



Report on the

3rd CADdemo@CARS Workshop

Friday, 24 June 2011, 14:00-17:00
CARS, Berlin, D, Estrelsaal C3/4

- On the third day's afternoon of the 25th Computer Assisted Radiology and Surgery Congress and Exhibition (CARS 2011) held in Berlin, D, around 30 interested and motivated participants joined the third 3-hour computer-aided detection (CADE) and diagnosis (CADx) demonstration workshop ("CADdemo@CARS"), organized by the EFMI Working Group Medical Image Processing (WG MIP).
- The goal of this workshop was to provide again the opportunity for CAD researchers and potential users to get in contact, to exchange experiences and to create and gather new ideas. The workshop aimed at providing an open platform for intense individual communication between the developers, researchers, providers, and users of CAD systems.
- This year the workshop was arranged slightly differently, compared to the two years before, with four CAD systems presented in the first hour and live demonstration in the second hour. In the third workshop hour the topic "Computer-aided detection, diagnosis and drug response assessment – how far have we come?" was discussed in an expert panel.
- In the first hour, after a brief welcome note and introduction to the aims and the format of the workshop by the session chairs Alexander Horsch, PhD (D), Hiroyuki Yoshida, PhD (USA), and Thomas Wittenberg, PhD (D), each demo-team introduced its CAD system in a 10-minutes slide presentation plus 5-minutes discussion.
- In the second hour, the participants of the workshop used the opportunity to get hands-on live demonstrations of the four CAD systems leading to detailed and individual discussions between participants and the presenters of the CAD demonstrations:
 - computer-aided detection (CADE) of osteoporosis, ischemic strokes and maxillary sinusitis in panoramic radiographies (demo 1), pulmonary nodules in lung CTs (demo 2), and ulcers (in Crohn's) in intestinal CTs (demo 3);
 - computer-aided diagnostics (CADx) of low- and high-grade lesions on the portio vaginalis uteri (demo 4).

Unfortunately, there was no demonstration on drug response assessment.

- In the third hour, an expert panel with Piergiorgio Cerello (I), Hiroshi Fujita (J), Kensaku Mori (J), Robert Nishikawa (USA), and Thomas Wittenberg (D) discussed the topic of "Computer-aided detection, diagnosis and drug response assessment – how far have we come?" under moderation of Alexander Horsch. Main results of the panel discussion included:
 - The maturity of systems, evaluated on a scale from prototype with potential benefit to product with proven clinical outcome, was – not unexpected – considered very diverse across the range of applications represented by the panelists. The current situation of CAD in the US was considered difficult, especially after the Fenton study on mammography CADE, which is one of the most advanced CADE. Reimbursement was identified a critical issue for acceptance. There was broad consensus that new CAD fields profit from the pioneering developments such as mammography CADE or melanoma CADx.
 - Naturally, it is hard to forecast the further CAD development in the various application specialties. Nevertheless, an overall positive trend was felt among the panel. Whether referring



to the applications as “image analysis systems” rather than “computer-aided diagnosis systems” could foster broader acceptance by shifting focus to the physician, was considered an idea worth being considered.

- CADe for CTC is probably the next clinical test for CADe. Given that CADe for mammographic screening has shown only modest effectiveness, application for CTC is important. I believe that it may produce a large positive effect.
- Adding CADx to CADe for mammographic screening may improve the clinical effectiveness of CADe.
- Reference imaging repositories with high-quality ground truth were clearly identified as a major asset for pushing CAD research and development. As a core problem, the definition and, particularly, the acquisition of ground truth were identified. The precedence case of the Digital Database for Screening Mammography (DDSM) was discussed with regard to, e.g., its impact on comparability of system performance. There was consensus that the goals set with the provision of the DDSM have not been reached, mainly due to non-standardized use (especially non-reproducible sub-selection of cases). All panelists confirmed they would use publically available repositories if of high quality. To provide access to such a repository only to those who also contribute cases to it was mentioned.
- Originally, the goal of creating public databases was to allow comparisons between different algorithms. While there are now several public databases, the goal has not yet been realized. This is because there is no agreed upon standard on how to use the databases. Two researchers can use the same database but be able to compare their algorithms in a meaningful way for several reasons: (a) different criteria for scoring a TP and FP were used; (b) different methods were used to partition the database into development, training and testing subsets; (c) for databases that do not have “gold” standard truth (e.g. LIDC), different definitions of truth were used. These databases can be used by researchers who do not have access to medical images, but they will not allow the field to be advanced quickly because they do not allow for meaningful comparisons to be made between algorithms.
- Concluding remarks: The number of participants at the workshop could have been higher. Possibly some of the attendees of the CAD sessions on Thursday had already left the conference. Participants, though, gave very positive feedback. The organization on site went well; the schedule could accurately be followed. The format used this year, “1-hour presentation – 1-hour demonstrations – 1-hour expert panel”, worked well. There was the concern that many workshop attendees would leave during the demonstration slot and drop the panel. But the panel participation was only slightly lower than that of the beginning (around 25). Nevertheless, we consider the workshop participation this year below the critical mass. The decision whether to organize the 4th CADDemo@CARS next year in Pisa is pending.

Prof. Dr. Alexander Horsch
Technische Universität München
alexander.horsch@imse.med.tu-muenchen.de

Dr. Thomas Wittenberg
Fraunhofer IIS Erlangen
thomas.wittenberg@iis.fraunhofer.de

Prof. Dr. Hiroyuki Yoshida
Mass General Hospital / Harvard Medical School
yoshida.hiro@mgh.harvard.edu

Prof. Dr. Robert M. Nishikawa
University of Chicago
r-nishikawa@uchicago.edu