Discipulus
Welcome

DISCIPULUS

The Digital Patient: Roadmap

The Digital Patient

Towards Personalised Medicine.

Our focus is the VPH Initiative in which we set a research roadmap that applies the avatar modelling potential of the Virtual Physiological Human (VPH)[1,2]. This is combined with the patient's medical data which enables the VPH to be transformed into the avatar of a specific patient. Modelling studies of the avatar are guided by population-level data in the medical literature. The intended result is a powerful predictive tool for the patient in terms of prevention, management, and prognosis. Put simply, this is personalised medicine guided by computer modelling.

Identifying the evidence and setting the agenda.

A number of small preliminary clinical validations[3,4] of specific cases at organ level have demonstrated that such computer modelling can have predictive capability for the respective patient, but these studies are very small indeed and there is still a lot of development that needs to happen with VPH technology before it can become mainstream clinical medicine. Our task is to set the research agenda to enable this development to happen, which we do by engaging experts and the general public. The outcome of our project will be a roadmap for the VPH digital patient. More information can be found on our website www.digital-patient.net. A first draft of the roadmap has already been published and this can be accessed from the second page of our website.

[1]www.vph-noe.eu

[2]www.vph-institute.org

[3]Delingette et al. IEEE T. Bio-Med. Eng. 2012;**59**:20-4.

[4]Sermesant et al. Med. Image Anal. 2012;**16**:201-15.

The DISCIPULUS Project is an undertaking set up by the European Commission to lay down a roadmap for the realisation of the digital "avatar" patient. The project is a multi-institutional program involving five research centres in four countries: *University College London* (UK), *University of Sheffield* (UK), *Universitat Pompeu Fabra* (ESP), *Istituto Ortopedico Rizzoli* (IT) and *Empirica* (DE).

Generally, the clinical use of Digital Patient technology can be separated into three parts:

Decision making (the clinical specialist decides the best course of action)

Explanation (the clinical specialist explains her /his decision to others: peers, carers, patient her-/himself)

Execution (the clinical specialist plans, carries out and monitors the treatment).

For each part, technological research challenges are depicted on the right.

Dr. Vanessa Díaz, PI, UCL

"Although it seems science fiction, the Digital Patient is not only a real possibility, it will happen. It is not a matter of if, but when. And what a difference the DP will make in healthcare! It is almost impossible to understand all the repercussions in science, medical practice and healthcare. It will have a profound societal impact" (Vanessa Díaz, PI)

Please send your comments/ideas to:

discipulus@empirica.com

Decision Making

Interface for exploration of large results space
Visual analytics to explore very large, multidimensional collections of simulation results.

Multiscale visualisation
As above, but for results that are defined over radically different space-time scales.

Generalised stochastic/probabilistic frameworks
Quantitative predictions should be presented together with an associated confidence interval or intrinsic physiological variability.

Reasoning querying
The option to query the hypermodel to find out which knowledge sets have been used to develop each component module, with links to relevant literature, validation results etc.

Explanation

Representing complex processes at variable level of detail
Load on demand mechanism. Go from a simple, cartoon-like representation that everyone can understand to more and more complex and detailed visual representations by simply moving a slider on the interface.

Logical zoom
The possibility to be able to hide entire branches of the sub-model, leaving only those outputs that effect other branches visible.

Search the match
A highly individualised avatar could be used as a search template to identify similar cases within the hospital database. This requires a definition of similarity and this will depend on the question posed.

Avatar look-alike
Develop rapid, automatic and low-cost strategies to individualise the physical appearance of the Avatar to that of the patient. This provides emotional intensification, as used in Microsoft's Xbox Live Service or Nintendo's Mii, which can affect individual behaviour, including healthy behaviour.

Show the outcome (treatment)
Use the avatar to simulate the possible outcome of the various treatment options, and represent the outcome as a functional animation.

Show the outcome (lifestyle)
Use similar animation technologies to show the patient the predicted effect of certain (in-)appropriate lifestyle choices.

Execution

(Quasi-)real –time VPH hypermodel response
Surrogate modelling, efficient execution of multi-scale models. Efficient restart of pre-computer hypermodels to support q sessions, i.e. where computers are embedded in surgical simulation environments.

Self-refining Avatar by intra-operative measures
Detailed measurements collected during the treatment are used to refine the hypermodel and improve its predictive accuracy for the treatment outcome.

Self-refining Avatar by monitoring
Post-treatment monitoring data are used to refine the long-term outcome prediction and feedback to the knowledge repository when significant deviations are observed between predicted and actual outcomes.

Forum: Join The Debate!

Why not join the debate and help contribute to our roadmap? To find out how, visit:
www.digital-patient.net
https://www.biomedtown.org/biomed_town/discipulus/reception/wiki/

By engaging with us and writing your comments on the websites, you could help us provide rich material for the Second Consultation Meeting (see below), which you could also be a part of.

In fact, we encourage you to come!

The second DISCIPULUS Consultation Meeting, a *think-tank* style workshop, will take place at Universitat Pompeu Fabra (UPF) in Barcelona. This event between the 26th and 27th of November 2012 invites experts and representative organisations to help us identify the research challenges that will be crucial for setting up the roadmap.
Register here: http://secondconsultationmeeting.eventbrite.co.uk/

SEVENTH FRAMEWORK PROGRAMME