

For the support of our project we found a paper [1]which uses the tracking software 'SwarmSigth' in combination with one camera to count the bees.

II. WORK PACKAGES AND TIMELINE

Task	Group Member	Time period
Literature research, get familiar with Python, OpenCV and COLMAP	Everyone	3 weeks
Taking several video recordings (test installation, different camera positions, uniformization of background)	Jonathan	1 week
Frame to frame association and Background subtraction	Julie, Philipp	2 weeks
Prepare presentation	Everyone	1 week
Midterm presentation	Everyone	
Implement segmentation and put ellipses around the bees	Jasmin, Philipp	3 weeks
Determine trajectories using COLMAP	Jonathan	2 weeks
Determine logic to count incoming and outcoming bees	Julie	1 week
Reflect on further improvement, possible enhancement of method and/or measurement	Everyone	2 weeks
Prepare final presentation	Everyone	1 week
Final presentation	Everyone	
Write the final report	Everyone	2 weeks
Final written report	Everyone	

Some problems we will encounter during the project are listed below:

- Since the hive has a brownish color, which causes a small difference in color between the bees and the hive. To facilitate the background subtraction we will put a coloured paper on the hive to better recognize the bees.
- Another challenge will be to detect the movement of the bees for which we need a frame rate which his high enough to map the trajectory of the bees through the consecutive pictures.
- Furthermore there will be the problem that we have overlapping bees, which will be hard to solve with only using one camera. This problem we will not be able to directly solve. But since we are interested in the number of bees flying around it does not falsify our result if we confuse two bees with each other as long as we count the correct number of bees. Additionally with tracking their path using COLMAP and using the size of the bees, we might be able to distinguish the different bees.
- We will not be able to distinguish bees from other insects. But we assume that this implies only a negligible error.

III. Outcomes and Demonstration

In the of this project we want to be able to count the bees entering and leaving. Furthermore we want to track the bees using a single camera. At the end of the semester we will demonstrate the result with a recorded videos, on which we will track the path of the bees.

Instructions:

- The document should not exceed two pages including the references.
- Please name the document **3DVision_Proposal_Surname1_Surname2.pdf** and upload it via the moodle.

References

[1] Justas Birgiolas & Christopher M. Jernigan & Brian H. Smith & Sharon M. Crook *SwarmSight: Measuring the temporal progression of animal group activity levels from natural-scene and laboratory videos* (Psychonomic Society, USA, 2016).