

IASEL

User Manual

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This document provides configuration and usage guidelines for IASEL.

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Chapter 1

Introduction

IASEL is a simple program for computing the area occupied by components in an image. It was written for obtaining the area occupied by types of cells in a Bee Hive frame for Hort Research in December 2008 and January 2009.

1.1 Area Computation

Area is computed in units of one pixel. The user selects pixels in the image (using the draw and fill tools) and the program counts them.

Knowing how many pixels something in the image occupies is not very useful however. The real world area (square centimeters, cm^2) that a pixel occupies will vary between images depending on resolution and the distance between the object and the camera.

So the size of a pixel in square centimeters needs to be determined in order to obtain useful results. This is achieved using Area Profiles.

1.2 Area Profiles

An Area Profile defines the area of an object in an image. It includes a width, a height, a name (for the user interface) and a short name (for inclusion with the results). The dimensions in the Area Profile are linked to the image by calibrating the software with a reference object.

For example, the reference object may be a Bee Hive frame. An Area Profile for the hive frame is created (using instructions in Appendix B) that specifies the height and width of a hive frame.

When processing an image, the user calibrates the calculations by creating a box around the hive frame. Because the dimensions of the hive frame are already known (they are stored in the Area Profile) we now know how many pixels is in a centimeter. The vertical line of the box was drawn by the user as x pixels long and the Area Profile tells the program that the height of the box should be y centimeters.

This allows the software to convert between pixels and centimeters.

1.3 Calculating Results

Once an Area Profile has been selected and the calibration box has been drawn the software knows the size of a pixel. This allows the software to simply count how many pixels the user has selected (coloured in) and count up the size.

The results are then provided as the number of pixels in the calibration box, the number of pixels selected, the percentage of pixels selected in the calibration box and the computed area in square centimeters. More information on handling results can be found in Chapter 5.

1.4 System Requirements

IASEL is a Java program. It is designed with portability in mind and is tested on both Windows and Linux. In theory it should also run on MacOS X, Other UNIX systems and perhaps HP OpenVMS.

The software is primarily tested with Sun Java 1.6 (Java 6). It has not been tested on older versions or any 3rd-party Java Virtual Machines.

As a result, IASEL requires at least a computer that meets the minimum system requirements of Sun Java 6. These are available in Table 1.1.

CPU	Operating System	RAM	Disk Space
Intel 32-bit	Windows XP Professional (SP1)	64mb	98MB
	Windows XP Home	64mb	98MB
	Windows 2000 Professional (SP3+)	64mb	98MB
	Windows Server 2003, Web Edition	128mb	98MB
	Windows Server 2003, Std Edition	128mb	98MB
	Windows Vista	128mb	98MB
	Linux	64mb	58MB
	Solaris 8	64mb	53MB
	Solaris 9	64mb	53MB
	Solaris 10	64mb	53MB
Intel 64bit	Windows XP	128mb	110MB
	Windows Server 2003	128mb	110MB
	Windows Vista	128mb	110MB
	Linux	64mb	58MB
	Solaris 10	64mb	53MB
SPARC 32-bit	Solaris 8	64mb	65MB
	Solaris 9	64mb	65MB
	Solaris 10	64mb	65MB
SPARC 32-bit	Solaris 8	64mb	53MB
	Solaris 9	64mb	53MB
	Solaris 10	64mb	53MB

Table 1.1: Java 1.6 System Requirements

In addition, it is recommended that your computer meets the system requirements in Table 1.2.

Operating System	Windows or Linux
CPU	2GHz Intel Pentium 4 or better 1.8GHz AMD Processor or better
RAM	256MB
Disk Space	1MB of disk space

Table 1.2: IASEL System Requirements

1.5 License

IASEL is Free Software (Open Source) licensed under the GNU General Public License (GPL). A brief license statement may be found below. For full details, see the GPL license text which you should have received with your copy of IASEL.

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Chapter 2

User Interface

The user interface consists of a number of windows:

1. Main Window
2. Work Queue
3. Results Window
4. Export Results window

The Work Queue is discussed in section 3.2. The Results Window and the Export Results Window are handled in chapter 5. The Main Window is covered below.

2.1 Main Window

The Main Window is where the image processing is done. It shows you the image you are currently working on along with any area you have selected and the boundary box you have specified.

The Main Window consists of three main sections (outlined and numbered in figure 2.1):

1. Menu Bar
2. Tool Bar
3. Display Area

The Display Area is where the current image is shown and where the selection is drawn. The tool bar provides quick access to some options available from the menus.



Figure 2.1: Main Window Sections

Chapter 3

Opening Images

There are two ways of opening images in the software. The first and most simple way is to directly open the image from the file menu. This is not convenient when there is a large set of images to process. For this purpose, the Work Queue is provided.

3.1 Opening an individual image

To open an individual image choose the *Open Image* option from the *File* menu (Figure 3.1). This will bring up a standard open file dialog for you to select the image to open. When you have chosen the image, it will immediately appear in the display area of the program.

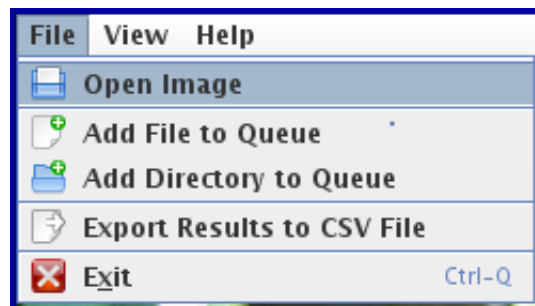


Figure 3.1: The File Menu

3.2 The Work Queue

The Work Queue allows you to create a list of images that need to be processed and then process them one after another with a single click. This allows multiple images to be processed much faster than opening each image one at a time. You can add an entire directory of images to the queue at once or you can add images individually.

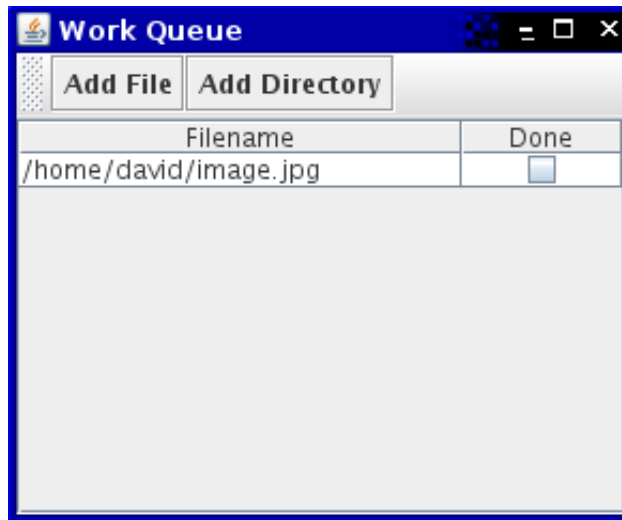


Figure 3.2: The Work Queue

3.2.1 Adding a single image to the Queue

A single image can be added to the work queue by either using the “Add File” button in the work queue window (see Figure 3.2) or the “Add File to Queue” item in the “File” menu of the main window (see Figure 3.1). Using either option will bring up a normal file open dialog where you can choose the file to add to the queue. When you select OK on the file open dialog the selected image file will be added to the end of the queue.

3.2.2 Adding multiple images to the Queue

Adding multiple images to the end of the queue is similar to adding a single image. You can use either the “Add Directory” tool bar button on the work queue window or the “Add Directory to Queue” item on the File Menu in the main window. When selecting either option, a standard open dialog will appear where you can select a *directory* to add to the queue.

Only directories will be visible in the dialog and you will have to press the OK button on the dialog to accept (double-clicking on a directory will not accept the dialog like double-clicking on a file will).

Once the dialog has been accepted, all image files directly in the directory will be added to the end of the queue.

Note that this is not a recursive operation. Only images in the selected directory will be added to the queue - images in any subdirectories will not be included.

3.2.3 Clearing the Work Queue

No way of clearing the queue is currently provided. This should change in the near future.

3.2.4 Using the Work Queue

Once a number of images have been added to the queue you can process them one at a time in order using the “Next Image” button on the main window toolbar. If no images have been loaded in the program yet, you will have to push this button to load the first image from the queue.

This button performs the same action as the “Accept Solution” button (described in Section 5.1), marks the current image as completed (A tick will be placed next to it) in the work queue window (if the current image came from the work queue) and then opens the next image in the queue.

When there is nothing left in the queue or the end of the queue has been reached, the button will no longer move onto the next image and the display area will go blank.



Figure 3.3: The Next Image toolbar button

Chapter 4

Performing Selections

Once an image has been loaded into the program, the following must be done before any results can be obtained:

1. Define the bounding box for the item in the image (Calibration)
2. Select any desired area
 - (a) Draw around areas to be selected
 - (b) Fill in areas

4.1 View Controls

Zoom and Pan are provided to help manage large images. Both of these are controlled only with the mouse.

4.1.1 Zoom

The zoom feature is controlled with the mouse wheel. To zoom out, turn the wheel as if scrolling down a page.

To zoom in, position the mouse over the area you wish to zoom in on. Then turn the mouse wheel in the opposite direction (as if scrolling up a page) to zoom in.

4.1.2 Pan

The image can be moved around on screen by holding down the *right* mouse button and dragging in the desired direction.

4.2 Calibration

The first thing that should be done when processing an image is to select the item in which area is being measured (more details in Section 1.2). This is done using the Calibrate button (Figure 4.1).

First a prompt will appear saying to click in the *Top left*. At this point you should click on the top left corner of the item (Figure 4.2).



Figure 4.1: The Calibrate toolbar button

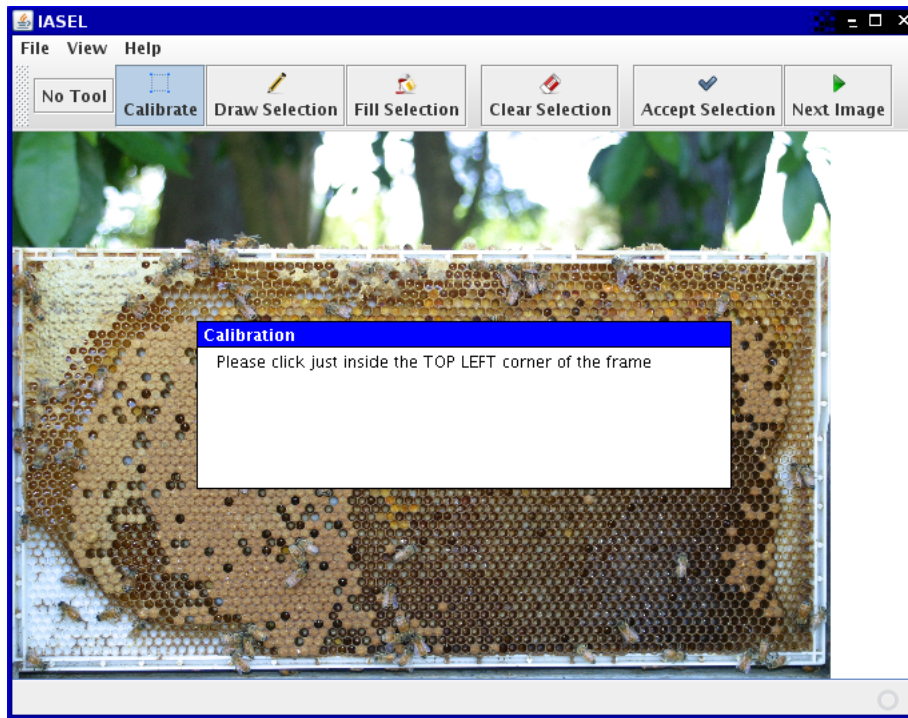


Figure 4.2: Calibrate first stage

Next a prompt will appear saying to click in the *Bottom right*. At this point you should click on the bottom right corner of the item (Figure 4.3).

This will cause a blue box to appear which should follow the border of the item in which the area is being measured if the picture is taken straight on (Figure 4.4).

When this appears, initial setup for the image is complete and the Draw Selection tool is automatically activated.

4.3 Drawing the Selection

To begin drawing the selection, click on the draw selection button on the toolbar (Figure 4.5) if the tool is not already active (it is automatically selected after calibration).

The selected parts of the image are coloured over in *red*. Any pixels that have been coloured red will be counted towards the area which will be calculated later.

The draw selection tool can be used to colour parts of the image red for

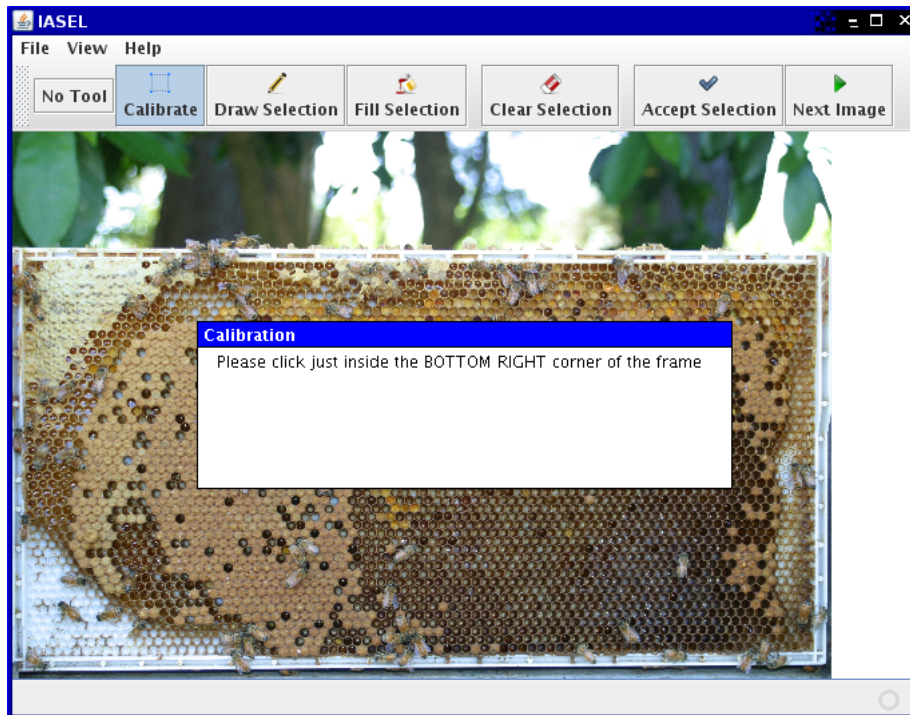


Figure 4.3: Calibrate second stage

inclusion in the area. This can be done either by zooming in and filling in the area with the draw tool, or by drawing an outline around the area and using the fill tool.

The first option is not useful when large areas want to be selected - colouring half the image with the draw selection tool would take a great deal of time. For this purpose, the fill selection tool is provided.

4.4 Filling selection areas

To use the fill selection tool, first draw a *closed loop* around the part of the image to be coloured. There must not be any gaps in the loop, otherwise the entire image will be coloured when the fill selection tool is used.

4.4.1 Joining selection ends

To make drawing the closed loop faster and easier, a method of immediately closing the loop is provided. This will draw a straight line from the start of the loop to where the mouse pointer.

The feature is activated by pressing the right mouse button at any time while drawing a line. When the left mouse button is released, the two ends of the line will be joined.

This means that the loop must be drawn as *one* line (you cant take your finger off the mouse button). To colour a square object (Figure 4.6) in the image



Figure 4.4: Calibrate complete

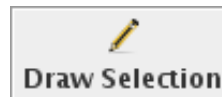


Figure 4.5: The Draw Selection toolbar button

red, you would click in the top left corner of the image, drag down to the bottom left corner, drag along the bottom, up the right side to the top right corner. Then you would press and release the *right* mouse button before releasing the *left* mouse button. When the left mouse button is released, a line will be drawn from the start of the line to where the mouse is - this would be along the top of the square object (Figure 4.6).

4.4.2 Filling Selections

To fill a selection (colour all of the area within the selection red), first click on the Fill Selection button (Figure 4.7) and then click *inside* the selected area. If there are no gaps in the line around the desired area, the area will be coloured red. If there are any gaps, the entire image will be coloured red and you will have to start again (there is not yet any undo feature) by pressing the Clear Selection button on the toolbar..

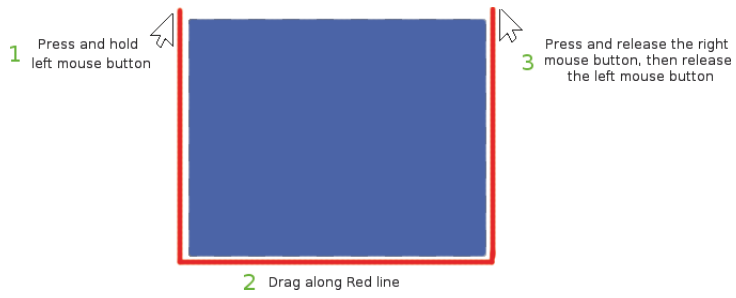


Figure 4.6: Drawing a Selection around an Object



Figure 4.7: The Fill Selection toolbar button

Chapter 5

Handling Results

When you have finished selecting the desired areas of the image you need to need to accept the selection. How this is done depends on if you are using the Work Queue (Section 3.2) as described in *Using the Work Queue* (3.2.4) or have just loaded an individual image (Section 3.1).

If you have just loaded an individual image, press the Accept Selection button (Figure 5.1). If you are using the Work Queue, press the Next Image button (Figure 3.3).

When one of these buttons is pressed there may be a slight delay as the software computes the size of the selected area. The delay length should normally be quite short unless the image is very large or the computer is very slow.



Figure 5.1: The Accept Selection toolbar button

If the Calibration step was forgotten a prompt (Figure 5.2) will appear asking you if you wish to proceed. Without performing the calibration step the results may come out incorrect. To go back and perform the calibration step just press *Cancel* and then perform the calibration as described in Section 4.2.

If you wish to proceed without performing any calibration, just press *OK* and the normal results gathering process will resume.

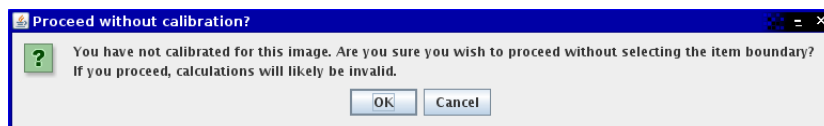


Figure 5.2: No Calibration Message

5.1 Obtaining Results

Once the selection has been accepted a number of prompts will appear asking for additional information to be included with the results. This additional information includes:

1. A Tag
2. The Area Type

Once both pieces of information have been acquired the results for the current image will be automatically added to the end of the results window and the current image will be unloaded. If the Next Image button was used then the next image in the Work Queue will then be loaded ready to be processed.

5.1.1 Tags

The first information requested upon completion of the selection is a tag. This can be any text you wish to include with the results for this image. If you have nothing to include just leave the box blank and click OK.

Clicking Cancel will cancel accepting the results and you will have to press the Accept Selection or Next Image button again.

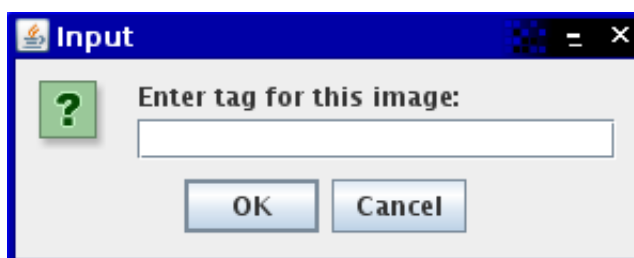


Figure 5.3: The Input Tag dialog box

5.1.2 Area Types

The next prompt to appear will ask you to select the area profile that best fits the current image. This can be done by selecting an area profile from the drop-down box (Figure 5.4) and then pressing OK. Like with the Input Tag dialog, pressing Cancel here will require you to press Accept Selection or the Next Image button again to get the results.

If there is only one Area Profile available, that one Area Profile will be used automatically and you will not be asked to choose one.

If there is a problem with the file in which Area Profiles are stored, you will see an error message like the one in Figure A.1. See Section A.1 for details on how to fix this.

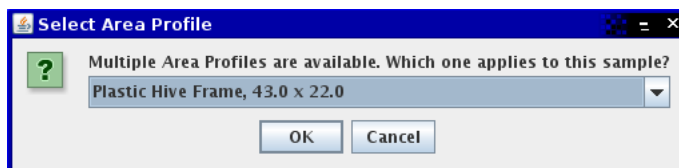


Figure 5.4: The Area Profile Selection Box

5.2 Results Window

Once a selection has been accepted and any prompts for further information have been answered, the results for the image will be appended to the list in the Results Window.

To bring up the Results Window (Figure 5.6), click on *Results Window* in the *View* menu (Figure 5.5). This will bring up the Results Window. To hide the Results window, you can either click on the menu item again or just close the window.

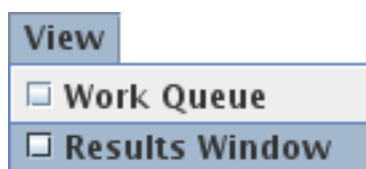


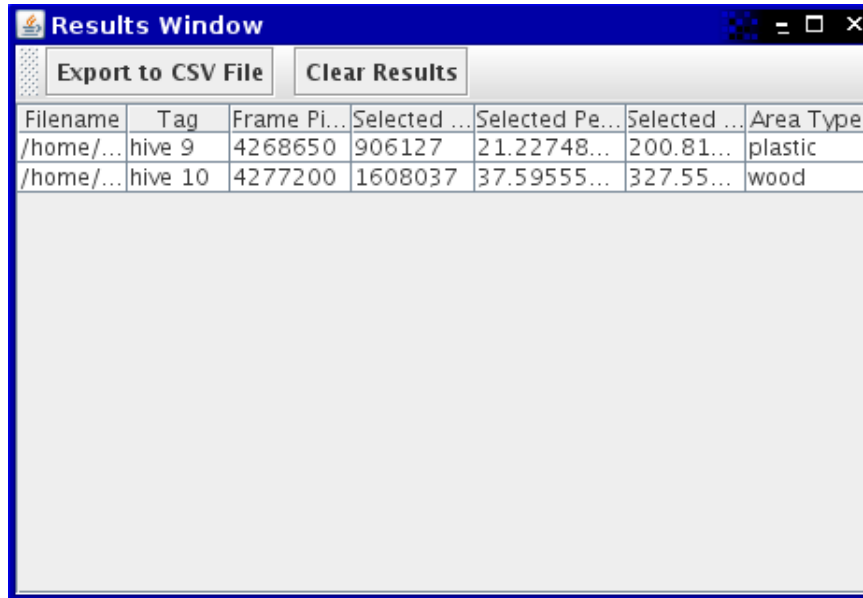
Figure 5.5: Show Results Window menu item

Results in the Results Window are organised into the columns described in Table 5.1.

Field	Description
Filename	The name of the file this row is for
Tag	The tag entered by the user when prompted
Frame Pixels	The number of pixels within the calibration box
Selected Pixels	The number of pixels coloured Red by the user in the image. Note that selections are not cropped so any pixels outside the calibration area will be counted too.
Selected Percentage	The percentage of Frame Pixels selected. If this is greater than 100 then all frame pixels have been selected as well as some outside the calibrated area.
Selected Area (cm^2)	The area in square-centimeters that has been selected in the image. This relies on the selection of the correct Area Profile as well as the calibration boxes dimensions being the same as the selected Area Profile.
Area Type	The short name of the selected Area Profile.

Table 5.1: Columns (fields) in Results Window

If the Selected Area and Area Type columns are blank there was likely a problem with the file which defines Area Profiles. See section A.1 for more details on this problem and how to fix it.



Filename	Tag	Frame Pi...	Selected ...	Selected Pe...	Selected ...	Area Type
/home/...	hive 9	4268650	906127	21.22748...	200.81...	plastic
/home/...	hive 10	4277200	1608037	37.59555...	327.55...	wood

Figure 5.6: The Results Window

5.3 Exporting Results

Before exiting the software you must export all results from the results window as these are not remembered between sessions. Exporting the results allows you to easily import them into any common spreadsheet software to allow for further processing.

It is recommended that you export your results occasionally as protection against data loss - IASEL does not yet have any autosave feature.

5.3.1 CSV Files

CSV files are a basic data interchange format allowing software like OpenOffice.org Calc and Microsoft Excel to import data from other sources. CSV files store their data as Comma-Separated Values such as in the example below:

```
"File Name", "Selected Area"
"/home/david/image.png", 3.14159
"/home/david/image2.png", 42
```

All common spreadsheet programs are capable of importing data from files formatted like this which makes CSV the logical choice of data export file formats for IASEL.

5.3.2 Export Results Window

The Export Results Window allows you to export all of the results in the Results Window to a CSV file. To bring up this window you can either select *Export Results to CSV File* from the File menu in the Main Window (Figure 5.7) or you can press the *Export to CSV File* button in the Results Window.

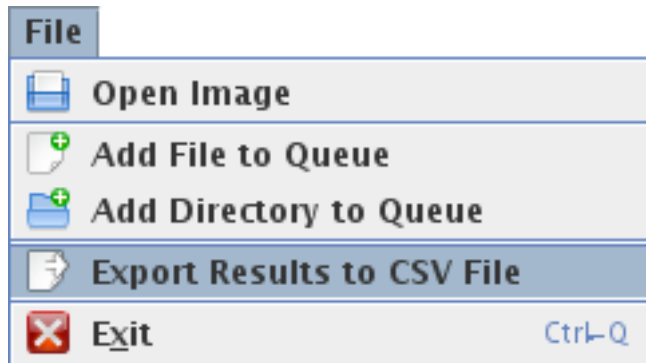


Figure 5.7: Export Results menu item

When either the menu item or the button is activated, the Export Results Window (Figure 5.8) will appear. This window allows you to choose which fields in the results you wish to export. This allows you to, for example, exclude the Tag field if it is not used.

To select which fields you wish to have exported to the CSV file, hold down the *Ctrl* key and click on each field in the list that you wish to appear in the CSV file. Selected fields will appear blue in the list.



Figure 5.8: The Export Results Window

Once you have selected the desired fields, press the Export button. This will bring up a File Save dialog where you can enter a filename to save the results as.

This filename should end in `.csv` so that other software knows how to interact with it properly.

If you decide you do not wish to export any results at this time just press the Cancel button to dismiss the dialog.

Exported results are not cleared from the results window. If you wish to clear the results window after exporting, see Section 5.4.

5.4 Clearing Results

If you are processing images in batches you may wish to export the results for each batch into its own CSV file. In order to do this a way of clearing the Results Window between batches is required.

All results in the Results Window can be cleared by pressing the *Clear Results* button. This will cause a prompt to appear asking if you really wish to proceed - once the results are cleared they can not be restored. Make sure you have already exported the results if they are important before clicking on OK.

There is not currently any way of removing individual results - this may be provided in a future version if required. For now if a mistake is made on an image just process that image again. You can remove any bad entries when you import the CSV file into a spreadsheet program.

Appendix A

Troubleshooting

A number of things can go wrong during normal operation of the program or during the initial setup. This appendix provides an overview of what to do in the event of something going wrong.

A.1 Unable to open Area Profile information file

A.1.1 Problem

A message with the text “Unable to open Area Profile information file. Area computations will be disabled for this session” (Figure A.1) appears after you have entered a tag when accepting the selection for an image.

A.1.2 Impact

This message will only appear once during the session. As it states, area computations will be disabled until the problem is fixed and the program is restarted. The *Selected Area* and *Area Type* columns in the results will be left blank.

If only the number of selected pixels, total pixels and selected percentage are required (the computed area in cm^2 is not important) then this message can be safely ignored.

A.1.3 Causes

The following are possible causes of this problem:

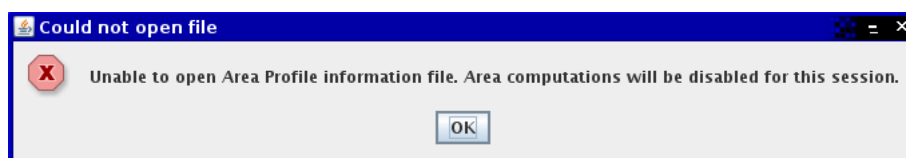


Figure A.1: Area Profile Information file not found

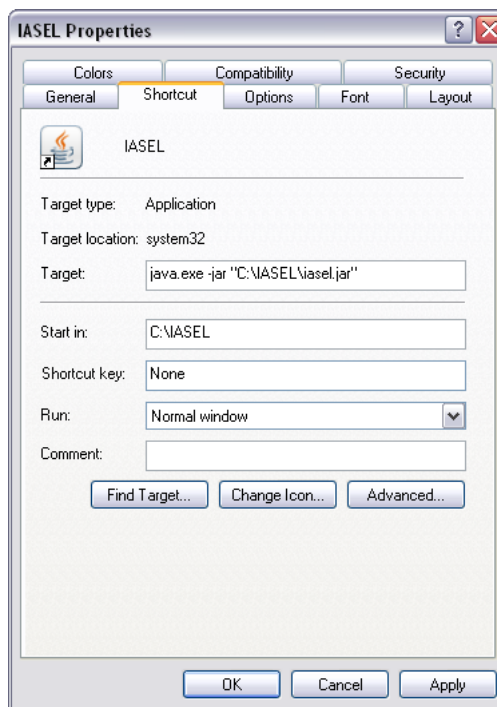


Figure A.2: Windows Shortcut Properties Dialog

1. `area_profiles.ini` does not exist.
2. The software does not have permission to read `area_profiles.ini`.
3. `area_profiles.ini` could not be found because the working directory is incorrect.

A.1.4 Solutions

1. Create the file as described in Appendix B.
2. Ask your System Administrator to provide you with read access to the file
3. Start the program from inside the directory where the `area_profiles.ini` file lives (See below)

Changing the Working Directory on Windows

If the program is being started with a Shortcut, enter the full directory name (eg, `C:\IASSEL`) in the *Start in* field of the shortcuts properties dialog (on the Shortcut tab, Figure A.2).

If the program is being started by clicking on the `.jar` file, run Notepad and enter the following text:

```
java -jar iasel.jar
```

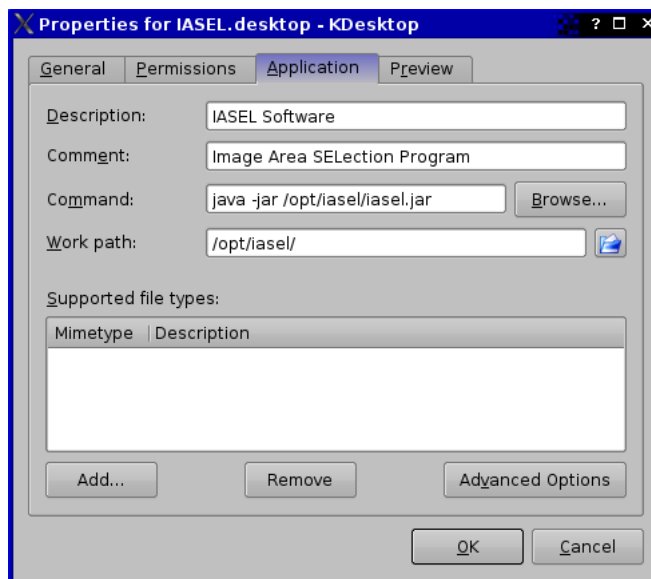


Figure A.3: KDE 3.5 Application Link Properties

and save it as `run.bat` in the same directory as `area_profiles.ini`. If `iasel.jar` is in a different directory from `area_profiles.ini` you will have to include the full direcectory name, for example:

```
java -jar C:\IASSEL\iasel.jar
```

Likewise, if your `.jar` file has been renamed to something different you should use that name instead of `iasel.jar`.

Changing the Working Directory on Linux (KDE 3.5)

In the properties dialog (A.3) for the Application Link, enter the directory where `area_profiles.ini` lives in the *Work path* box. In this example, `area_profiles.ini` is in the same directory as IASEL.

Changing the Working Directory on Other Systems

Changing the working on other Linux desktop environments should be fairly similar to how it is done in KDE 3.5. If you encounter difficulties, consult your desktop environments documentation.

While IASEL is probably compatible with other UNIX systems, MacOS X and OpenVMS current versions are not tested with platforms other than Linux and Windows. Any problems with other platforms are outside the scope of this manual.

A.2 Unhandled Exception Errors

It is not possible to forsee all ways in which the software may be used or how its components may interact. As such, unanticipated errors may occur which the

software was not designed to be able to handle. In these cases, an Unhandled Exception occurs.

An Unhandled Exception is an exception (error) that the software lacks any code to handle. When one occurs, the software stops what ever it is doing to prevent damage or further malfunction. An Unhandled Exception error message is then displayed such as the one in Figure A.4.

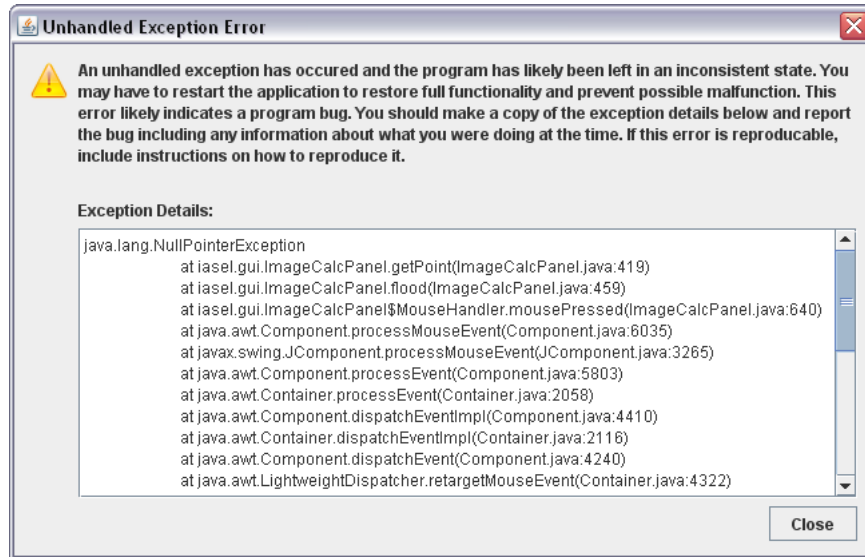


Figure A.4: Unhandled Exception Message

The Unhandled Exception Message (Figure A.4) contains detailed information on the error in the text area at the bottom of the window. These details include what the error was, where in the program it was and what happened directly before. This information is required in order to diagnose the fault and fix it.

As an Unhandled Exception likely indicates a bug in the program, the exception details should be copied and attached to a bug report including a description of how to reproduce the error if possible. See Section A.3 for more details on reporting bugs.

A.3 Reporting Bugs

When a bug in the software is found (including if the program performs in an unexpected way), a bug report should be made in order for it to be fixed quickly. This report should include:

1. A description of the bug.
2. Your Operating System.
3. The Specifications of your computer.
4. The version of the software you are using.

5. A copy of the Exception details if there was an unhandled exception.
6. A description of what you were doing leading up to the problem.
7. Instructions on reproducing the problem if possible.

The report should then be emailed to dgsoftnz@gmail.com. If possible the bug will be fixed in the next version of the software. If no major or minor release is due for release soon, a patch release will be made.

A.3.1 Example Bug Report

1. An Unhandled Exception occurs when trying to load the flood fill tool before an image has been loaded.
2. Operating System: Windows XP Service Pack 3
3. HP-Compaq nx6125 Laptop, AMD Turion64 1.8GHz CPU, 512MB RAM
4. IASEL version 1.0-1
5.

```
java.lang.NullPointerException
    at iasel.ImageCalcPanel.getPoint(ImageCalcPanel.java:4)
    at iasel.ImageCalcPanel.flood(ImageCalcPanel.java:459)
    ...
```
6. Program was opened, then the fill selection tool was used. No image was opened.
7. Start Program, click on Flood Fill toolbar button, then click on the image area.

Appendix B

Defining Area Profiles

Calculating the selected *Area* (rather than the selected percentage) uses Area Profiles which are defined in `area_profiles.ini`, a windows INI format file.

When no Area Profiles are present in the file, area calculations in the program will be disabled. If only one Area Profile is present, that one will be automatically used. If more than one Area Profile is present, the user will be asked which profile to use for each image.

B.1 INI Format Files

INI files contain grouped key-value pairs. Group names are contained in square brackets ([and]). Every key-value pair that comes after a group name belongs to that group. The software expects certain group names to be present - when creating `area_profiles.ini` you must use these group names.

Key-value pairs are written as `key=value`. Like with group names, the keys that you can use are defined by the software. Each key has its own purpose and expected value type.

B.2 Keys

B.2.1 information group

key	type	example value	purpose
entries	Integer	1	Defines how many Area Profiles are in the file.

Key: entries

The `entries` key defines how many area profiles are present in the file. When ever an area profile is added or removed, this key must be updated to reflect the new number of area profiles present in the file. If there are no area profiles present, this number should be 0. If there are 5 area profiles present, this number should be 5.

If the value is set to be lower than the number of area profiles present in the file, all area profiles after the set value will be ignored.

B.2.2 numbered groups (1, 2, 3, etc)

key	type	example value	purpose
display-name	String	Normal Area	A descriptive name for the profile that will be shown to the user.
short-name	String	norm	The name that will be inserted into the results.
width	Double	5.5	The width of the area in cm.
depth	Double	10.9	The depth (or height) of the area in cm.

These groups represent Area Profiles and each group name *must* be a number. There *must not* be any gaps in the numbering. This means that numbering area profiles 1, 2, 5, 6 is *not* valid. Assigning two area profiles the same number is also not allowed - if this is done one of the area profiles will be ignored. Numbers can be no higher than the value set for the `entries` key under the `information` group. Any area profiles numbered higher than this value will be ignored.

The ordering of area profiles in the file does not make any difference. Having the sections arranged 1, 2, 3 or 3, 1, 2 is perfectly fine as long as there are no gaps in the numbering.

Key: display-name

This is the name of the profile which is used in the programs user interface. When more than one profile is available the user will be given a list of all the display-names and asked which area profile to use.

This means that the display-name should be unique and descriptive to ensure the user selects the correct profile when prompted.

The display-name will be presented to the user along with the dimensions (e.g. "Normal Area (5.5 x 10.9)")

Key: short-name

This is the name of the profile that is inserted into the results for each image that the profile is used on. It should also be unique if this information is important.

Key: width

This is the width of the area in centimeters. Its type is Double Precision so it can take values like 1215.912363477773.

Key: depth

This is the depth (or height) of the area in centimeters. Its type is Double Precision so it can take values like 1215.912363477773.

B.3 Example File

The following example defines two Area Profiles, "Plastic Hive Frame" and "Wood Hive Frame"

```
[information]
entries=2
```

```
[1]
display-name=Plastic Hive Frame
short-name=plastic
width=43
depth=22
```

```
[2]
display-name=Wood Hive Frame
short-name=wood
width=42.5
depth=20.5
```

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