

MANUAL

DatInf[®] MoleExpert *macro*



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Introduction

The observation of changing pigmented lesions can give us as much important information as the detection of new lesions in the early detection of melanoma. Changes in size, form and color of existing or newly detected pigment lesions are hard to recognize without technical assistance. History checks are especially difficult in cases of patients with multiple melanocytic nevi. Often the patients themselves recognize a greater change in a pigmented lesion and contact their GP or Skin doctor. Changes on the back however are harder for patients to recognize themselves.

The software MoleExpert macro has been developed for the support in the observation of pigmented lesions on the body. Through an automatic image compare process, the software is capable of identifying new moles and detecting changes in existing moles on the skin.

MoleExpert macro thereby takes into account important aspects which are necessary for a practical application: the images for comparison do not need to be taken under identical circumstances. Small differences in lighting, body position and camera-to-subject distance are equalized.

The software should not be seen as a substitute for dermatoscopy, but instead as a complement. This program can be especially beneficial for the caring of patients with a large amount of pigmented lesions.

Scientific Background

An analysis of age distribution in groups of patients with different melanoma tumor thickness (Breslow) resulted in an age distribution of 7.8 years after comparing the groups 'Smaller 0.75 mm' and 'Larger 3 mm' tumor thickness [1]. Based on this data, realistic and relevant changes could be recognized. Tsoa et al found an increased risk of skin pigmented lesions in persons aged 40 and over of possessing malignant melanoma [2].

The pigment lesions for this particular group of patients should therefore be strongly controlled.

Liu et al develop in a third of melanoma at a growth rate of 0.5 mm per month. The monthly growth rate for SSM (superficial spreading melanoma) was 0.12 mm, for LMM (lentigo maligna melanoma) 0,13 mm and 0.49 mm

for NM (nodular melanoma). The ABCD-rule could not be reliably confirmed for fast-growing melanoma [3]. On the basis of this data an observation time frame of 6 months for high-risk patients seems appropriate – for NM however too short.

Bishop et al describe a progressive change in form, size or color of a lesion as important factors in melanoma detection [4]. These characteristics described should thus be taken into account in clinical monitoring.

Program Features

Together with the dermacenter Küssnacht (Switzerland) the image analysis software MoleExpert macro was designed as a practical solution for the clinical monitoring of nevi. The starting points for the analysis are always photographed bodily regions of interest (e.g. the back). The body area to be examined is photographed under as identical as possible conditions (distance, angle, lighting) within a time interval of approximately half a year to one year and saved in an image database. When the original and developed images are loaded, the image analysis software will begin. The detection of skin pigmented lesions and organizing of pairs in the two images is automated. After a few moments, the analysis result appears drawn directly in the images.

MoleExpert macro is very well suited for the detection of changes in patients with a large amount of pigmented lesions. With this software, images of the back, the legs and also from the chest or throat regions can be analyzed and subsequent changes highlighted.

The software is designed so that image information even from high resolution pictures can be used, in which the areas of special interest can be displayed greatly enlarged in both images simultaneously using the magnification function.

Experience with the program has so far shown that size change from approx. 10% can be detected in good quality images.

From a technical viewpoint, the software offers the following features:

- automated detection of pigmented lesions in every image,
- automated organization of these lesions into image pairs,
- detection of new moles and changes in existing,

- determination of size and color changes,
- as accurate as possible correction of differences in photo taking conditions (position, distance, rotation, lighting)

Description of Algorithm

Described below is the principle of analysis.

1. Recognition and evaluation (score) of pigmented lesions in every image through the use of a knowledge-based system (artificial intelligence)
2. Automated selection of conspicuous pigmented lesions (highest score) in both images
3. Calculation of possible transformations, taking into account different conditions (position, rotation, distortion), based on the location of the chosen pigmented lesion
4. mapping of pigmented lesions using the transformation
5. Correction of parameters for the transformation by the use of the found pigmented pairs
6. Repetition steps 4 and 5 until no further improvement is possible
7. Concrete mapping and comparison of pigmented lesions
8. Presentation of results

Approach for the Analysis of Images

If there is an image data base, two images can be transferred directly into MoleExpert macro. The image analysis then begins automatically. Otherwise, images can be loaded under 'File' on the main menu. The automatic processing of the images begins when the 'Analyze' button is clicked.

First the software searches for all moles in each image, which fulfil a specific criteria of size and conspicuity. The mapping of the corresponding moles from both images follows through the use of a specially developed algorithm.

Unchanged lesions are circled in green and changed lesions circled in red. Lesions in which no corresponding lesion could be found will be circled in yellow.

Program Use

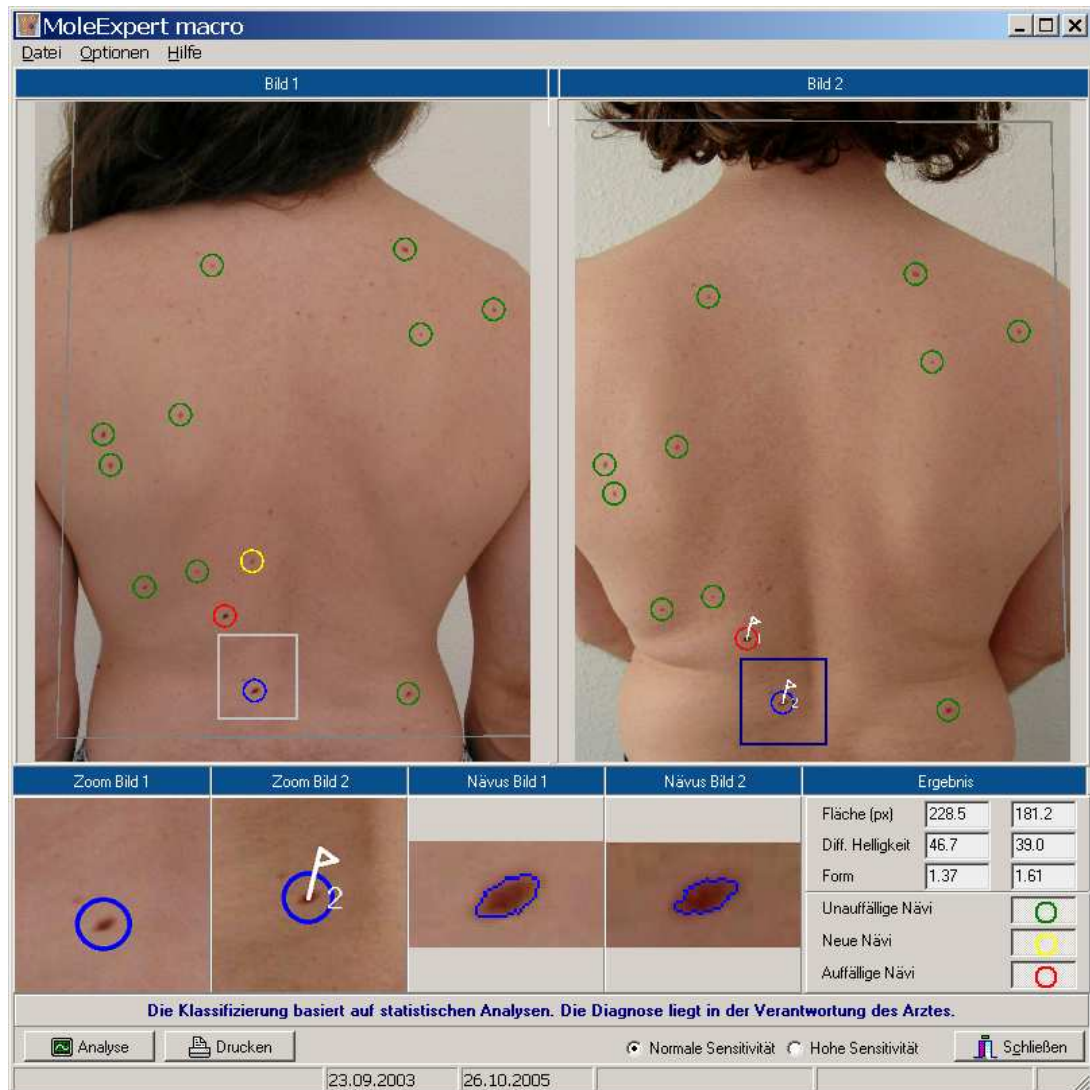


Fig. 1: Screen shot after automatic analysis: Photo of the back

When the mouse is moved over one of the two original images, a blue rectangle moves along with the mouse. The contents of this rectangle are displayed enlarged at the bottom of the window. In the second image, the corresponding area is displayed in a grey rectangle. The contents of this area are also displayed enlarged at the bottom of the screen (Zoom Image 1 and Image 2).

If a mole is clicked on, its corresponding screen area where applicable will be displayed in maximum enlargement on the bottom right-hand side (Nävus Image 1 and Image 2).

When you right-click on the original image a pop-up menu will appear. From here you can choose whether a lesion is marked and you can choose to view the image displayed scalable in full or with the moving of the rectangle.

In the bottom right-hand side in the results section the meaning of the colored circles is briefly outlined. The displaying of the circles in the image can here be switched on or off.

Options

To adapt to the particular screen settings, the layout parameters can be set under 'Options':

1. Saving the window coordinates upon closing the program:
upon close the window coordinates will be saved so that the window position and size can be reapplied the next time the program is started
2. Use of the automatic Skin-search:
This option is currently only available for research projects

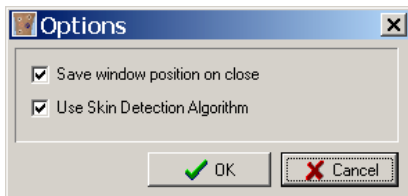


Fig. 2: Program options

FAQ – Frequently asked questions

What can be analyzed with MoleExpert macro?

MoleExpert macro was developed for the analysis and measurement of skin pigmented lesions in photographed images. This program can be particularly useful for high resolution digital images.

Which patients should be controlled? In which intervals?

On the basis of studies for the analysis of risk factors is above all things the number of Nevus > 2mm a deciding factor [5]. Melanoma patients have a

very high risk of further melanoma. This patient group should also be regularly controlled.

According to NIH Consensus Conference, high-risk patients (>50 Nevus, atypische nevus, immediate relatives affected by melanoma) should be monitored every 4 to 6 months.

Which standards are necessary in photo taking?

Images should be taken under conditions as identical as possible. Different angled shots (up to approx. 10°) and smaller deviations are automatically balanced by the software. The sharpness of these shots is however very important. Lesions may not be properly detected in fuzzy images.

Does the lighting have to be identical?

The better standardized the photo conditions are, the better the results will be. However photo conditions in a daily routine situation can not be produced like in a photo studio. That is why this software has been programmed so that differences in illumination can be detected and taken into consideration.

Does the software still function if a patient is lightly tanned and later untanned in the photographs?

The software tries to determine a main color and balance this effect. A very dark tanning can however not be corrected.

What are the hardware requirements?

The software runs on Standard-PCs with an up-to-date version of Windows from 98SE onwards, with at least 800x600 point image resolution. A System with Pentium-III-Processor, 1 GHz and at least 256 MB saving space, or faster, is recommended. In particular for large image files a faster PC with a lot of storage space is recommended. The most important program windows are scalable and support large image resolutions.

Are my pictures suitable for the image analysis?

An important requirement for image analysis is a clear recognizability of the lesions. What is difficult for the naked eye to see may also be difficult to be

recognize by the software. The standardized conditioning of photo taking is important. For example, the lighting should always be kept as constant as possible.

For the image comparison the photos should be of the same size and orientation (e.g. both images in high format). A minimum resolution of 1280x1024 pixels is recommended; a minimum of 480 pixels image width is required. Currently, only images with a maximum size of 8 mega pixels can be analyzed.

If you are unsure about the suitability of the images for the DatInf[®] Mole-Expert *macro*, send two or three images to DatInf GmbH. You will be informed by reply about the analysis results.

Which image formats are supported?

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

- BMP (Windows/OS2 Bitmap)
- JPG (JPEG)

For JPG images the compression should not be too highly set otherwise compression artifacts can distort the results.

References

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