Detecting skin cancer quickly

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The Dermascanner scans the surface of a patient's skin from different positions and divides it into around one hundred individual images. Credit: Dirk Mahler/Fraunhofer IFF

Melanoma is aggressive and life-threatening. If it is not detected early, the prospects of recovery drop. Screening is complicated, though. Together with several project partners, Fraunhofer researchers have

developed an assistance system that helps dermatologists with diagnosis.

According to the German Cancer Society, around 200,000 people contract skin cancer every year. Melanoma is particularly dangerous. Once it has penetrated deeper layers of skin, the prospects of recovery drop to less than ten percent. Routine screening is the only way to detect critical skin changes at an early stage. A doctor uses a dermatoscope – a magnifier that peers into deeper layers of skin – to examine abnormal moles, called melanocytic nevus by experts, for features such as size, texture and edges and to observe whether they change over time. Since most people have many moles, the procedure is time consuming. What is more, keeping an eye on changes such as the growth of individual moles is difficult since a doctor often cannot identify them with absolute certainty during the next exam.

Full body scanner helps diagnose skin conditions

At the initiative of and together with the University Clinic for Dermatology and Venerology in Magdeburg as well as the partners Dornheim Medical Images GmbH and Hasomed GmbH, researchers at the Fraunhofer Institute for Factory Operation and Automation IFF have developed a full body dermatological scanner intended to help doctors diagnose skin conditions in the future. "The scanner delivers standard data for the evaluation of skin. At the same time, it improves documentation of the development every single conspicuous mole," says Dr. Christian Teutsch from the Fraunhofer IFF. When the exam starts, the surface of the patient's skin is scanned from different positions and broken down into approximately one hundred individual scans. Such image documentation already exists. "The crucial point, however, is that the actual size and changes in growth cannot be clearly discerned solely on the bases of scans," explains Teutsch. That is why the Dermascanner generates additional scanned 3D data, which are fused with the 2D scans, thus assigning a scale to every single pixel in the image. The experts are

integrating several 3D sensors in the scanner so that this functions. The sensors and cameras are calibrated so that their location in space is known precisely. The beams of light from the camera striking the mole can be assigned a precise 3D distance. Even when different scans have not been taken from the exact same distance – which is hardly likely – the doctor can apply the scale to determine the actual proportions precisely. The scanned data and scans are fed into analysis software and analyzed and presorted by automatic classification. The software compares any existing earlier scans of development with current images. "Our technology detects growth upwards of half a millimeter," says Teutsch. Another advantage is that the scanned 3D data enables a doctor to clearly locate every single mole again.

"A single patient frequently has several hundred moles," says Prof. Harald Gollnick, Director of the University Clinic for Dermatology and Venerology. When such a high risk patient visits the doctor again after a while, common methods of examination cannot discern whether the location and size moles on skin covered with pigmentation spots are still identical. According to Gollnick, "The new full body, early skin cancer detection system makes a nearly standard evaluation of skin condition and changes possible for the first time."

"The diagnosis itself is and remains the doctor's purview," stresses Teutsch. Doctors have both the scan results and the scans with an additional 3D depth map, which records the distance of the individual pixels in the scan, at their disposal to make a diagnosis. Since minimal changes of an abnormal mole can already be significant, the scanned and image data have to be comparable at any time and also among different equipment. That is why another important aspect of development was the standardization of the Dermascanner – another of the Fraunhofer IFF's specializations. "We calibrate every relevant element such as light sources and convert the scans into a standard color space," explains Teutsch. This assures that effects such as fading luminosity over time do

not affect the results.

The Dermascanner is just about ready to be marketed. The first pilot systems have been built. What is more, the project team was recently awarded the 2014 Hugo Junkers Award for Research and Innovation in Saxony-Anhalt for its development by the Ministry of Higher Education, Research and Economic Affairs (www.hugo-junkers-preis.de). Now, investors have to be found in order to mass produce the skin scanner.

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