IMPACT

Optimising workflows at every level of healthcare

Focusing on personalised diagnosis & treatment planning, minimally-invasive & robotic-assisted surgery, workflow optimisation and data intelligence, the ITEA project IMPACT (Intelligence-based iMprovement of Personalised treatment And Clinical workflow support) makes healthcare more efficient, accurate and cost-effective.

Personalised treatment planning, workflow optimisation and robotic assistance can all play a vital role in managing growing demand and declining staff capacity in healthcare. A shift from evidence-based to intelligence-based healthcare is necessary not only to enhance patient quality of life and improve public health but also to reduce costs and improve the working experience for care providers.

Building on a series of ITEA projects going back to 2010, IMPACT takes the healthcare domain to the next level of data intelligence. This centres around clinical use-cases on cardiac treatment, liver oncology and brain oncology, which overlap in an additional workflow optimisation use-case. The result is a number of breakthroughs in areas as diverse as personalised diagnosis, minimally-invasive surgery and human-data interaction, helping to streamline every step of the healthcare process.

Technology applied
IMPACT began with the identification of two healthcare trends: personalisation and robotic assistance. These drive improvements in minimally-invasive procedures based of data gathering and imaging, ultimately leading to workflow optimisation and efficiency. To enable its clinical applications, the project focused on data intelligence, such as the inclusion of medical image data in data lakes and the automation of labour-intensive processing steps like image segmentation. This has opened up the

opportunity to use patient and imaging data for diagnosis and personalised treatment planning, which traditionally involve large amounts of manual work.

For the cardiac use-case, a key innovation in personalised treatment planning is FEops' HEARTguide simulation tool for virtual device deployment in the heart, whereas brain oncology has mainly focused on speeding up overall image acquisition, segmentation and treatment planning times. Robotic-assisted control is not yet at a clinical level but shows promising results for the future. In liver oncology, for instance, real-time motion compensation for breathing should increase needle placement accuracy in tumours; intuitive head motion control should also make it easier to move endoscopes through intestines. Finally, the integration of 3D models to inter-operatively determine segmentation should improve the effectiveness of Da Vinci robots for surgery.

These breakthroughs all lead to workflow optimisation, which has been realised at various levels: at the operating table, within a room and across departments or wards. Results include New Compliance's automatic performance improvement analysis, Philips' efficiency dashboards integrating multiple data sources and Barco's application-agnostic multi-modality display system which calibrates multiple image modalities according to the clinical case. As some results involve automatic video-based tracking, IMPACT has also developed video de-

identification to automatically recognise and blur faces.

Making the difference
For patients and physicians, IMPACT's results concern time, accuracy and workflow. HEARTguide, for example, has reduced procedure time by 30%, meaning the use of 25% less x-ray contrast agent and 14% less radiation exposure for patients. In brain oncology, SyntheticMR's MRI acquisition time has gone from 60 minutes to six or eight minutes depending on image resolution, while the planning time for brain metastases segmentation has fallen from 60 to 30 minutes. In terms of accuracy, the visibility of tumour tissue has been increased
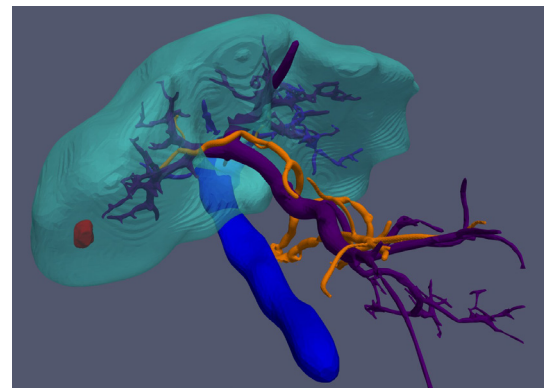
⌃ Liver 3D model for planning and treatment

during surgery, allowing the margin for tumour excision to be reduced by 20% so that less healthy tissue is removed. Tentative results for breathing motion compensation also suggest that only one extra iteration will be needed for correct needle placement compared to between two and seven currently. Finally, data intelligence has brought the time taken for data analysis down to less than five minutes in an operating environment – a vast improvement on the days or weeks previously taken to retrieve and manually combine data.

IMPACT is now seeing initial exploitation in a healthcare IT market worth roughly USD 280.25 billion worldwide. The 25 new products, services and systems include Quantib's micro-bleeding detection and SyntheticMR's improved MR quantification method, both of which have demonstrated compatibility with the major MRI imaging equipment vendors. FEops has signed a contract for preoperative planning of 2000 patients with a TAVI manufacturer and released the LAAO workflow to the market. In terms of access to new domains, Inovia has extended their data lake towards medical imaging data, thereby integrating information which was siloed or stored in different formats into one data source. Across the consortium, eight people were hired due to the project.

The IMPACT partners will continue to build on their innovations in the upcoming ITEA project ASSIST and EUREKA project IWISH and their results have already been disseminated via 25 publications, 13 conferences and involvement in various standardisation working groups and regulatory activities. Through this, they further enhance patient experience, improve population health, reduce costs and improve the work life of healthcare providers. These are widely accepted as the best methods to optimise health system performance and, in their ultimate goal of improving quality of life for both givers and receivers of healthcare, IMPACT can be considered an enormous success.

Major project outcomes

Dissemination
> 25 publications, 3 press releases and 13 presentations at conferences/fairs

Exploitation (so far)
New products:
> Cathlab cockpit, dashboard to optimise Cathlab productivity
> HEARTguide, CE-marked procedure planning tool for structural heart interventions
> Launch of Gamma Knife Inverse Planner, application for radiation therapy planning
> New quantitative MR acquisition protocol, clinical evaluation has started
> AI-based liver tumor segmentation software
> Microbleeds, CE certified AI application to detect vascular microbleeds on brain MRI scans
> Color processing modules for multi-modal image processing pipeline
> Clinical Business Information System, data warehouse and analytics tool for the Cathlab department

New services:
> 3D modelling and simulation tool selected for Dassault 3DEXPERIENCE lab
> Medical data lake solution available for external consortia

New systems:
> Needle Placement System including respiratory motion compensation, for use in interventional radiology

Standardisation
> Member of International Working Group for Intravascular OCT Standardisation and Validation
> Participation in relevant IEC and ISO committees, e.g. IEC 62 Software Network and Artificial Intelligence Advisory Group
> Participation in DICOM working group and AAPM Task Group 196 on colour calibration
> Contribution to Werkgroep Veldnorm Medische kwaliteit AI of the Dutch Ministry of Health, Welfare and Sport
> Contribution to the expert group AI & Medical devices, an official norm committee of the NEN (Dutch Norm Institute)

Patents & Spin-offs
> 3 patent application filed and 4 patent applications in preparation
> Quantib-U. Joint venture of Quantib and UMCU targeting AI for precision diagnosis

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Partners

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> Barco N.V.
> FEops

The Netherlands
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> Leiden University Medical Center
> NewCompliance IT B.V.
> Philips Electronics Nederland B.V.
> Philips Medical Systems Nederland B.V.
> Quantib B.V.
> University of Twente
> Utrecht University Medical Center

Sweden
> Elekta Instrument AB
> Inovia AB
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> SyntheticMR AB

Project start
October 2018

Project end
September 2021

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