Method for Evaluation of Surgical Wound Healing: A Case Study

We arranged a case study in order to examine whether tetrapolar bioimpedance measurement could be applied for evaluating the healing of a surgical wound. We measured the donor site surgical wound of a patient who had undergone a breast reconstruction surgery. The measurements were conducted three times in a nine days period, starting from the first postoperative day. As a reference, the impedance of an unaffected site was also measured. The electrodes were placed at equal distances, four centimetres apart in a parallel formation. The results show that, at low frequencies, the impedance of the wound increases with time. At higher frequencies, the situation is opposite; the impedance of the wound is initially higher than the reference and decreases with time. Both ends seem to approach the reference impedance as the healing proceeds. Our results are in accordance with the normal course of surgical wound healing and more specifically appear to be related to the diminishing swelling around the wound site. We conclude that the obtained results are interesting in a level that calls for further investigation.

General information

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Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Physiological Measurement Systems and Methods Group, Turku Univ Hosp, University of Turku, Åbo Akademi, Tampere University Hospital
Authors: Kekonen, A., Bergelin, M., Eriksson, J., Kaartinen, I., Viik, J.
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Biomaterials for Electronics

Challenges of climate change, ecological scarcity and depletion of natural resources form a global push towards a bioeconomy, which means shifting from fossil to renewable raw materials. Wood biomass will likely get a significant role in the Finnish bioeconomy. Finnish economy has conventionally focused on bulk products, while the challenge in the future is to bring high added value to the fibre based components and products. Cellulose based nanomaterials are low-cost, strong, porous, lightweight, solution processable, biocompatible, biodegradable and piezoelectric biomaterials, which have obvious applications for example in biomedical and electronic applications.

Piezoelectric sensors are widely applicable for various healthcare and well-being applications. We have recently studied flexible piezoelectric sensors made from commercial PVDF films and printable PVDF-TrFE ink, as well as biodegradable films from wood-based cellulose nanofibrils (CNF) [1] and bacterial cellulose (BC).

The high porosity of CNF makes it also a promising material for supercapacitors, also known as electrochemical double-layer capacitors (EDLC). We have recently demonstrated the fabrication of supercapacitor electrodes from a mixture of CNF and dandelion using high temperature pyrolysis.

References:
The impact of acquisition dose on quantitative breast density estimation with digital mammography: results from ACRIN PA 4006

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Web of Science (2014): 6.867 7.259 >10.0 0.935 0.07686 2.548
Publication Forum (2014): 3
Scopus rating (2013): 3.21 2.953
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Scopus rating (2009): 3.121 2.76
Scopus rating (2008): 3.051 2.664
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Scopus rating (2006): 3.078 2.537
Scopus rating (2005): 2.712 2.642
Scopus rating (2004): 2.664 2.595
Scopus rating (2003): 2.522 2.709
Scopus rating (2002): 2.479 2.56
Scopus rating (2001): 2.507 2.665
Scopus rating (2000): 2.949 2.586
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Original language: English
Fully-automated quantitative estimation of volumetric breast density from digital breast tomosynthesis images

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Scopus rating (2014): 3.795 3.046
Web of Science (2014): 6.867 7.259 >10.0 0.935 0.07686 2.548
Publication Forum (2014): 3
Scopus rating (2013): 3.21 2.953
Publication Forum (2013): 3
Scopus rating (2012): 3.279 2.855
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Scopus rating (2003): 2.522 2.709
Scopus rating (2002): 2.479 2.56
Scopus rating (2001): 2.507 2.665
Scopus rating (2000): 2.949 2.586
Scopus rating (1999): 2.83 2.855
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Health figures: an open source JavaScript library for health data visualization
Background
The way we look at data has a great impact on how we can understand it, particularly when the data is related to health and wellness. Due to the increased use of self-tracking devices and the ongoing shift towards preventive medicine, better understanding of our health data is an important part of improving the general welfare of the citizens. Electronic Health Records, self-tracking devices and mobile applications provide a rich variety of data but it often becomes difficult to understand. We implemented the hFigures library inspired on the hGraph visualization with additional improvements. The
purpose of the library is to provide a visual representation of the evolution of health measurements in a complete and useful manner.

Results
We researched the usefulness and usability of the library by building an application for health data visualization in a health coaching program. We performed a user evaluation with Heuristic Evaluation, Controlled User Testing and Usability Questionnaires. In the Heuristics Evaluation the average response was 6.3 out of 7 points and the Cognitive Walkthrough done by usability experts indicated no design or mismatch errors. In the CSUQ usability test the system obtained an average score of 6.13 out of 7, and in the ASQ usability test the overall satisfaction score was 6.64 out of 7.

Conclusions
We developed hFigures, an open source library for visualizing a complete, accurate and normalized graphical representation of health data. The idea is based on the concept of the hGraph but it provides additional key features, including a comparison of multiple health measurements over time. We conducted a usability evaluation of the library as a key component of an application for health and wellness monitoring. The results indicate that the data visualization library was helpful in assisting users in understanding health data and its evolution over time.

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Publication Forum (2016): 1
Scopus rating (2015): 1.055 1.391
Web of Science (2015): 2.042 2.209 3.9 0.246 0.00687 0.759
Publication Forum (2015): 1
Scopus rating (2014): 0.89 1.199
Publication Forum (2014): 1
Scopus rating (2013): 0.693 1.236
Publication Forum (2013): 1
Scopus rating (2012): 0.783 1.229
Publication Forum (2012): 1
Scopus rating (2011): 1.053 1.634
Scopus rating (2010): 1.084 1.678
Scopus rating (2009): 0.87 1.508
Scopus rating (2008): 0.797 1.576
Scopus rating (2007): 0.653 1.415
Scopus rating (2006): 0.426 1.125
Scopus rating (2005): 0.3 0.812
Scopus rating (2004): 0.258 1.073
Scopus rating (2003): 0.351 1.957
Scopus rating (2002): 0.547 0.244
Original language: English
Electronic versions:
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Comparison of injury severity between moped and motorcycle crashes: A finnish two-year prospective hospital-based study

Background and Aims: The coverage of the official statistics is poor in motorcycle and moped accidents. The aim of this study was to analyze the severity of motorcycle and moped crashes, and to define the degree of under-reporting in official statistics. Material and Methods: All first attendances due to an acute motorcyclist or moped driver injury registered in the emergency department between June 2004 and May 2006 were analyzed. The severity of the injuries was classified using the Abbreviated Injury Scale score and the New Injury Severity Score. The hospital injury data were compared to the traffic accident statistics reported by the police and compiled and maintained by Statistics Finland. Results: A total of 49 motorcyclists and 61 moped drivers were involved in crashes, leading to a total of 94 and 109 injuries, respectively. There were slightly more vertebral and midfoot fractures among motorcyclists than among moped drivers (p = 0.038 and 0.016, respectively). No significant differences were found between the severity (maximum Abbreviated Injury Scale and median New Injury Severity Scores) of the motorcycle and moped crashes. There was no in-hospital mortality. The degree of agreement (overlap) between the hospital dataset and the official statistics was 32%. The rate of under-reporting was 68%. Conclusions: According to the maximum Abbreviated Injury Scale and New Injury Severity Scores, the injury severity was equal for motorcycle and moped crashes. The degree of agreement between the hospital dataset and the official statistics was 32%.

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Authors: Airaksinen, N., Nurmi-Lüthje, I., Lüthje, P.
Keywords: (Injury, Injury severity, Moped, Mortality, Motorcycle, Under-reporting)
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Scopus rating (2015): 0.579 0.885
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Publication Forum (2015): 1
Scopus rating (2014): 0.554 1.131
Web of Science (2014): 1.258 1.536 6.3 0.333 0.0018 0.516
Publication Forum (2014): 1
Scopus rating (2013): 0.561 0.857
Publication Forum (2013): 1
Scopus rating (2012): 0.575 0.807
Publication Forum (2012): 1
Scopus rating (2011): 0.502 0.878
Scopus rating (2010): 0.452 0.826
Scopus rating (2009): 0.464 0.567
Scopus rating (2008): 0.451 0.569
Scopus rating (2007): 0.457 0.493
Scopus rating (2006): 0.514 0.639
Scopus rating (2005): 0.465 0.711
Scopus rating (2004): 0.251 0.356
Implementation and User Testing of a System for Visualizing Continuous Health Data and Events

Efficient ways are needed to visualize the health status of a person and how the lifestyle, daily choices and health care actions are affecting it. Current systems lack a comprehensive interface for interaction and exploration of large and complex data and events affecting the data. Based on state-of-the-art data visualization techniques, we implemented and user tested a system that visualizes health data holistically over time. The system focuses on the dynamic changes by using a timeline of events affecting the overall health status. We conducted an extensive user testing process involving surveys, heuristics and observations in order to evaluate our system. The results show that our system has a high level of User Satisfaction while providing an adequate understanding, interaction and navigation of the data.

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Organisations: Department of Signal Processing, Research group: Personal Health Informatics-PHI
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Keywords: (health, Visualization, Health and wellness applications, Javascript, Health data, application)
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Feature-based analysis of mouse prostatic intraepithelial neoplasia in histological tissue sections
Prostatic intraepithelial neoplasia (PIN) represents premalignant tissue involving epithelial growth confined in the lumen of prostatic acini. In the attempts to understand oncogenesis in the human prostate, early neoplastic changes can be modeled in the mouse with genetic manipulation of certain tumor suppressor genes or oncogenes. As with many early pathological changes, the PIN lesions in the mouse prostate are macroscopically small, but microscopically spanning areas often larger than single high magnification focus fields in microscopy. This poses a challenge to utilize full potential of the data acquired in histological specimens. We use whole prostates fixed in molecular fixative PAXgene™, embedded in paraffin, sectioned through and stained with H&E. To visualize and analyze the microscopic information spanning whole mouse PIN (mPIN) lesions, we utilize automated whole slide scanning and stacked sections through the tissue. The region of interests is masked, and the masked areas are processed using a cascade of automated image analysis steps. The images are normalized in color space, after which exclusion of secretion areas and feature extraction is performed. Machine learning is utilized to build a model of early PIN lesions for determining the probability for histological changes based on the calculated features. We performed a feature-based analysis to mPIN lesions. First, a quantitative representation of over 100 features was built, including several features representing pathological changes in PIN, especially describing the spatial growth pattern of lesions in the prostate tissue. Furthermore, we built a classification model, which is able to align PIN lesions corresponding to grading by visual inspection to more advanced and mild lesions. The classifier allowed both determining the probability of early histological changes for uncategorized tissue samples and
interpretation of the model parameters. Here, we develop quantitative image analysis pipeline to describe morphological changes in histological images. Even subtle changes in mPIN lesion characteristics can be described with feature analysis and machine learning. Constructing and using multidimensional feature data to represent histological changes enables richer analysis and interpretation of early pathological lesions.

**Levosimendan alone and in combination with valsartan prevents stroke in Dahl salt-sensitive rats**

The effects of levosimendan on cerebrovascular lesions and mortality were investigated in models of primary and secondary stroke. We aimed to determine whether the effects of levosimendan are comparable to and/or cumulative with those of valsartan, and to investigate whether levosimendan-induced vasodilation has a role in its effects on stroke. In a primary stroke Dahl/Rapp rat model, mortality rates were 70% and 5% for vehicle and levosimendan, respectively. Both stroke incidence (85% vs. 10%, P<0.001) and stroke-associated behavioral deficits (7-point neuroscore: 4.59 vs. 5.96, P<0.001) were worse for vehicle compared to levosimendan. In a secondary stroke model in which levosimendan treatment was started after cerebrovascular incidences were already detected, mean survival times were 15 days with vehicle, 20 days with levosimendan (P=0.025, vs. vehicle), 22 days with valsartan (P=0.001, vs. vehicle), and 31 days with levosimendan plus valsartan (P<0.001, vs. vehicle). The respective survivals were 0%, 16%, 20% and 59%, and the respective incidences of severe lesions were 50%, 67%, 50% and 11%. In this rat model, levosimendan increased blood volume of the cerebral vessels, with significant effects in the microvessels of the cortex (∆R=3.5±0.15 vs. 2.7±0.17ml for vehicle; P=0.001) and hemisphere (∆R=3.2±0.23 vs. 2.6±0.14ml for vehicle; P=0.018). Overall, levosimendan significantly reduced stroke-induced mortality and morbidity, both alone and with valsartan, with apparent cumulative effects, an activity in which the vasodilatory effects of levosimendan have a role.