

MANUAL

DatInf[®] MoleExpert *micro*



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Introduction

MoleExpert-Micro is a program created on a foundation of years of experience in the automated analysis of pigmented skin lesions. The important requirement for this software project was the usability of the software with different image recording systems. The most important requirements for the functioning of this software are high-quality, even and well illuminated incident light microscopic images of skin lesions.

MoleExpert *micro* was developed for the support of diagnosis findings. The system does not give a diagnosis, but instead provides measurement results on expansion, color, net structure, globules and the border which can be evaluated in comparison with many hundred lesions at any time.

The parameters for the ABCD-rule have been recognized for some years as important parameters in dermatoscopy. In addition to this data the software calculates some additional parameters, which have emerged during research work in recent years as relevant (such as color variation and gray veil).

Using a special algorithm suited to the image analysis, some of these parameters are integrated in a score that works with values between 0 and 1. Lesions with a high score are more likely to be a melanoma than lesions with a lower score. Threshold values of the score are dependent on the camera and must be determined in special studies.

As well as the individual scores, the observation of changes for the recognition of melanoma is very important. MoleExpert *micro* is equip with a very unique comparison function, which with changes can be assuringly visualized and assessed.

Steps for image analysis

During an image analysis a number of steps are carried out, based in part on a complex image analysis algorithm. The following individual steps are performed:

- Removal of inclusions, bubbles
- Editing out of hairs
- Determination of the color distribution
- Border search
- Drawing of the boundary and the edge
- Determination of the dermatoscopic parameter for the specification of lesions

Specification of parameters

Asymmetry

For the specification of asymmetry, axes are laid in a close distance over the middle point of the lesion. For each of these axes the correlation for the lesions on both sides of the axis are measured. This correlation is used as the measurement of symmetry. As well as the symmetry axis, the angle dependent symmetry value is displayed in the middle of the lesion. The greater the symmetry, the larger the cross section of the blue region for this angle.

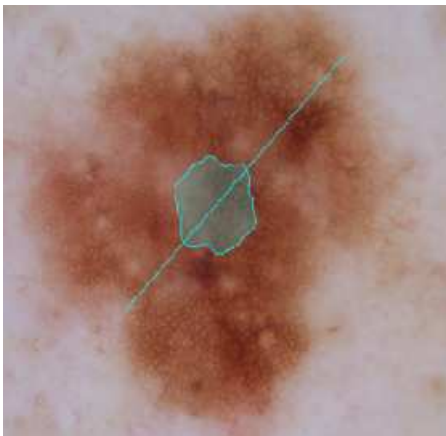


Fig. 1: Symmetry diagram and Symmetry axis

Boundary (frame)

In many cases lesions have a diffused frame. Thus, through the software algorithm a simple border is drawn as well as a outlined area, whose width is dependent on sharpness.

For the determination of border sharpness as a measurement of boundary, the initially calculated border is compared with a smoothed border. The border sharpness is drawn in as transparent shadowing. The wider the drawn in border shadowing is, the sharper the border on this position.

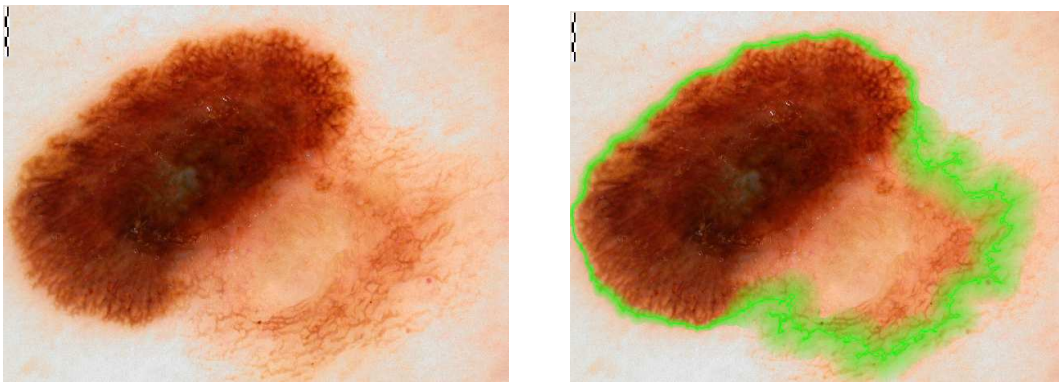


Fig. 2: Original image with scale (left) and image after analysis with drawn-in border (right)

Color

The absolute measurement of color parameters is less meaningful, since the skin color can change depending on tanning or other exogenic factors. Thus, the parameters for color variability, gray veil and decentral hyperpigmentation are determined relatively.

The rotating RGB Diagram (button 3D-display) serves for a 3D display of color distribution. In this diagram the red, green and blue parts for each image point are removed.

The color distribution for Nevus often appears as a narrow tube. In the case of melanoma this tube is normally wider and dilates towards the other side of the border.

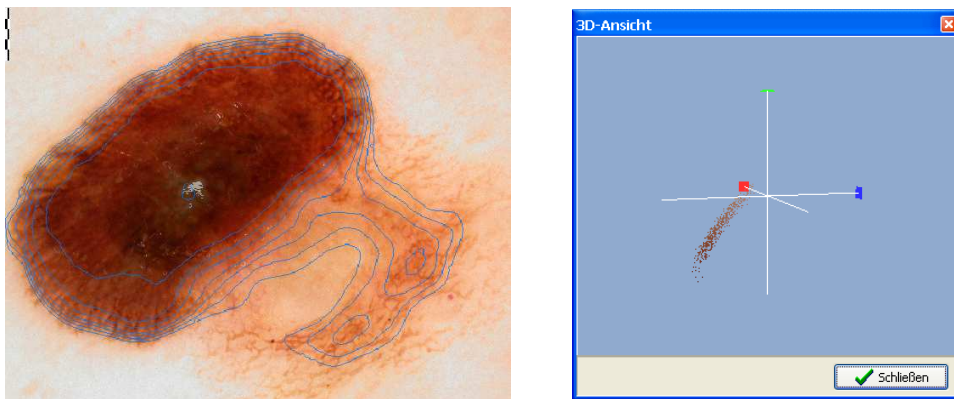


Fig. 3: Decentral hyperpigmentation (blue lines), gray veil (gray marking in the middle of the image), and picture of the animated 3D-RGB-Diagram

Cross section

Like with asymmetry, axes are laid through the middle point of the lesion for the determination of the maximum diameter. The outermost border is used for the determination of the diameter for all axes.

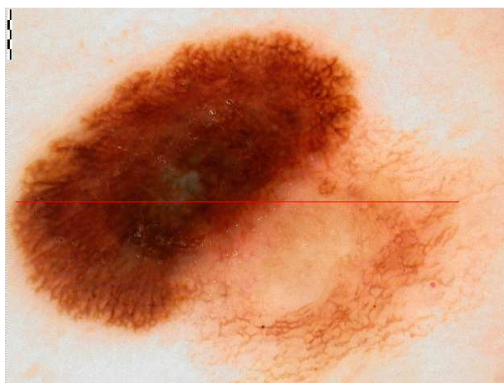


Fig. 4: Maximum diameter (rote Line)

Network structure

The software evaluates structural characteristics for detection of network structures. Detected network structures are marked in yellow. From these markings network structures a parameter is calculated which allows for a differentiation of typical and atypical pigment networks.

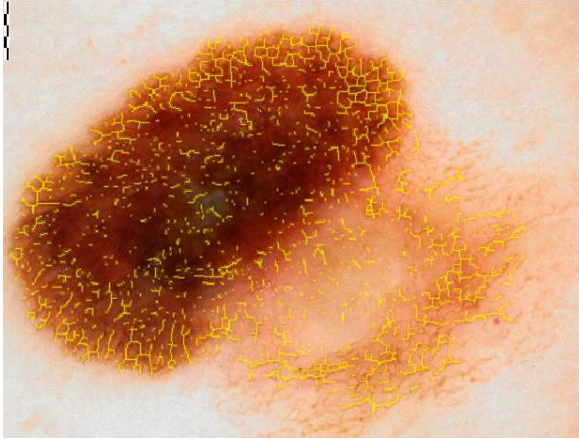


Fig. 5: Network structure (marked in yellow)

Globules

Irregularly distributed, clearly recognizable points are marked and labeled as globules. Number and frequency are given as parameters.

Image optimization

For most camera systems an exposure setting is selected, with which the entire image as well colored as possible can be correctly depicted.

Through technical limitations, finer structures in darker lesions surrounded by lighter skin are almost invisible. For image optimization the contrast inside the lesions is strengthened so that the structures are more visible. Image optimization is based alone on the adjusting of brightness/contrast settings and brightness distribution. Artificial or forged images should not be used.

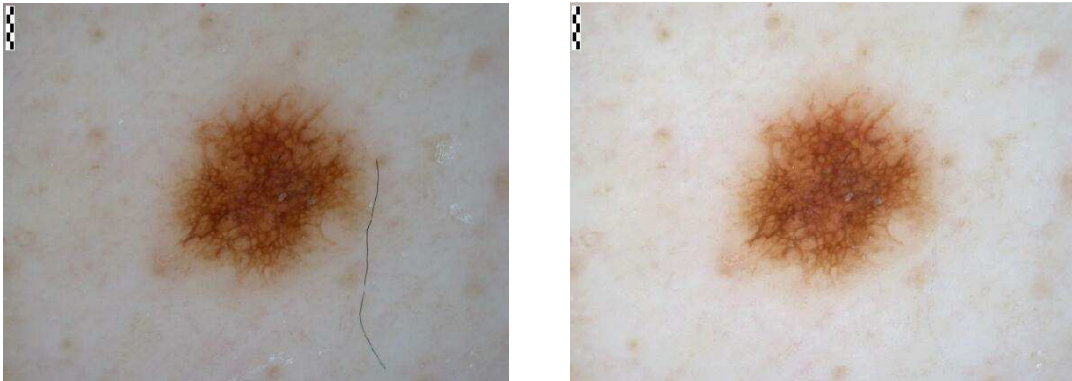


Fig. 6: Original image and image after color optimization

Display of analysis parameters

During the analysis of a lesion, all implemented parameters are calculated. Which of these should be displayed in the image can be determined in the window 'Display of analysis parameters'.

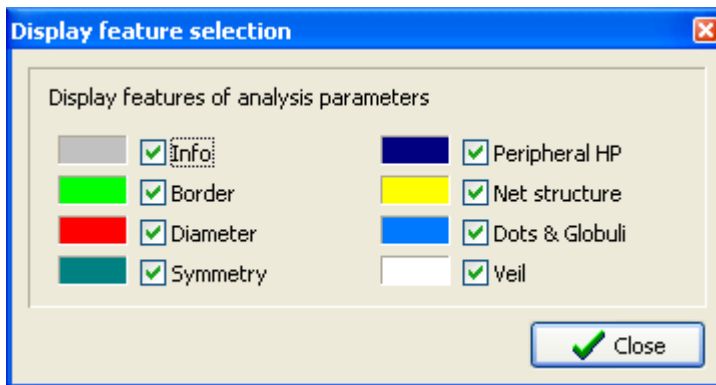


Fig. 7: Selection of parameters to be displayed

In the main menu under 'Options' simply select 'Display analysis parameters' to select the parameters you wish to be displayed.

Image comparison

When processing two progress images the display occurs in synchronization. This mode is particularly interesting for the comparison between progress images. By clicking the icon for direct image comparison an overlay animation can be generated, so that changes can be visualized.

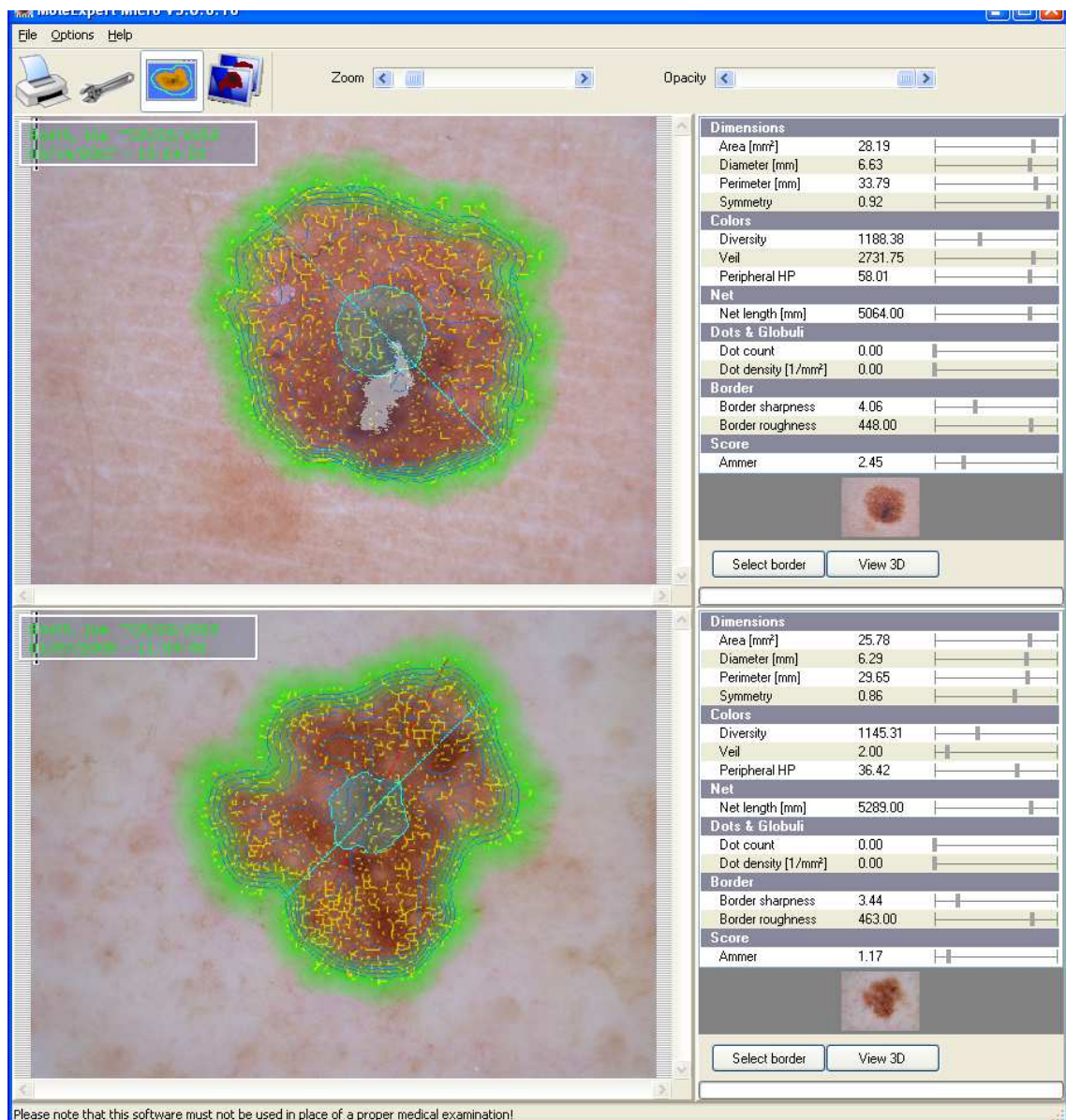


Fig. 8: Comparison between two lesions

The overlay work tool automatically aligns the lesions as optimally as possible. If the alignment doesn't suit, a manual fitting is possible. In this case the zoom, intensity of the overlay, the rotation and the displacement can be influenced.

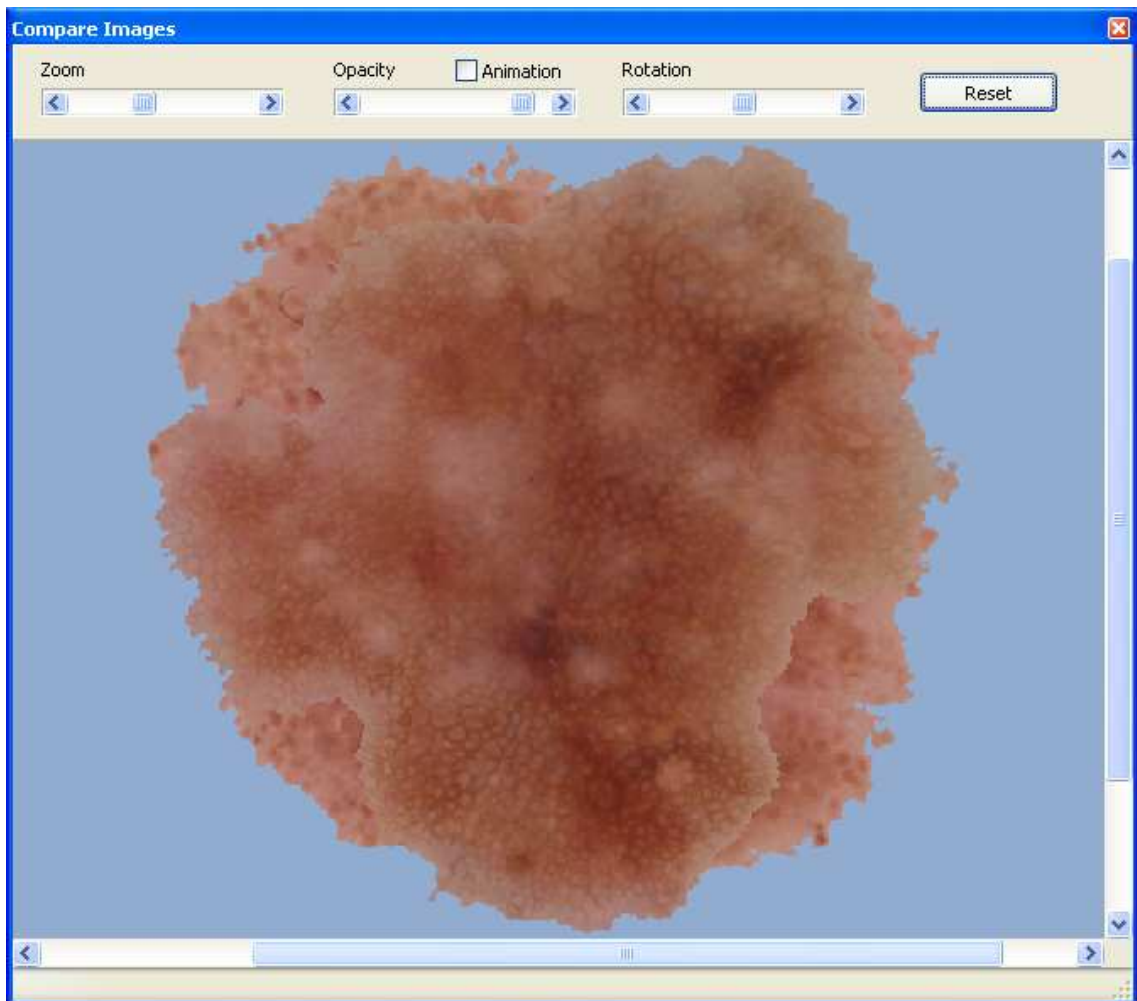


Fig. 9: An overlay of two lesions

FAQ – Frequently asked questions

What can be analyzed by MoleExpert micro?

MoleExpert micro was developed for the analysis and measurement of pigmented moles. Through the application of robust procedures, in principle other skin lesions can also be analyzed. However the given parameters are designed especially for moles.

Is there any clinical data on the diagnostic accuracy of the software?

When images of pigmented moles are photographed using different systems these images strongly resemble one another. Nevertheless differences are present which make a special customization necessary for each system. Without this customization the software can only be used for follow-up evaluations.

What are the necessary hardware requirements?

The software runs on Standard-PCs with up-to-date versions of Windows from Windows 2000 onwards with at least 1024x786 point image resolution. A system with Pentium-II-Processor, 1 GHz and at least 64 MB memory space or more is recommended. A faster PC is recommended particularly for larger image files. The most important program windows are scalable and support large image resolutions.

Are my images suitable for the image analysis?

An important prerequisite for the image analysis is a clear recognizability of the lesions. The software won't be able to recognize areas which are not well visible by the naked eye. The standardized photo taking requirements are important. For example, the illumination should always be kept as constant as possible. If you are unsure about the suitability of your images for Dat-Inf® *MoleExpert micro*, send a small sample of representative images to Dat-Inf GmbH. You will be informed of the resulting analysis.

Which image formats are supported?

In the current program version the following image formats are supported:

- BMP (Windows/OS2 Bitmap)
- JPG (JPEG)
- PNG (Portable Network Graphic)
- TIF (Tagged Image File Format)

Modules for reading about DICOM-images (common standard for medical devices) can be provided upon request.

How does MoleExpert know the magnification?

The MoleExpert-Software has a control file, in which magnification information for the photographing system can be entered. For the use of Datinf[®] ImageDB med together with current canon-cameras the zoom settings can be freely selected. The software recognizes the settings and from there calculates the correct measurement.