

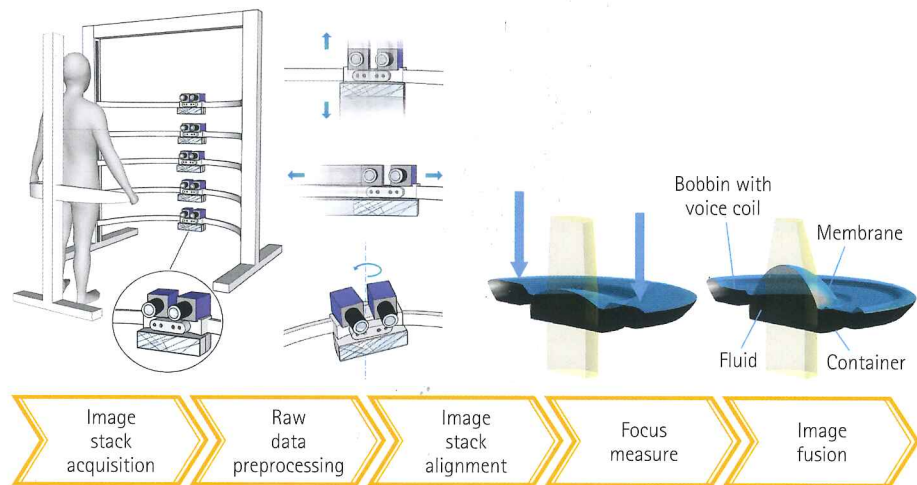
AI-Powered Optical Body Scanner for Skin Disease Detection

Lennart Jütte, Gaurav Sharma and Bernhard Roth

Skin cancer is the most common human cancer, and its incidence has increased in the last decade. With more than 144,000 new cases per year, cutaneous melanoma is Europe's sixth most common type of cancer. Fortunately, skin cancer may be cured if treated at an early stage. However, if cancer cells spread, the survival probability after five years drops to below 30 %. Thus, rapid diagnosis is vital to increase the survival rate.

EU-wide collaboration for early melanoma detection

The EU project iToBoS – Intelligent Total Body Scanner for Early Detection of Melanoma with PhoenixD (HOT – Hannover Centre for Optical Technologies) at Leibniz University Hannover as a partner, aims to reduce the mortality rate of skin cancer by improving early melanoma detection. "Our diagnostic system works contactless and captures the entire skin surface simultaneously", says Prof. Bernhard Roth (HOT). It combines optical imaging with artificial intelligence (AI) and incorporates



Top: Sketch of the iToBoS system (left) and the lens with tunable focus for high resolution imaging (right). Bottom: Image processing pipeline.

information from all relevant sources, i.e. dermatoscopic images and patient records. It also includes specific characteristics such as age, gender and previous illnesses, as well as the location and size of the skin malformation.

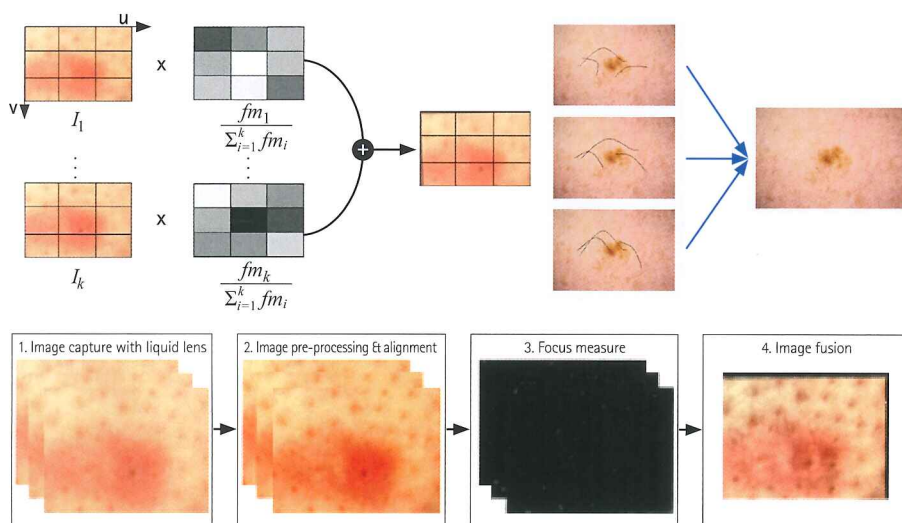
In addition, the system takes care of the handling and protection of sensitive patient data. This is of paramount importance for approval and acceptance in the market. The AI in the scanner will – for the first time – not only diagnose skin cancer but also transparently

explain what information was used to assess the diagnosis. This means that a comprehensive and meaningful conclusion can be drawn.

Coordinated by Prof. Rafael Garcia of the University of Girona, a total of 19 partners from Europe, Asia and Australia are cooperating to realize and validate this novel diagnostic system. "As part of PhoenixD, we are focusing on the development of the illumination and imaging system, which uses tunable optics," says Prof. Bernhard Roth. Two scientists from Roth's group, Lennart Jütte and Gaurav Sharma, contribute to the system as part of their PhD theses. "The greatest challenge is to reconcile optical imaging, mechanical design and artificial intelligence," says Lennart Jütte.

Our system can save several hundred million euros per year

The medical partner of Roth's group, Prof. Steffen Emmert from the University Dermatology Clinic Rostock, has high hopes for the new approach. He says: "If doctors could detect only 10 % of melanoma at an earlier stage, this could save costs of up to several hundred million euros per year. In future, such diagnostic systems could also be applied to other skin diseases and lead to completely new therapeutic approaches".



Top: Weight-based image fusion process (left). Digital hair removal is realized with several images of the same skin region ("true value inpainting") (right). Bottom: Crop from focus stacked images (left) to increase the image resolution (right).