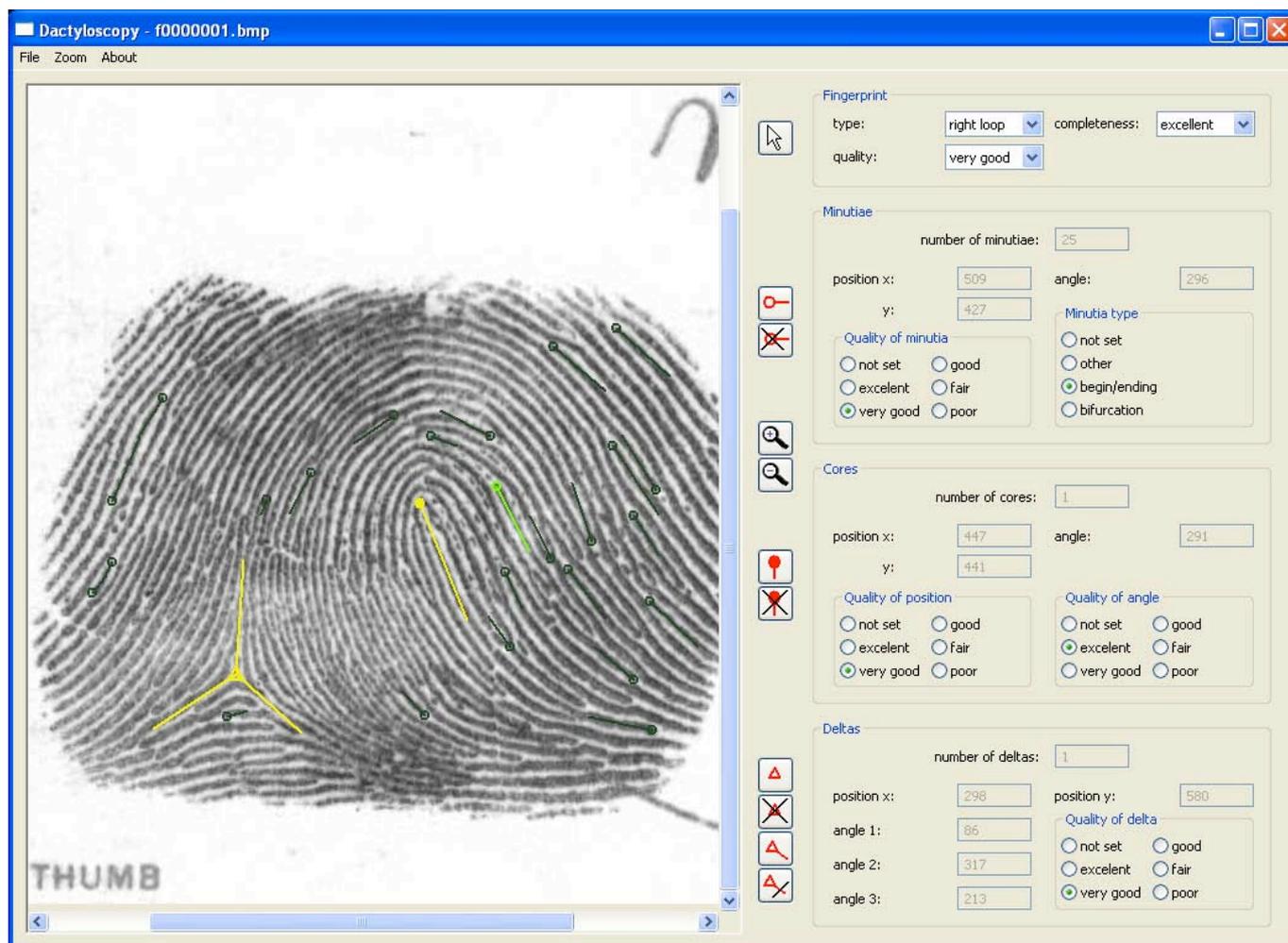


A Graphical User Interface for Ground Truth Minutia v1.1 – Sept 17, 2008



 **Selection.** When you click on this button, you can select by clicking on the center of an item, which item (minutiae, core or delta) will be active. Once some item has been selected, it is displayed with light color and at the same time information about that item is displayed in the right hand part of the GUI and some of this information can be also changed. It is not possible to change the active item until all necessary parameters of the previously selected item are set.

When you click on this button and push down the left mouse button on the end of a delta line (angle) you can change this angle by moving the mouse.

 **Minutia insert.** When you click on this button, you can insert the minutia and its angle by pressing the left mouse button in the picture and moving the mouse. The maximum number of minutiae is 255. It is not possible to insert a new minutia until all necessary parameters of the previous minutia are set. NOTE: For every minutia you must specify an angle.

 **Minutia delete.** When you click on this button, you can delete the minutia by clicking on its circle in the picture.

 **Core insert.** When you click on this button, you can insert the core and its angle by pressing the left mouse button in the picture and moving the mouse. The maximum number of cores is 15. It

is not possible to insert a new core until all necessary parameters of the previous core are set.

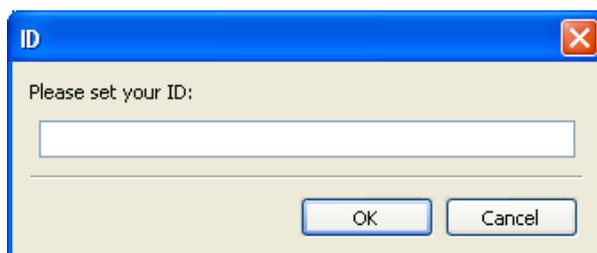
-  **Core delete.** When you click on this button, you can delete the core by clicking on its circle in the picture.
-  **Zoom up.** The zoom can be between 10 percent of image width (and height) and 500 percent.
-  **Zoom down.** The zoom can be between 10 percent of image width (and height) and 500 percent.
-  **Delta insert.** When you click on this button, you can insert a delta with three default angles by clicking in the picture. The maximum number of deltas is 15. It is not possible to insert a new delta until all necessary parameters of previous delta are set.
-  **Delta delete.** When you click on this button, you can delete the delta by clicking on its triangle in the picture. It does not matter if this delta has any angle or not.
-  **Delta angle insert.** When you click on this button, you can insert the delta angle by pressing the left mouse button in the center on triangle and moving of mouse. Maximum number of angles by one delta is 3.
-  **Delta angle delete.** When you click on this button, you can delete the delta angle by clicking on its end in the picture. Minimal number of angles by one delta is 2.

Expert ID:

Warning:

It is necessary to fill ID number between 0 and 20. You should ALWAYS use the same number that was assigned to you.

When you will not set the number, program will not start.



Menu:

File / Open image file ...

The GUI can open BMP and WSQ files.

File / Save minutiae ...

The GUI will save the ground truth information that has been edited in the open image file, regarding fingerprint (pattern, quality, completeness), minutiae, cores and deltas in Ground Truth Minutiae (*.gtm) file format. The generated file will have the name as the open image with added ending "-NN.gtm", where NN is two digit expert number, which you have set at start of the program. The file will be saved in the same directory from which you load the image.

Warning:

It is not possible to save the edited results until all necessary information is filled in. Only a third angle for a delta is not mandatory, all other information is mandatory (see below under GTM Data 14.). It is also mandatory to set at least 1 minutia in the picture (The usefulness of a GTM-data set with only one minutia can be doubted and this case should be avoided).

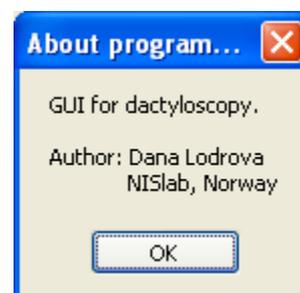
Zoom / Zoom up

The zoom can be between 10% of image width (and height) and 500%.

Zoom / Zoom down

The zoom can be between 10% of image width (and height) and 500%.

About / About program...



GTM Data:

The following data fields will be filled subsequent to the editing of a fingerprint image by a dactyloscopic expert. The encoding scheme follows the ISO 19794-2 standard, where possible.

1. **Pattern type:** 1st Level classification will be done according to the following Fingerprint Classification Codes:
A = Arch
L = Left Loop
R = Right Loop
W = Whirl
U = Unknown
2. **Sample level quality:** Level of difficulty to analyze in correspondence to NFIQ ranging from 1 “excellent”, 2 “very good”, 3 “good”, 4 “fair” down to 5 “poor”.
3. **Completeness level:** Completeness level of fingerprint ranging from 1 “excellent”, 2 “very good”, 3 “good”, 4 “fair” down to 5 “poor”.
4. **Minutia type:** ISO 19794-2 Clause 7.4.2.1
Undetermined, ridge ending, ridge bifurcation. The bits 00 will represent a minutia of other type, 01 will represent a ridge ending and 10 will represent a ridge bifurcation.
5. **Minutia Position:** ISO 19794-2 Clause 7.4.2.2
The coordinates of the minutia (horizontal X and vertical Y). The origin of the coordinate system is, as in ISO/IEC 19794-2, the upper left corner and the X and the Y coordinates shall be in pixel units.
6. **Minutia Angle:** ISO 19794-2 Clause 7.4.2.3
Absolute angle of the minutia. The angle is measured counter-clockwise from the horizontal axis to the right. The angle of a minutia is in degree. The granularity shall be, as in ISO/IEC 19794-2 of (360/256) degrees. The value shall be a non-negative value between 0 and 255, inclusive.
7. **Minutia Quality:** ISO 19794-2 Clause 7.4.2.4
The quality (accuracy) figure shall assess both position and angle and range from 100 as a maximum to 1 as a minimum.
8. **Number of Cores:** ISO 19794-2 Clause 7.5.3.1
The number of core points represented.
9. **Core Position:** ISO 19794-2 Clause 7.5.3.3
The coordinates of the core (horizontal X and vertical Y).
10. **Core Position Quality:** The quality (accuracy) figure shall range from 100 as a maximum to 1 as a minimum.
11. **Core Angle:** ISO 19794-2 Clause 7.5.3.4
The angle of the core shall be recorded in one byte in units of 1.40625 (360/256) degrees. The core angle is measured increasing counter-clockwise starting from the horizontal axis to the right.

The value shall be a non-negative value between 0 and 255, inclusive. For example, an angle value of 16 represents 22.5 degrees.

12. Core Angle Quality:

The quality (accuracy) figure shall range from 100 as a maximum to 1 as a minimum.

13. Number of Deltas: ISO 19794-2 Clause 7.5.3.5

The number of delta points represented.

14. Delta Position: ISO 19794-2 Clause 7.5.3.7

The coordinates of the delta (horizontal X and vertical Y).

15. Delta Angle: ISO 19794-2 Clause 7.5.3.8

The three angle attributes of the delta shall each be recorded. The delta angle is measured increasing counter-clockwise starting from the horizontal axis to the right. The value shall be a non-negative value between 0 and 255, inclusive. For example, an angle value of 16 represents 22.5 degrees. If not all three angles can be extracted from the image because of noise or image cropping, the angle fields affected shall be filled by repeating any of the other angle(s) for the same delta.

16. Delta Quality:

The quality (accuracy) figure shall assess both position and angle and range from 100 as a maximum to 1 as a minimum.

Example of GTM file format:

```
Width           : 832 px
Height          : 768 px
Fingerprint type : R
Fingerprint quality : 2
Fingerprint completeness: 1

Number of minutiae: 3
-----
id:  type,   x   ,   y   , angle, quality of minutiae
-----
0:   2,   527,  234,   81,   90
1:   1,   452,  358,  104,   70
2:   0,   360,  170,  187,   10

Number of cores : 1
-----
id:  x   ,   y   , quality of position, angle, quality of angle
-----
0:  388,  165,                90,  213,   70

Number of deltas : 1
-----
id:  x   ,   y   , angle, angle, angle, quality of delta
-----
0:  342,  341,   66,  231,   66,   70
```

You can see the example data from a fingerprint image with 832 x 768 Pixel. The pattern type of the fingerprint is a “right loop”, the quality of fingerprint sample was assessed as “good” and fingerprint completeness level is set as “excellent”. The user edited (specified) 3 minutiae, 1 core and 1 delta in this image. The first minutia is a bifurcation with excellent quality (90%) and angle 81 (it is about 113.91 degree). A second minutia is edited as “ridge ending” and a third minutia is of type “unknown” with poor quality (10%). You can see that for the delta the third angle same is identical as the first one. According to ISO 19794-2, when it is impossible to set the third angle for an identified delta, the program should copy the angle information from the first angle.

NOTE: All angles are displayed in degrees (from 0 to 359) but they are stored in the range from 0 to 255.