Dear partners and friends of IGD,

This issue’s lead topic “Individual Health” refers to how we harness visual computing for personalized medicine. In recent months, our researchers have made a number of significant achievements. They will be presenting the results of their efforts at MEDICA 2017 in Düsseldorf, Germany. This issue is dedicated to their excellent work.

This report explores the following:

- Placing health in safe, digital hands
- Pinpointing lymph nodes with AR glasses
- Gaining actionable insights from patient data

I hope you enjoy reading this issue.

Prof. Dieter W. Fellner

Hospital visits generate a wealth of patient data. However, only a fraction is readily available for clinical decision-making and to potentially improve patient health. Against this background, Fraunhofer IGD researchers will be presenting special software at MEDICA 2017 (hall 10, stand G05) in Düsseldorf, Germany. The digital solution, named Health@Hand, captures and visualizes data from multiple sources – ensuring doctors and nurses in diverse healthcare environments have all the information they need at a glance.

Healthcare professionals are under immense pressure to perform within tight timeframes – and that can make it difficult to provide tailored advice to individual patients. In particular, capturing, analyzing and sharing patient data within the medical team saps significant time. Simultaneously, the rise of new types of examinations and cutting-edge digital technologies, e.g. smartwatches, for monitoring...
vital signs, is generating ever larger volumes of data. For doctors and nurses, that means even more rushing from room to room to record this information.

In the future, however, this will no longer be necessary. Hospital staff, as well as caregivers in nursing homes and similar facilities, will simply require a single, central endpoint, such as multi-touch table or tablet, to view all patient data at a glance. The key to this solution is the visual control center Health@Hand, developed by researchers at Fraunhofer Institute for Computer Graphics Research IGD in Rostock, Germany. Dr. Mario Aehnelt, Head of the Visual Assistance Technologies Competence Center at Fraunhofer IGD, explains: “Health@Hand first integrates the various systems and consolidates all data, then analyzes this information and visualizes it in a way that is easy to understand. The system is designed for personalized medicine, where an individual’s data play a pivotal part.” Each patient has individual and specific pre-existing conditions and reacts differently to medications. Health@Hand makes it easy to monitor patients’ health at all times. Appointments for treatment, medication dosages and even more general parameters, such as cleaning schedules and hospital bed utilization, can be quickly and simply planned and tracked.

Health@Hand is a central information hub, consolidating all data from across the organization. At the same time, it fulfills all strict security standards for sensitive information. Moreover, Health@Hand not only brings all the essential bits and bytes together, it also automatically analyzes and makes them useful. “Previous systems were primarily designed for documentation, without interpreting data. With Health@Hand, analysis is a key focus,” says Aehnelt. To this end, the system combines data to deliver entirely new insights. This makes it possible to identify trends and patterns in the patient’s health sooner, and to arrive at a prognosis faster. These time savings can be highly advantageous for the patient. Aehnelt underscores: “Health@Hand not only helps to maintain an overview and avoid errors – as patients, we will also directly benefit. It also reduces the burden on healthcare professionals, allowing them to be more responsive to our personal needs.”

A video about Health@Hand can be viewed at: https://www.youtube.com/watch?v=lWvz_KYdRec

PINPOINTING LYMPH NODES WITH AR GLASSES

Fraunhofer researchers have developed a navigation tool to assist surgeons with the challenging task of locating lymph nodes for biopsies after removing tumors. 3D-ARILE is an augmented-reality (AR) system that can precisely pinpoint a lymph node via a head-mounted display (HMD). Fraunhofer will present the solution for the first time at the MEDICA show in Düsseldorf, Germany.

Sentinel lymph nodes play a central role in the diagnosis and treatment of various types of cancer, including of the skin, breast and prostate. Once a tumor has been removed, doctors perform a biopsy of the sentinel lymph nodes to determine whether the cancer has already metastasized. Despite advancements in medicine, it remains difficult to zero in on the precise location of these lymph nodes and to determine whether they have been completely removed. Fraunhofer IGD’s 3D-ARILE helps surgeons navigate node biopsies. Within the scope of the project, its Darmstadt-based researchers worked in real-world healthcare settings – in cooperation with the Clinic of Dermatology at Essen University Hospital, and with Trivisio Prototyping, which provided the hardware.

What makes the AR head-mounted display special? In combination with powerful surgery navigation software, it leverages stereo near-infrared (NIR) cameras and the fluorescent dye indocyanine green (ICG). As Dr. Stefan Wesarg, Head of the Visual Healthcare Technologies Competence Center at Fraunhofer IGD, explains: “To make the targeted lymph nodes visible, the fluorescent dye is injected near the tumor. This spreads through lymphatic vessels, draining into the sentinel lymph nodes.” Infrared light excites the tracer dye, causing it to fluoresce. The NIR cameras capture this fluorescence and create a 3D image of the lymph node. Its precise location is depicted in real time on the surgeon’s AR head-mounted display (HMD).
“The fluorescence enables the physician to determine whether they removed all of the targeted tissue,” states Wesarg.

To date, surgeons have employed the radioactive nanocolloid technetium-99m as the tracer. The hope is that ICG will eliminate the need for this hazardous substance. Furthermore, ICG saves time. The surgeon no longer has to wait around 30 minutes for the tracer to work. Instead, their HMD immediately indicates the specific lymph node or nodes. This makes the operation simpler to perform, as the surgeon no longer has to glance back at a screen. Wesarg emphasizes: “The doctor is free to focus entirely on the patient, and operates with less stress.”

The TakeCare network promotes collaboration for the development of innovative products and services as well as medical assistance systems. In addition, it aims to unlock new markets and create jobs. People are at the very heart of TakeCare – and an essential part is played by the sensor-based capture and analysis of activity and vital signs, plus biometric information of diverse types and from many scenarios.

More information is available at:
http://takecare.igd-r.fraunhofer.de/projektziele/

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YOUTUBE PODCAST

Our Visual Computing Report is also available as a video podcast. We present our most exciting research projects once a quarter on Fraunhofer IGD’s Youtube channel. Stop by and have a look!
https://www.youtube.com/user/FhVCC
GAINING ACTIONABLE INSIGHTS FROM PATIENT DATA

The analysis of patient data forms the basis for personalized medicine. At this year’s MEDICA in Düsseldorf, Germany, Jörn Kohlhammer and his department will be presenting the latest research results and insights from the VA4Radiomics project. The method harnesses the experience of medical practitioners, image data and general patient data for improved decision-making.

If physicians are in a position to compare several similar cases, they are better equipped to decide on the best treatment for the individual patient. However, investigating patient cohorts to identify significant similarities and differences is extremely time-consuming. VA4Radiomics, a software solution developed by researchers at the Information Visualization and Visual Analytics Department at Fraunhofer IGD, enhances and streamlines this process.

Radiomics – a portmanteau that blends radiology and genomics – refers to the analysis of quantitative image features in large medical databases. It enables statistics-based conclusions to be drawn on tissue characteristics, disease progression and diagnoses using radiological image data.

VA4Radiomics derives information from radiological image data and then relates this knowledge back to the corresponding patient data. This allows the generation of patient cohorts and the visualization of individual patient attributes. These, in turn, serve medical professionals as a basis for comparison with regard to diagnosis, treatment and outcomes. A further advantage is that physicians can, theoretically, include patients they have never seen in person – for example, where the condition in question is extremely rare. Patients can be selected not just by age or gender, but by any attribute extracted from the image data.

The aim of visual analytics methods of this kind is to help medical professionals present clinical, radiological and pathological data in a way that generates actionable insights. As Prof. Jörn Kohlhammer, Head of the Information Visualization and Visual Analytics Department at Fraunhofer IGD, explains, “Going forward, the goal is to predict which treatment method will achieve the best outcomes for the individual patient. We are currently trialing our technology with clinical partners in Germany, with the intention of helping medical practitioners to learn more from clinical data.”

More detailed information: https://fh-igd.de/VC-Report_Video_Podcast_4-16-E