

User's Manual

AGATHE software Flying Insect Counting

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1 INTRODUCTION

This document is the user's manual for the AGATHE software.

This software is aimed at extracting insect numbers out from MP4 videos (the footage) collected using the BEEcam in indoor or outdoor conditions.

2 DESCRIPTION

2.1 Product references

Commercial name: AGATHE

Current version: 2.5.3

Product number: none

2.2 Product usage

The software must be used to count insect flying all over a bunch of flowers or the vegetation in open conditions. The footage must have been collected by the BEEcam from Advansee. The current version (2.5.3) accepts MP4 videos.

Minimum configuration

The following description shows the minimum and recommended Hardware and Software requirements:

Minimum:

- Windows 7, 8, 10
- Any CPU (Intel i5/i7/Xeon recommended).
- 4 GB RAM.

Recommended:

- Windows 7, 8, 10 64 bits.
- CPU quad-core or hexa-core Intel i7/Xeon.
- 16 GB RAM.

2.3 Software installation

Execute the launcher setup_Agathe_2.5.6.exe with appropriate administrator rights. Select the directory where you want the AGATHE software be installed. Answer the questions. By-default answers are recommended.

Once installed, you can run the AGATHE software by either click the AGATHE icon or run Agathe.exe from the installation directory you have selected.

3 AGATHE FIRST SCREEN

At first use, the AGATHE software will display the screen as per Fig. 1. The zones illustrate different information that are either provided by the software or by the operator.

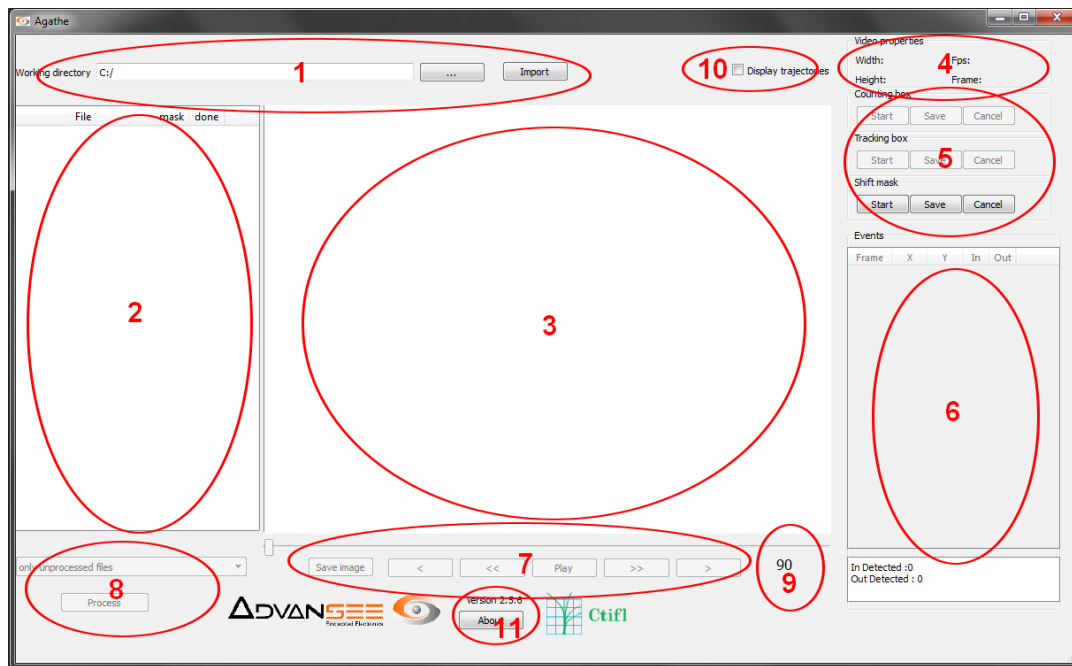


Figure 1: AGATHE screen at first use

Zone 1: The directory where video files are available. This will be the working directory.

Zone 2: The list of videos available in the working directory

Zone 3: The 90th image of the video selected in zone 2 will be displayed here

Zone 4: Resolution and frame rate of the selected video are displayed

Zone 5: User will draw areas of interest using these buttons

Zone 6: This area is designed to display events (one insect has been detected) when the video is being processed.

Zone 7: Standard buttons to play with the selected video

Zone 8: The process button and some selections to be used when ready to process

Zone 9: The number of the current frame (the one displayed)

Zone 10: This button validates the display of an image with accumulation of all insects trajectories

Zone 11: The software version number.

4 THE WORKING DIRECTORY

4.1 Selection of the working directory

The selection of the working directory is the very first operation to make when using AGATHE. In this directory must be placed the videos to be treated.

4.2 Results in sub-directory

As far as the software has been ran once, an **ExportCSV** sub-directory is created that will contain the results of the counting, and some additional information related to the masks that have been defined by the operator (cf §4.2). The files generated in this sub-directory have the root name of the initial video with different extensions.

5 THE LIST OF VIDEO FILES

Once the working directory has been selected, the list of available videos is displayed. In relation with each video file, the software displays whether the file has been already processed and if the masks have been defined (cf example in Fig. 2).

Working directory C:/Users/tcorbiere/Videos/video_demo_agathe

	File	mask	done
1	Am1_22 juillet_15h25	N	N
2	MAH00433	N	N
3	MAH00433_1	N	N
4	MAH00434	N	N
5	video3	Y	Y
6	video4	Y	Y
7	video5	Y	N
8	video7	Y	Y
9	video8	Y	Y
10	video9	Y	Y
11	video_20150704_1340_30_I	Y	Y
12	video_20150704_1350_30_I	Y	Y

Figure 2: List of files present in the working directory and their status

Working directory C:/Users/tcorbiere/Videos/video_demo_agathe

File	mask	done
Am1_22 juillet_15h25		
MAH00433		
MAH00433_1	N	N
MAH00434	N	N
video3	Y	Y
video4	Y	Y
video5	Y	N
video7	Y	Y

Figure 3: You can reset the status of every file

It is possible to reset the status of each file (cf Fig. 3). Select the video in the list, click the right button and choose the option you want to reset (mask and/or processed).

6 DISPLAY OF THE VIDEO 90TH IMAGE

Once one video has been selected in the list of files, the software displays the image number

90 of the video.

7 DRAWING OF THE AREAS OF INTEREST

Before starting drawing the two boxes, please read carefully the note in §8.

To run, the AGATHE software needs the operator to declare two main areas:

- The counting box: all insects going through this area will be counted. It is displayed in green color
- The tracking box: if an insect is detected in this area, and provided the green area remains inside the red area, then its trajectory is examined so as it is counted only if it crosses the borders of the area of interest. It is displayed in red color.

7.1 Drawing the two boxes

To draw the box, select the appropriate button in zone 5 of the screen. Draw small adjacent segments and finish your drawing by a double click. Click on save to record your box.

Repeat this operation for the other box. Fig.4 and Fig.5 illustrate the process of drawing the two boxes.

It is important to notice that only the insects going through the counting box will be included in the total counting. Therefore, and because of their speed, it is highly recommended to leave as much as possible space between green and red lines.

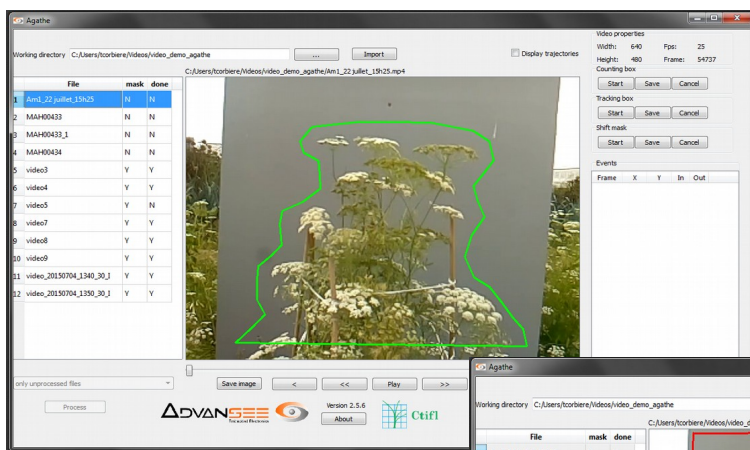


Figure 4: Drawing the Counting box (green lines)

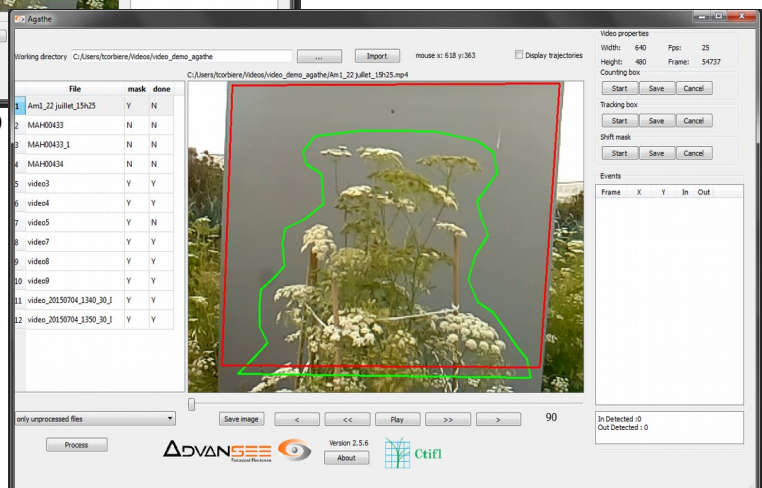


Figure 5: Drawing the Tracking box (red lines)

7.2 Apply these boxes to several videos at once

These boxes might be defined only once and applied for several videos. In case the videos are small shoots repeated regularly over the day, the same two boxes are applicable. In this case, select, in the list of videos, the one of reference and follow the instruction (§7.1) to draw the two boxes.

When ready to process the videos, select in the appropriate list of zone 8 (cf Fig.1) either the option “only unprocessed files” or “all files”. When you will press the button “Process”, all the videos of the working directory will be processed sequentially.

8 IMPORTANT NOTICE

The software is using movement detection. As such, processing videos captured in outdoor natural environment justifies some constraints associated to the parasitic effects of moving plants or leaves.

8.1 Optimizing the scene

To obtain correct detection rate, it is highly recommended to adapt the zone of the shooting with a colored panel to mask the background.

8.2 Dimension of the back panel

One constraint is due to the algorithm used to detect insects:

one insect is positively detected if, and only if, its trace is found in two successive images, **and**

if its trajectory crosses the counting area as designed by the operator (cf. §7.1).

Therefore, the drawing of the two areas (counting and tracking) is of very high importance.

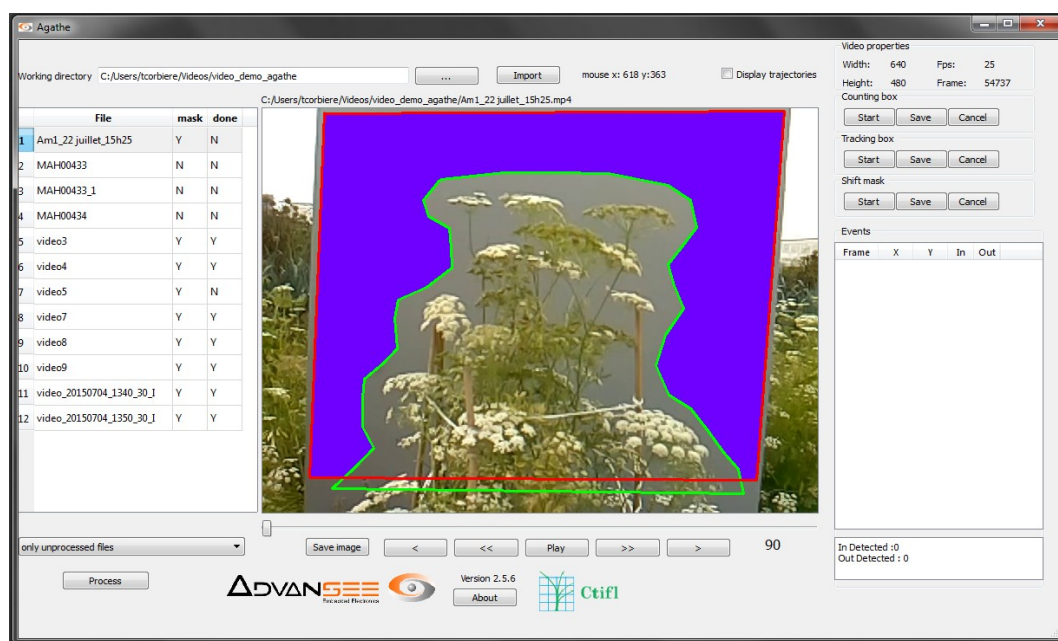


Figure 6: Resulting counting area (in violet) as the intersection of Counting and Tracking boxes

In Fig.6 , the area colorized in violet is the area where the tracking of the insects is done. Since we need two successive detections to qualify an insect of interest, the maximum the violet area, the best the results. If the bunch of flowers can not be adapted, only the back panel can.

8.3 Dimensions and speed of the insects

We would like to know what insect are visiting this lovely flower of Fig.8 . We suppose to put a colorized gray panel to suppress parasitic movements created by the vegetation at the background. The formula in [1] gives the minimum dimension Delta that allows the detection of insects traveling at a particular speed.



Figure 8: Original

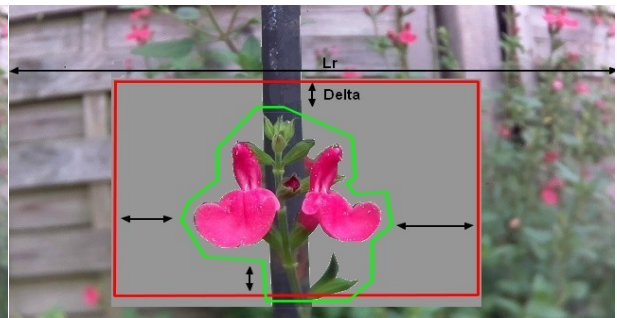


Figure 7: Instrumented area

$$\Delta = 2x ((V_{max} \times L_p) / (L_r \times F)) \text{ with } [1]$$

Delta in pixels

Vmax in cm/sec.

Lr = Horizontal (or vertical) length of the scene (in cm)

Lp = Horizontal (or vertical) resolution of the video

Example: An insect traveling at a speed of 120cm/sec (4,3km/hour) would need 28 pixels to be surely detected.

8.4 Other parasites removal

The bottom of the Fig.5 (page 6) gives an illustration of the overlapped areas where the stems of the flowers might move with the wind. The red border goes into the green area. With such a trick, no counting nor detection will be made in this particular zone. This will definitively prevent the software to over count erratic movements caused by the vegetation. The resulting counting area is presented in violet in Fig.6.

9 PROCESSING THE VIDEO

9.1 Processing mode

When all the parameters have been correctly set-up, select the processing mode in the list of zone 8. Several options are possible:

- only unprocessed files: all files with “Done” as N will be processed. They will use the masks setup of the selected file

- only one file: the selected file will be processed, and only this one. It will use its own masks
- all files: all files will be processed. They will use the masks setup of the selected file

9.2 Start the image processing

Press the *Process* button to start processing the video. The images of the video will be displayed and the software will indicate when a movement has been detected with a red rectangle overlay. An actual count will be qualified only if the trajectory of the insect crosses the red border of the counting area (see limitations above). The event is logged and displayed in the list of event (zone 6).

Once started, the *Process* button is changed to a *Cancel* button that you can use to cancel the image processing.

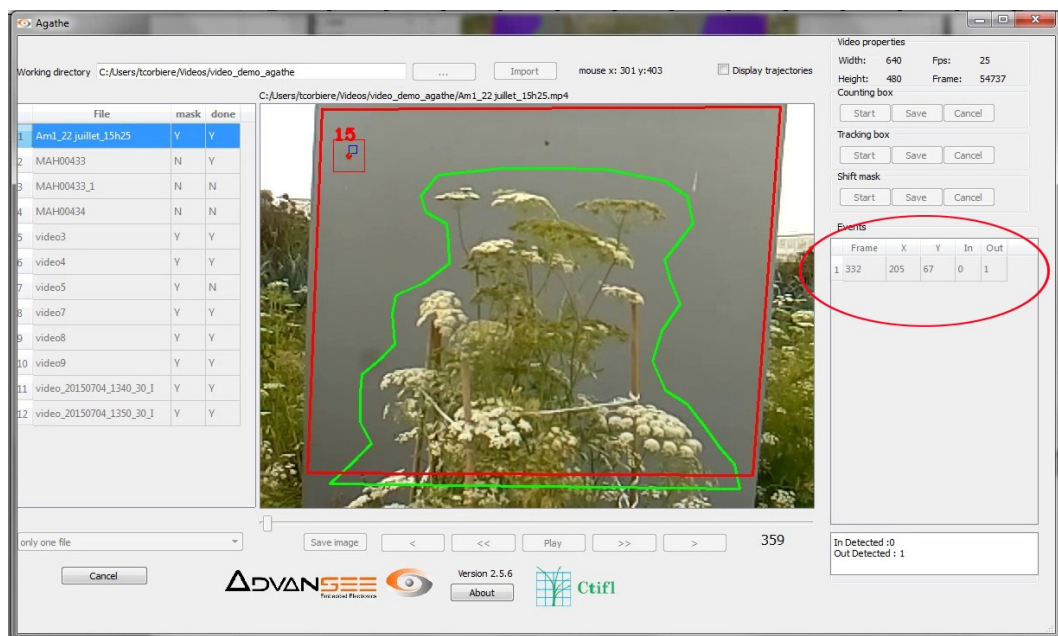


Figure 9: The red little box and number illustrate the insect detection

10 THE VIRTUAL LINE

For those who simply want a counting of individuals crossing a virtual line, you can replace the counting box (the green line) by a straight line (one starting point and one end-point).

In this mode, every line crossing detection will be both counted as IN and OUT.

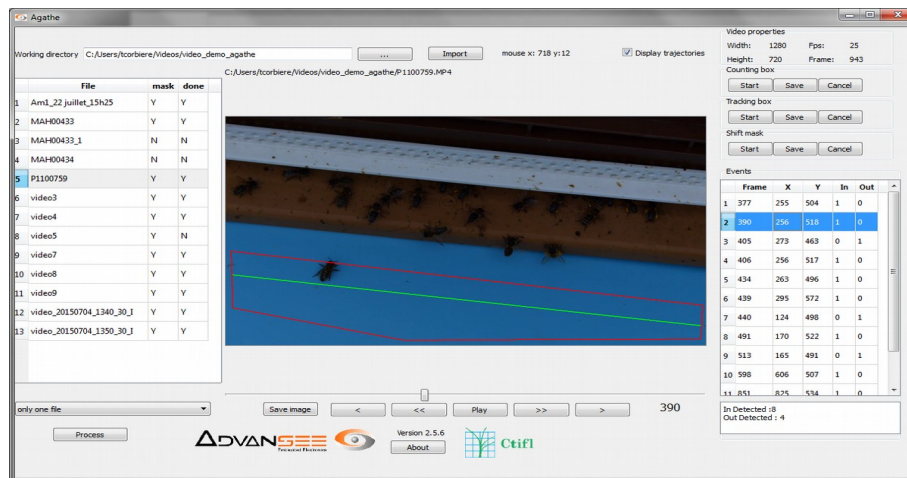


Figure 10: An illustration of a virtual line counting

11 COUNTS OF EVENTS

Every detection that has been qualified as a count is both logged into a file and displayed in the list of events. The information associated to this event are:

- Number of the frame in the video
- The insect position (X and Y) in this frame at the time of the first detection
- Whether it is an entering (IN) or exiting (OUT) insect (with reference to the area of counting)

At the end of the video processing, you can click on one of the event. The software will display the corresponding frame so you can check the insect.

12 ZOOM AND RECORD OF IMAGES

In case an image or a part of an image may present some interest, you can zoom on the area by double clicking on the image. This option is valid only for videos with resolution higher than VGA (640 x 480).

Thus, what is displayed (the image or the zoom) can be recorded by clicking on the *Save Image* button (you must select the name and place where the file will be stored)

13 DISPLAY TRAJECTORIES

When selected, the *Display Trajectories* button opens, in an other window, the traces of all the trajectories of the insects that have been counted.

This image is, at the end of the video processing, archived in the ExportCSV sub directory. The name of the image is composed of the root name of the video combined with the extension *_hank.jpg*

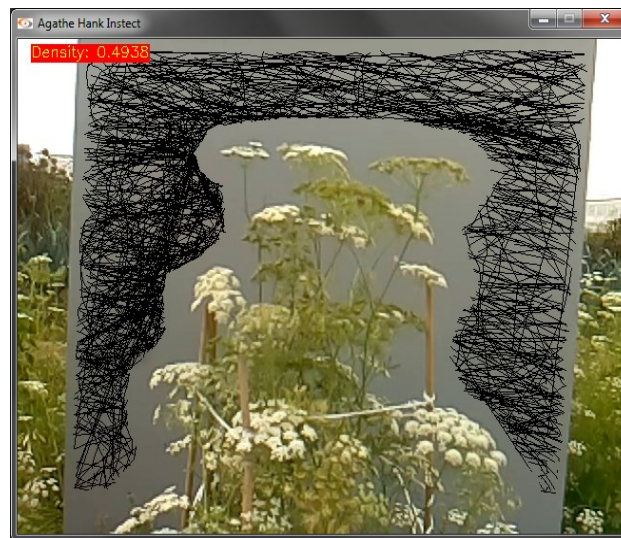


Figure 11: Concatenation of all the trajectories into a single jpg image

The density of pixel represented in this image is a good indicator of the activity of insect for this particular area at this particular time.

14 RECORDS

When finished, the software records several files in the ExportCSV directory¹.

14.1 List of events compatible with Excel

First is a text file containing a list of events with the same information as what is displayed in the event zone (cf §11). The name of the file is composed of the root name of the video with an extension .csv. This file can be easily imported into any excel or similar software for further treatments.

14.2 Concatenation image

As indicated above (cf §), the image of the all trajectories is recorded as root_name plus extension _hank.jpg. The density associated to all the trajectories is stored into a file named rootname plus the extension _hank.txt

14.3 Series of masks

The masks information are also recorder for further use with other videos. Extensions are mask.adv, area.adv and .alg (proprietary formats).

¹ : all files created by the software are recorded in this ExportCSV directory, a sub-directory of the working directory.

15 TROUBLE SHOOTING

15.1 Over counting

As indicated above, the software is based on movement tracking. As indicated in chapter 8, it is important to leave a margin between the flowers or the vegetation and the counting box (the green border). If not large enough, any movement of the plants caused by the wind or anything else will provoke an erroneous count. This is illustrated by Fig.12 where the green line gets too close to the large white portion of the flower which, because of the wind, blends and crosses the line, generating false counts.

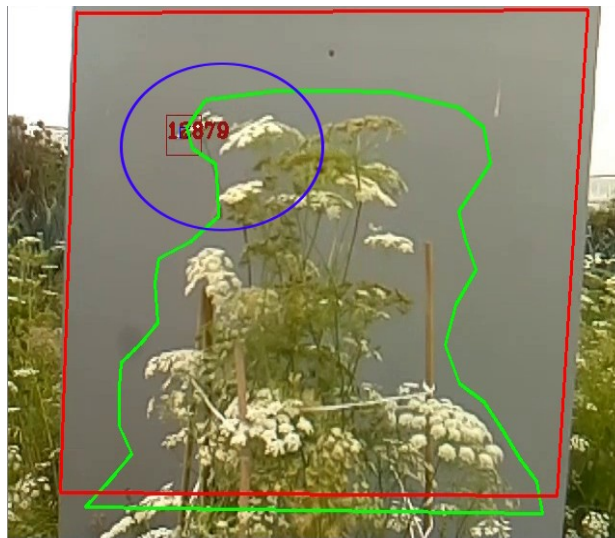


Figure 12: A false detection due to a flower bended by the wind

15.2 Shadow

To eliminate the double count of an insect due to the projection of its shadow onto the background colored “wall”, orient the scene so that the sun does not project too much light in the direction of the panel.

15.3 Respect the distance

The regular BEECAM is equipped with a 5Mega-Pixel image sensor. The lens of the sensor is fixed and not accessible. The focal plane is managed to get correct images from 60cm to infinity.

For a full resolution image, the lens gives:

- Horizontal field-of-view: 53°
- Vertical field-of-view: 40°

With these numbers, one can calculate the area that an image will correspond using the following equation (full resolution of 2591 x 1944) :

- Width of the image (cm) = distance from the object x 0.906

- Height of the image (cm) = distance from the object x 0.684

Example:

a distance of 1m from the camera will result in a shooting area of 90.6cm x 68.4cm. At this distance, one pixel will thus correspond to 0.34mm height and 0.35mm width.

16 SUPPORT

Support and additional information can be found at http://beecam.advantsee.com/support_en/