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newsletter | VPHPRISM

VPH**PRISM:** Virtual Physiological Human: Personalised Predictive Breast Cancer Therapy Through Integrated Tissue Micro-Structure Modelling

Dear Readers,

The second edition of the VPH-PRISM newsletter is focused on the advances being undertaken in Work Package 3 – *Multidisciplinary data model for discovery of personalised risk and outcome prediction factors*.

This work package is the technical backbone of the project, and will allow us to evaluate the integration of heterogeneous multidisciplinary data and data processing tools. Extending far beyond clinical data, this work aims at correlating population based imaging studies with extensive clinical data on breast cancer cohorts.

Since our last newsletter, we are happy to announce that data collection has begun at the project's four clinical partner sites. The project expects to obtain prospectively collected data from at least 200 patients by August. More information about data collection in the project is available in the **first newsletter.**

The VPH-PRISM project was also the focus on a presentation given at the recent European Congress of Radiology, held from March 6–10 in Vienna, AT. An abstract summary and recording of the presentation VPH-PRISM: opening doors in breast cancer care are available on the **congress website.**

Sincerely,

Horst Hahn
Scientific Coordinator

Markus Harz
Scientific Project Manager

Alena Morrison
Project Manager

Leveraging the power of the web for multi-centre clinical studies

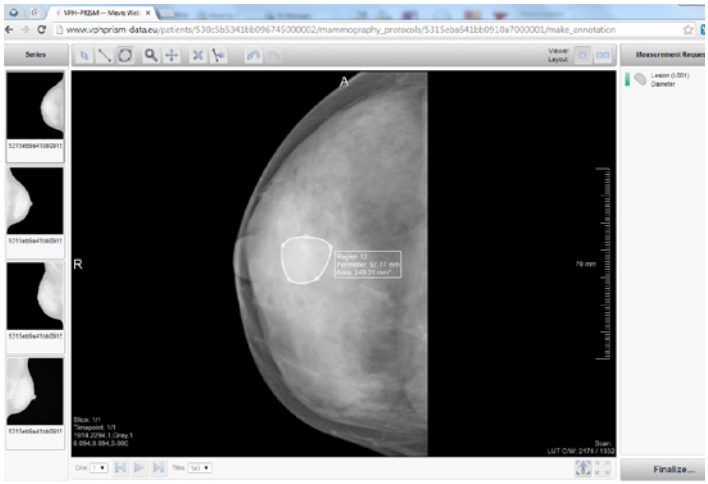
Infrastructure for multi-centre clinical data collection

Dr. Thomas Netsch, Dr. Thomas Bülow, Philips Research Hamburg, DE

ICT projects in the medical sector depend on reliably tagged and annotated data to develop and validate algorithms, models, and clinical software prototypes. Hence, they share the important task of collecting data and corresponding clinical annotations in a homogeneous format. Particularly in multi-centre projects like VPH-PRISM, the efficiency of the process is of great importance.

Three strategies for this process have been assessed by the VPH-PRISM consortium. The first and most obvious strategy is for each partner to use their own, site-specific tool stack to generate annotations. The biggest downside of this approach is that additional, site-specific data conversion steps are required to assure the quality and consistency of the data. Alternatively, it is possible to select and distribute the most appropriate tool stack to all partners. However, substantial effort is required for installation, documentation and training in the usage of the tools. This may become very costly and time consuming. Thirdly, instead of distributing the tools, the data can be submitted to one specific clinical site for annotation, but while this guarantees data consistency, other experts do not have the possibility to contribute their knowledge and the impact of inter-observer variations cannot be assessed. Also, the significant workload of annotation is imposed on a single partner.

Consequently, the project consortium agreed to implement a web-based data collection and annotation framework that is directly integrated into the content management system of the central image and patient database. This approach is based on the HTML5 standard, together with modern web frameworks. Computing power is only required on the server side, while the single task for the web client is to manage interaction with the user. Latency rates in the order of tens of milliseconds provide a user experience comparable to a local software system, therefore making it possible to draw annotations on top of images in a web browser in real time. As a further advantage, the web application running on the local web browser is not required to provide a full-featured diagnostic tool set. In the scenario of the project, the diagnostic workup has been performed prior to the annotation on a site-specific dedicated PACS or viewing workstation.



The annotation of radiology images is done based on a web viewer that operates directly on the remote images. It is easily extensible since it is based on a versatile image computing framework.

VPH-PRISM project facts

Duration: March 2013 – February 2016
Funding Program: EU FP7-ICT-2011-9 (STREP)
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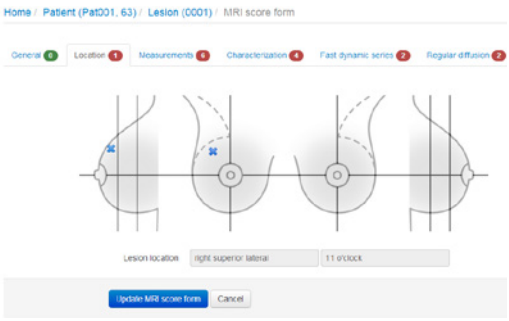
Simple, efficient, effective

Tools for annotation of radiology data

Markus Harz, Fraunhofer MEVIS, DE

Creating a useful research resource from the imaging and non-imaging data that is submitted to the VPH-PRISM database requires marking and annotating structures in the images, and connecting these marks to semantic objects – lesions, parenchymal tissue, etc. To guarantee robust, homogeneous and uniform annotations, both in terms of content and of representation, that are in addition easy to produce by the team radiologists, efficient to query in the database, and readily distributable among research partners, the project implements a web-based annotation tool that seamlessly integrates with online patient forms and radiology reports. In this annotation tool, pre-defined annotation requests are displayed for each type of imaging data, and corresponding annotation tools, like point marks, lines, or area annotation tools are offered to fulfil the requests. With such a system, the clinical partners can annotate data from anywhere they have an internet connection and a browser: in the hospital, while travelling, or at home. At the same time, there is no gap between annotation creation and data storage, making the process simple and integrated at the level of information organisation.



The lesion location in the MRI score form is an example of how rich information can be assessed in the digital questionnaires. The textual description, "right superior lateral, 11 o'clock", is automatically updated.

Project partner profiles

University College London, Centre for Medical Image Computing, UK

Leading Work Packages 4 and 6, the UCL Centre for Medical Image Computing (CMIC) has considerable experience manipulating and analysing medical images from a range of imaging modalities for the purposes of diagnosis, surgical guidance and detailed structural and functional analysis to improve healthcare. CMIC 's contribution to VPH-PRISM will focus on establishing the link between the microscopic cellular imaging of excised breast tissue from the pathology laboratory, and the routine radiology images, namely MRI, X-ray mammography and ultrasound, acquired in clinical practice. In addition they will develop physics-based modelling of the radiological imaging process to characterise and quantify the appearance of breast tissue in these images.
www.cmic.cs.ucl.ac.uk

Philips Technologie GmbH

Philips is among the world-leading companies in both breast imaging and digital pathology and represents the largest concentrated research and development capacity in these fields in Europe. Leading Work Packages 3 and 8, Philips provides dedicated technological expertise on computer assisted visualisation and analysis, organisation and handling of heterogeneous multi-vendor, multi-modality data, as well as system integration of heterogeneous software components.
www.research.philips.com

Integrating digital pathology in VPH-PRISM

Histopathology: Huge Images, Small Effort

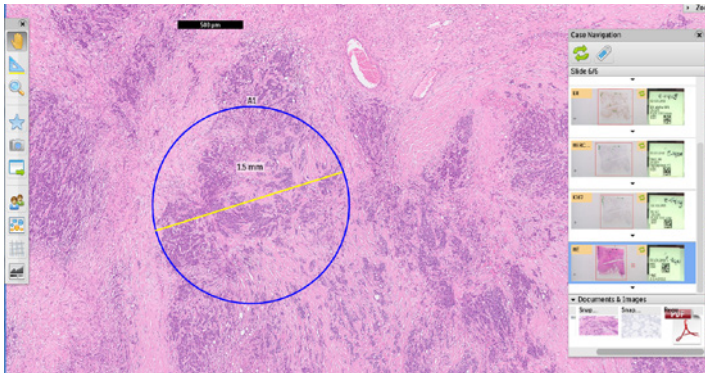
Dr. Tim Harder, Dr. Kirsten Meetz, Philips Research Hamburg, DE

Compared to the field of radiology where digital imaging has been around for a long time, it has only recently started to emerge in the field pathology. The excessive size of such images, which easily exceed 10,000 by 10,000 pixels per slide, could partially be responsible for this delay. One of the central aspects in the VPH-PRISM project is the quantitative integration of such massive digital pathological image data with all other imaging modalities through a common breast model. For every patient in the study, a broad sample of radiological and pathological images is collected and stored in the central data collection.

The Philips Digital Pathology Image Management System (IMS) is a comprehensive web-based application providing viewing and annotation tools. The IMS is able to handle image collections of up to hundreds of tera bytes, similar to what is found in pathology departments of larger hospitals. The VPH-PRISM consortium will utilise the IMS, which will interface with the VPH-PRISM content management system, to share and annotate data.

The VPH-PRISM project, with clinical experts and data allocation centres distributed across Europe, is a prime example for the advantages of web-based solutions. The set of image data for a single patient can easily exceed 30-40 GB, making a complete data transfer to all local experts and researchers infeasible. In clinical practice, however, only small parts of the specimen are actually viewed at full resolution making the on-the-fly delivery of those selected parts a very viable solution. The experts then annotate their findings in the same web-based tool. A simple, Google-maps-like interface minimizes the learning burden and sources of error even for novice users.

Broad and well annotated data collection is the foundation for tasks carried out in other work packages in VPH-PRISM and will have application in future research projects.



With the Philips Digital Pathology IMS, a full-fledged web-based solution for efficient viewing and annotation of digital pathology images will be tightly integrated into the web-based tool suite.

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