Bridging from Medical Informatics, Biometry and Epidemiology to Medical Engineering

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The 53rd Annual Conference of the German Society of Medical Informatics, Biometry, and Epidemiology (GMDS), September 15–19, 2008 in Stuttgart, had the thematic focus “Bridging from Medical Informatics, Biometry and Epidemiology to Medical Engineering.” GMDS members pioneered in the development of algorithms and analytical procedures, which are now routinely used for the monitoring of physiological parameters and body functions. Accordingly, innovative medical devices and novel technical solutions have shown great progress in the last decades but major challenges for the development of highly complex technical systems and their application in medicine and health care are emerging. Biomedical engineering is still a fascinating area, which offers attractive perspectives for medical informaticians, biometricians, and epidemiologists for future research and development projects. Due to the immense growth of knowledge and expertise in this field it is promising to create closer links between biomedical engineers on the one hand and informatics, biometry and epidemiology experts on the other hand. The fusion of knowledge, skills, and expertise helps create patient- and outcome-oriented technical solutions, supports pragmatic approaches in health service management and integrated patient care, and fosters relevant innovations solving problems in the patients’ daily life. The aim of the GMDS 2008 conference was to encourage contacts and cooperation between GMDS researchers with research groups in the field of biomedical engineering.

Main topics of the Stuttgart meeting ranged from bioinformatics, image-processing, computer-aided diagnostics and therapy, e-learning, health care research, terminologies, to methodological problems of screening programs.

The promotion of young scientists is one of GMDS’s greatest concerns. In dedicated sessions students are given the opportunity to present their first results to a scientific audience.

The selected medical informatics (MI) papers provide a showcase for current research and new scientific applications in this field.

Beginning with medical image processing, one of the MI topics of highest health care impact, we selected the contribution of Forkert, Säring, Fiehler, Illies, Möller, and Hands [1]. They describe a robust and fully automatic 3D Time-of-Flight method for brain tissue segmentation of MRA images by a specifically adapted graph-based extraction of the brain contours. This work is a cooperation of three institutions at Hamburg University and offers a significantly improved view on the individual vascular brain anatomy, especially in case of severe intracranial arteriovenous malformations.

The next paper presents a stimulating and highly useful combination of MI and biometry issues: Kuchinke, Aerts, Semler, and Ohmann [2] report on their work “CDISC Standard-based Electronic Archiving of Clinical Trials”. Running complex clinical studies requires a sophisticated planning and monitoring in order to assure that all trial documents are archived in an integrated, legally secure and feasible manner. The CDISC standard ODM now offers the oppor-


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tunity to adequately structured storage of the entire clinical data and the full audit information. For further developments this standard is open for eCRF submissions and the use of electronic source data. The authors critically assess this standard and its application, e.g. for the storage of selected study data in a data warehouse.

Data warehouses are of high importance in software engineering, especially in the context of large and complex clinical systems. That is why "the integration of decentralized clinical data in a data warehouse" – the title of the paper written by Hanß, Schaaf, Wetzel, Hahn, Schrader, and Tolxdorff [3] – is of special interest. They applied a novel service oriented approach (SOA) in their realization and explained how to solve the difficulties for the integration of data from various clinical partners in a nephrology project.

As SOA has not often been used in clinical settings, this critical review of a complex medical SOA project will be of special value for developers in the future.

Another important challenge in software engineering refers to the methods of change management, because the changes, adaptations and improvements of health care structures and procedures must be constantly accompanied by the supporting IT systems. The "applicability of Lewin’s change management model in a hospital" is studied by Šuc, Prokosch, and Ganslandt [4] who developed a systematic and detailed application of this model. In a convincing way they proved its viability and elaborated useful suggestions for some hospital-specific characteristics. We assume even small medical IT systems can benefit from Levin’s model.

The medical informatics part of this special topic is closed by a paper which is an excellent example of a sophisticated theoretical approach for an old but further important MI problem: medical record linkage. Sariyar, Borg, and Pommerening [5] evaluated record linkage methods for iterative insertions. They took record linkage as a special form of object identification and improved the Fellegi-Sunter model, comparing it to other classification methods by artificial and real data. They found that stochastic record linkage by expectation-maximization algorithms yielded best results when calibrating data differ structurally from validation data. Alternatively they recommended bagging, boosting and support vector machines.

The biometrical paper by Wolkewitz, Beyersmann, Gastmeier, and Schumacher [6] investigates the impact of different sampling procedures to account for time-dependencies of exposure on biases of estimated hazard ratios in epidemiological studies. The authors compare different procedures applied to real data on nosocomial pneumonia and to simulated data. They propose a sampling approach that avoids potentially biased and underestimated hazard ratios compared to matching for time to exposure or complete ignorance of time-dependency of exposure.

The following two papers present remarkable results from epidemiological studies. Schmidt, Chang-Claude, Slanger, Obi, Flesch-Janys, and Steindorf [7] analyzed data from 2004 breast cancer cases and 6569 controls in order to investigate whether breast-feeding and other risk factors modify the effect of physical activity on breast cancer risk. If their results were confirmed by other studies it would be encouraging for women at higher risk for breast cancer due to familial history or other reasons that they might lower their risk by being physically active.

In their paper Githinji, Herbst and Kistemann [8] for the first time describe two new independent risk factors for malaria in South-West Kenya: the presence of eaves in roofs of houses and the participation in community ceremonies carried out at night. Knowledge about these factors can be included in future environmental management and housing construction to control malaria which still remains one of the most prevalent health problems in sub-Saharan Africa.

References