Augmented Reality Assisted Surgery

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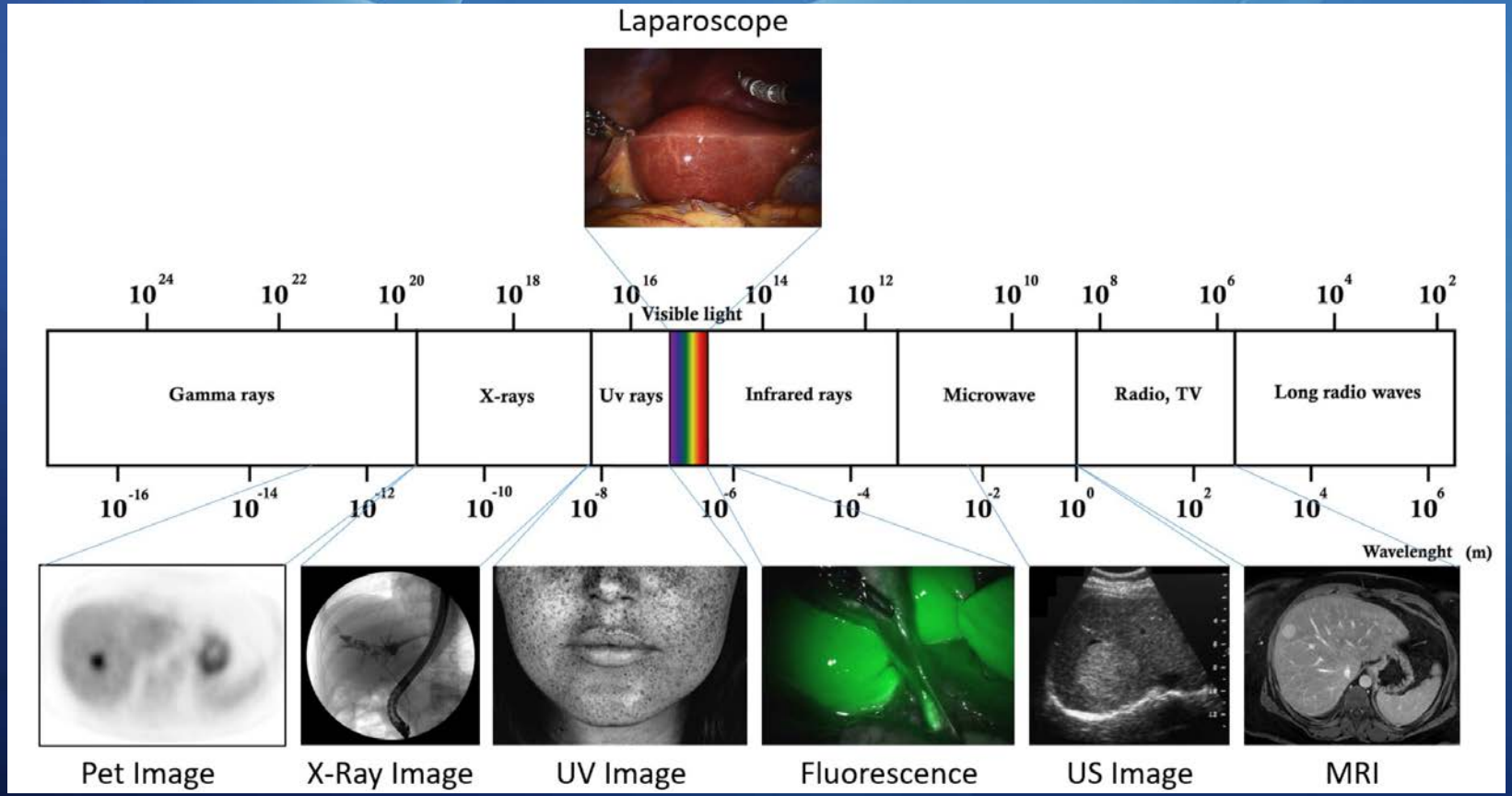
IRCAD – IHU Strasbourg

Aeronautics solution for surgery

Airplane

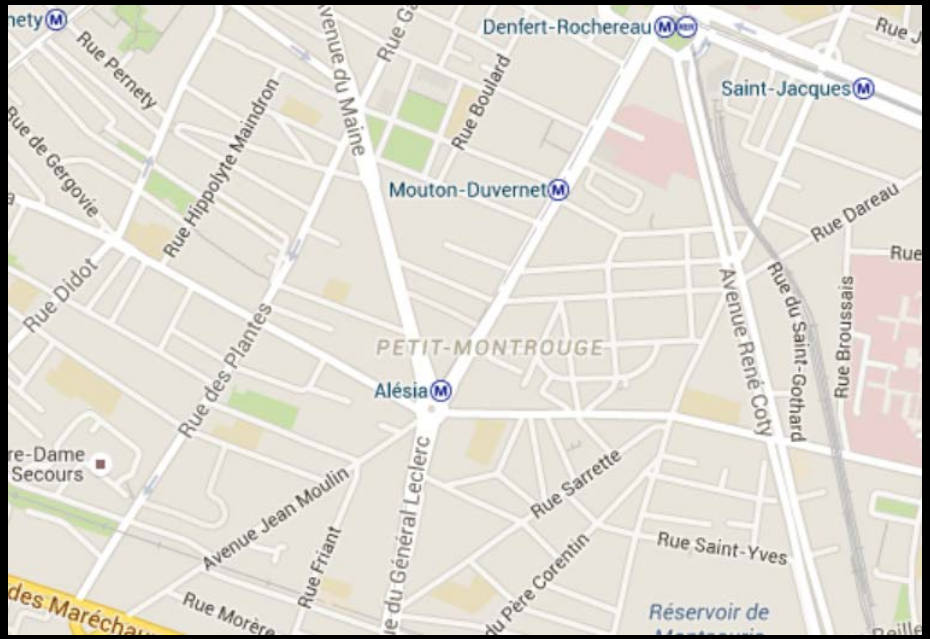
R&D: Overcoming Human limits



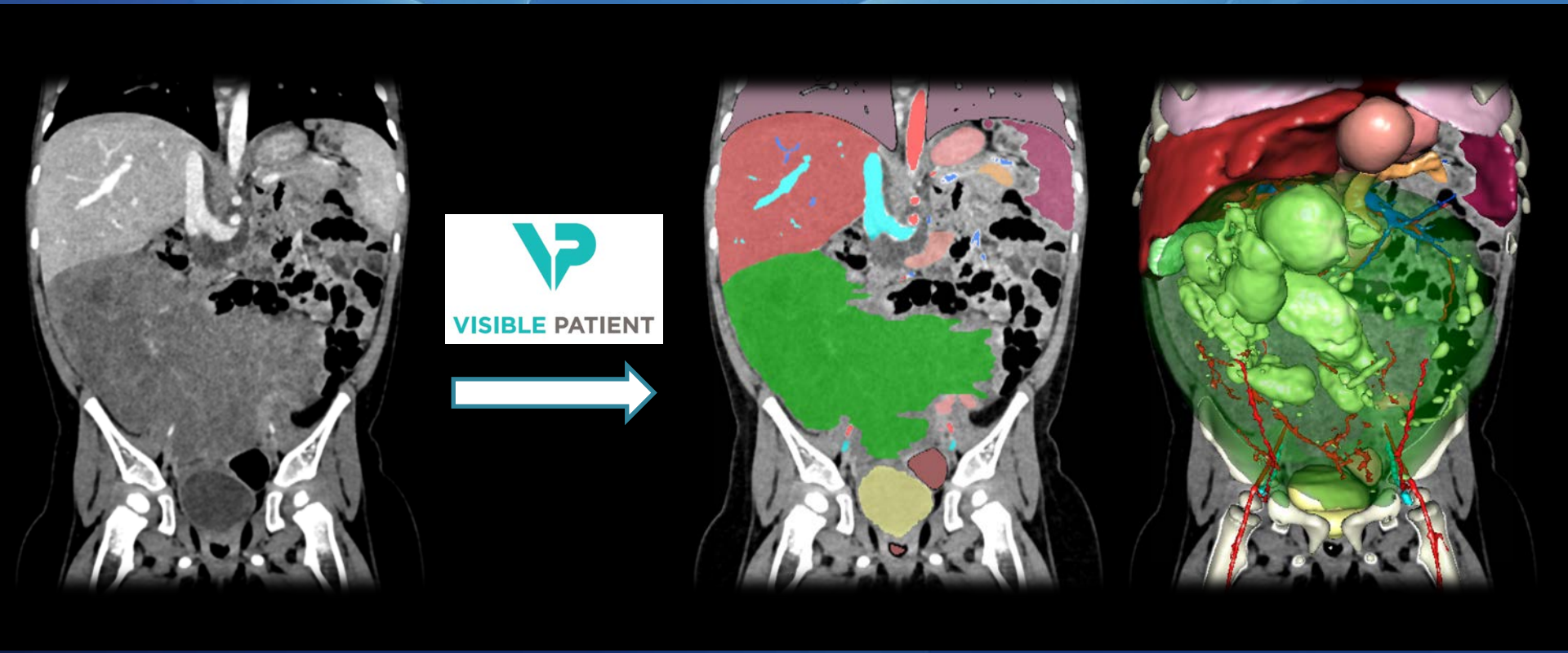
Aeronautics solution for surgery

From Satellite view to planning

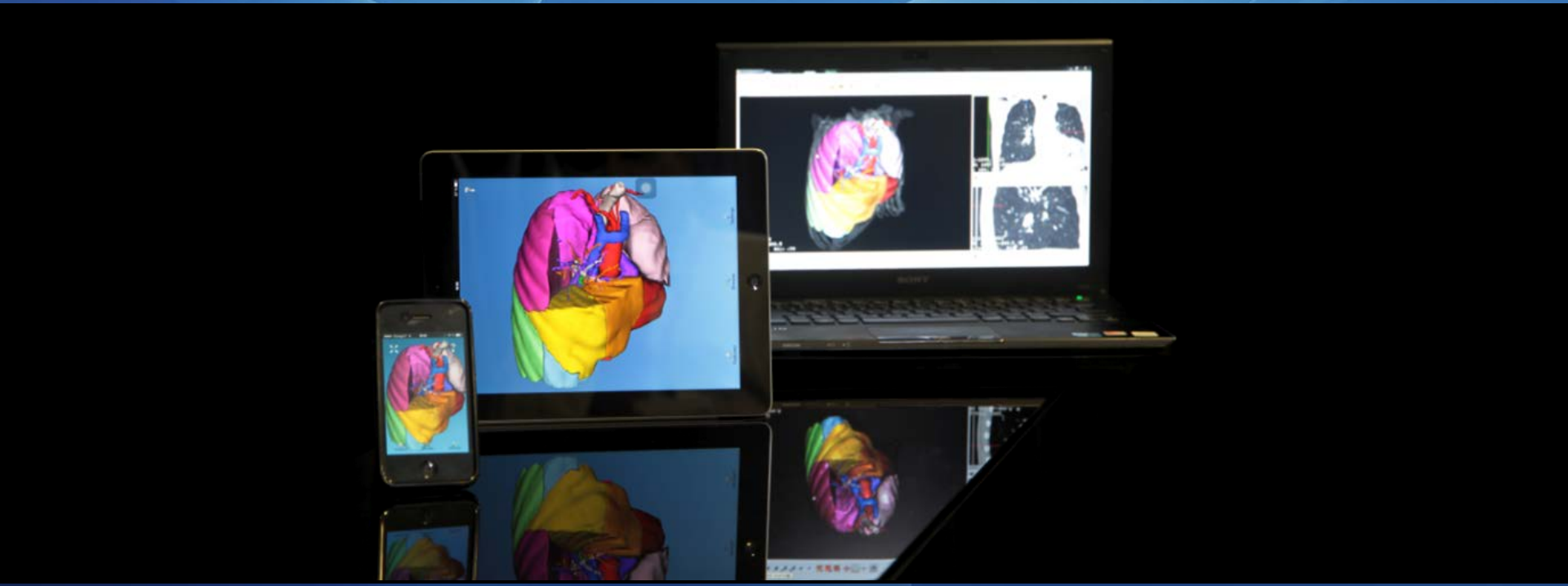
Solution : Have a Map !



3D Cartography of Patient



3D Patient modelling and Surgical planning

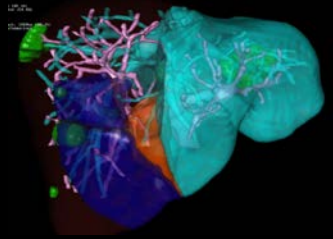


www.visiblepatient.com

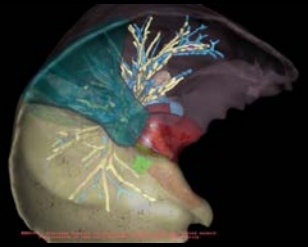
Windows 64 bits / MacOS X Maverick (9) / iOS / Android

3D Patient modelling and Surgical planning

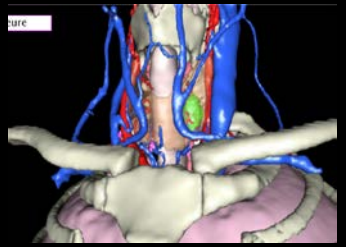
Foie



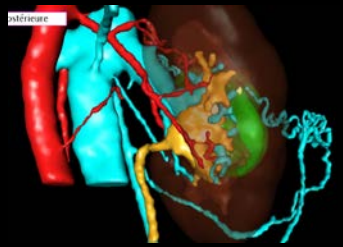
Poumons



Para-Thyroïde

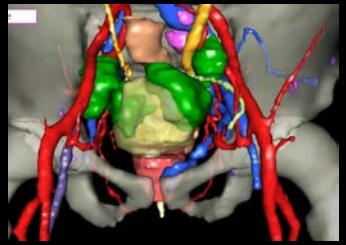


Rein

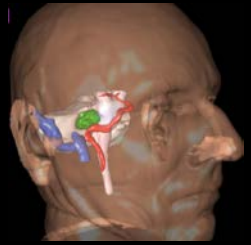


Pancréas

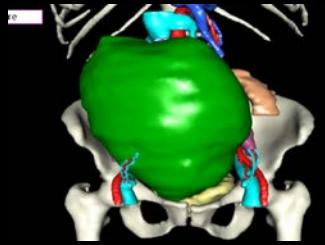
Prostate



Cerveau



Gynécologique



Endocrine

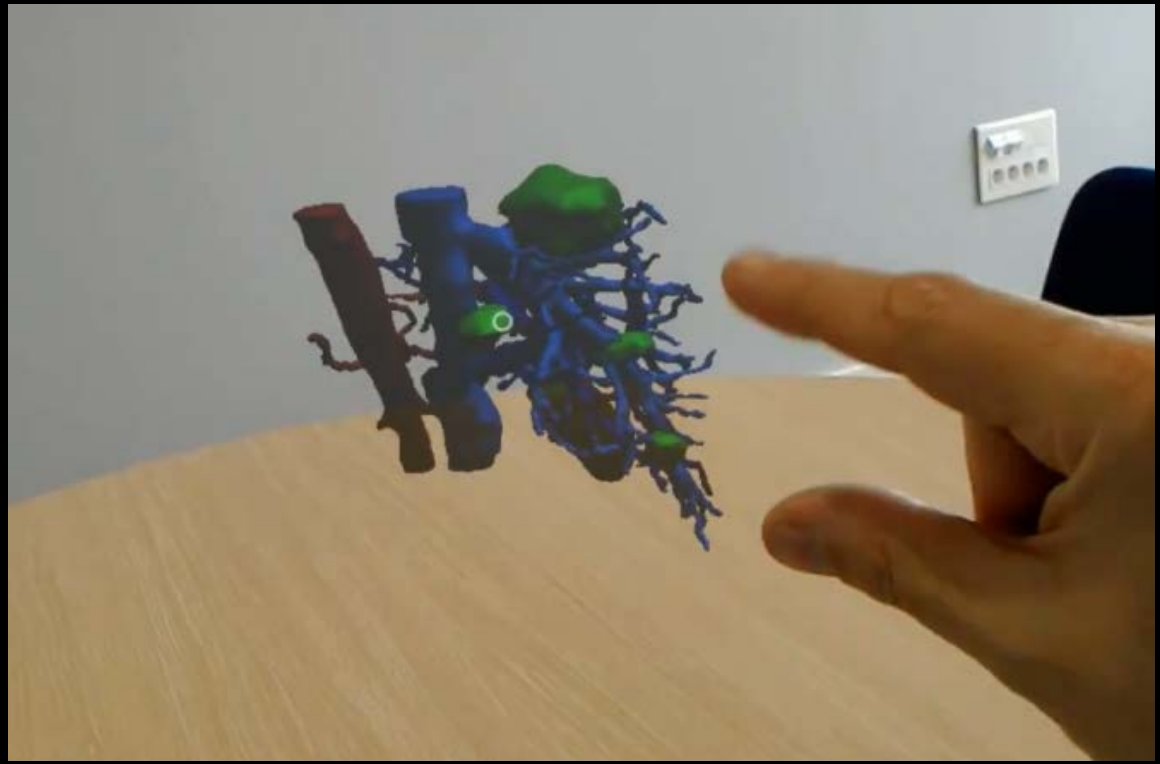
Colorectal

www.visiblepatient.com

Exemple of last 6 months 3D modelling

R&D: Hololens Surgical planning

Microsoft HoloLens



Aeronautics solution for surgery

From Planning to AR Guidance

Intraoperative Use

VISIBLE PATIENT

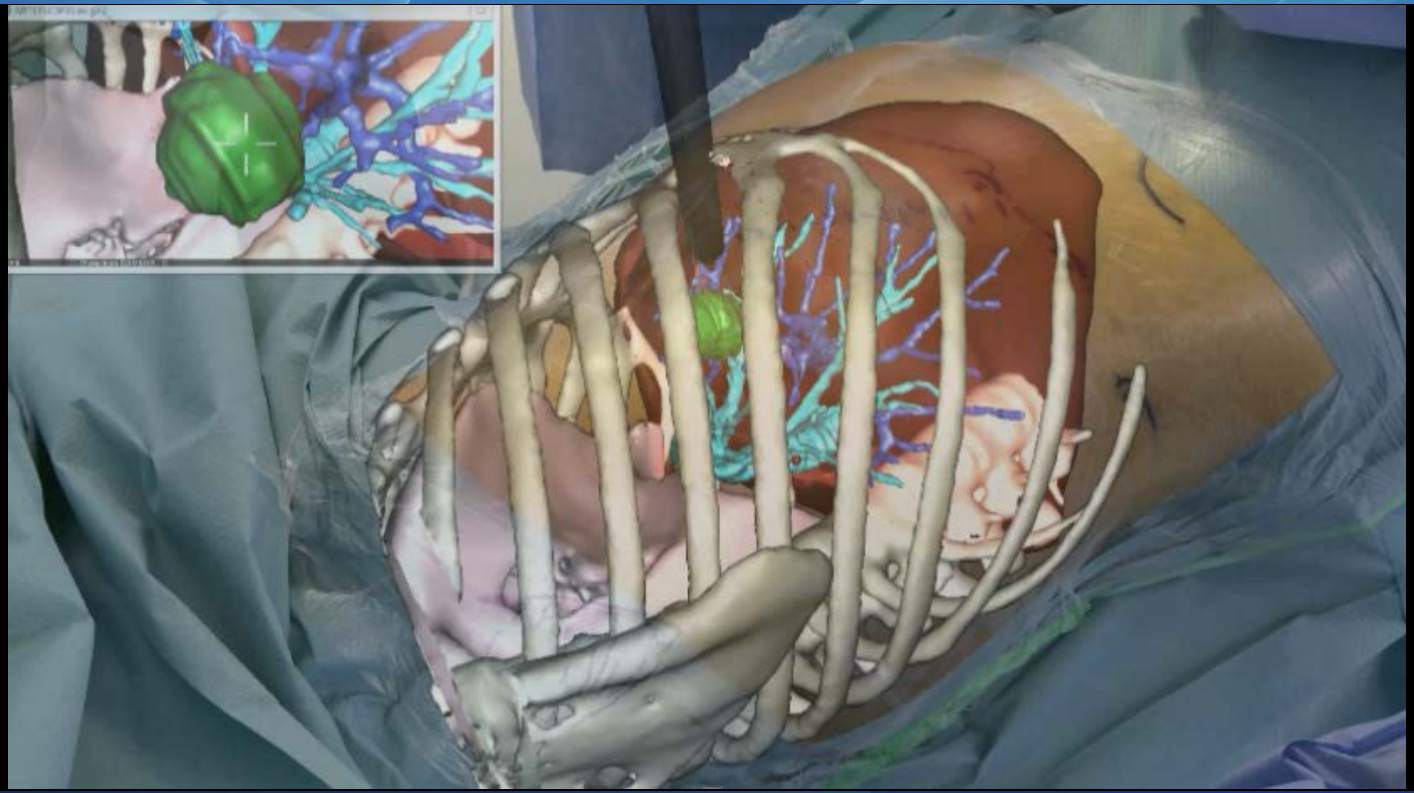
Augmented Reality Guidance

FUSION

Virtual 3D Image + Video Image

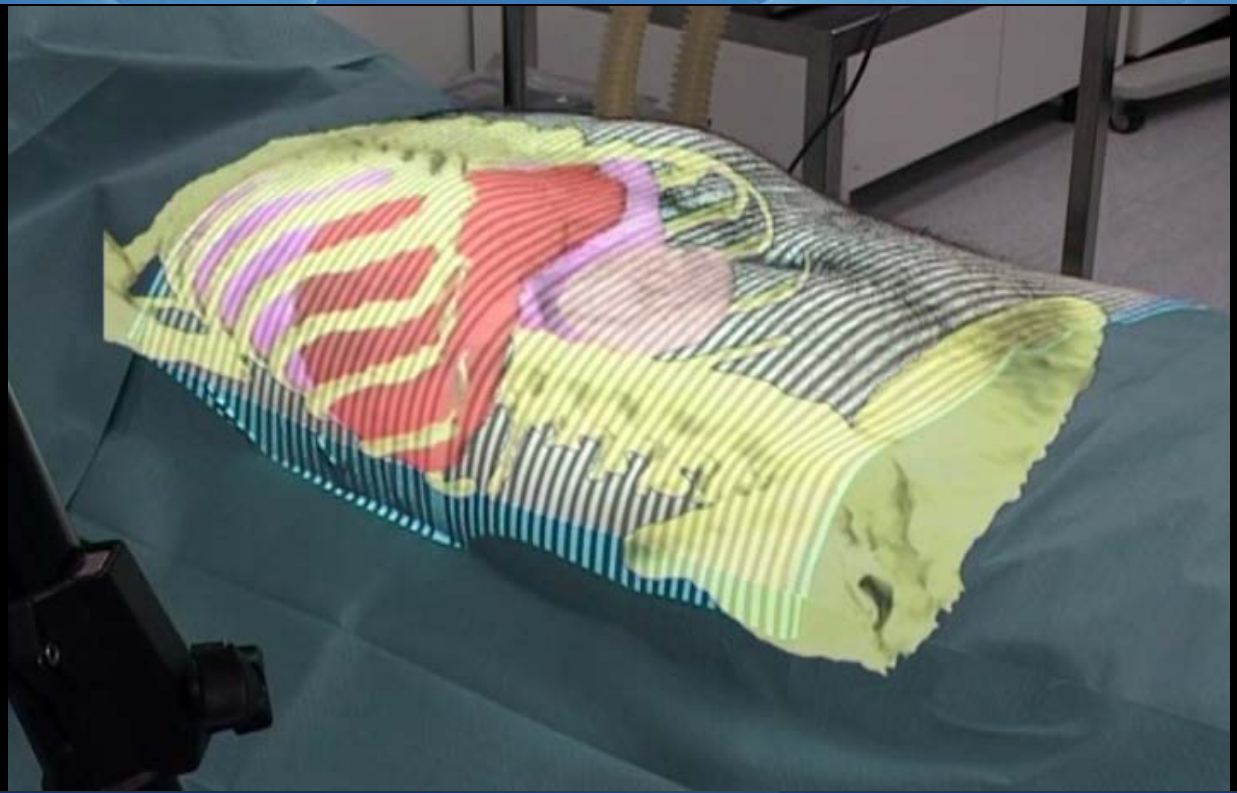
= Augmented Reality

IRCAD Interactive Augmented Reality



Trans-thoracic minimally invasive liver resection guided by augmented reality, Hallet J, Soler L, Diana M, Mutter D, Baumert T, Habersetzer F, Marescaux J and Pessaux P, **J. Am. Coll. Surg**, 2015

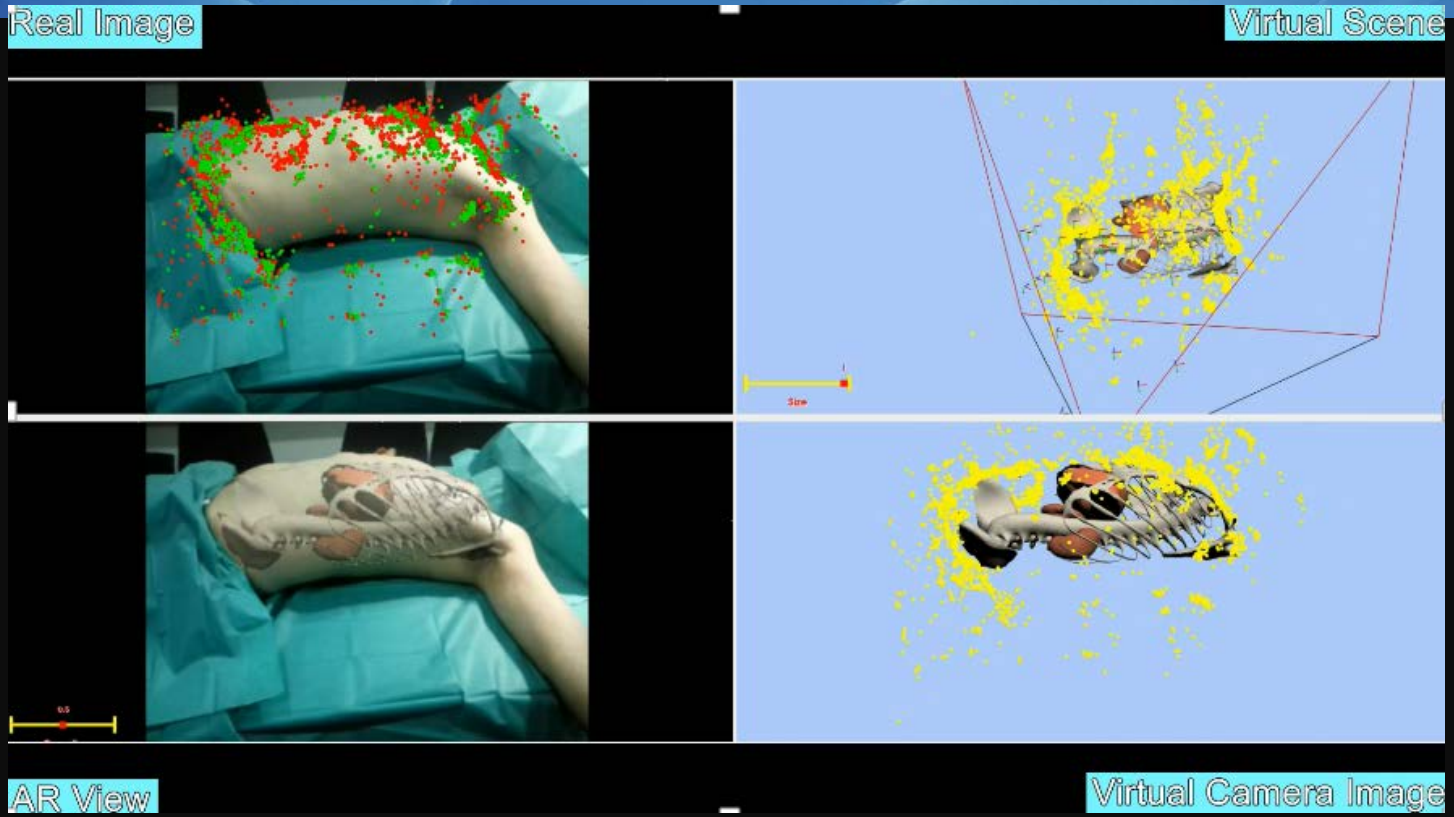
Automated Augmented Reality 2010



Real-time tracking of skin deformation ➔ Simulation of organs deformation

A. Hostettler et al., Prog Biophys Mol Biol. 2010 Dec;103(2-3):169-84.

Automated Augmented Reality (Tablet PC) 2016

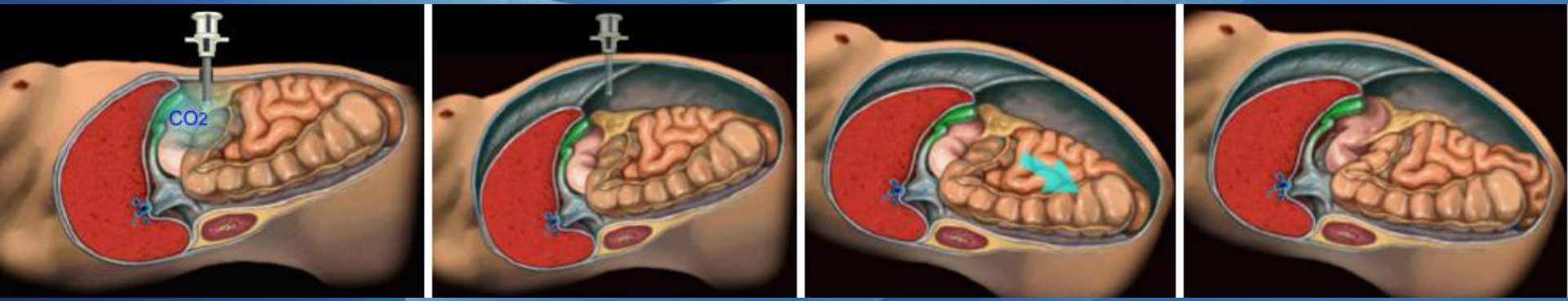


Future : Holographic Augmented Reality

Microsoft HoloLens

Hololens ©Microsoft

Second case : Minimally Invasive Surgery

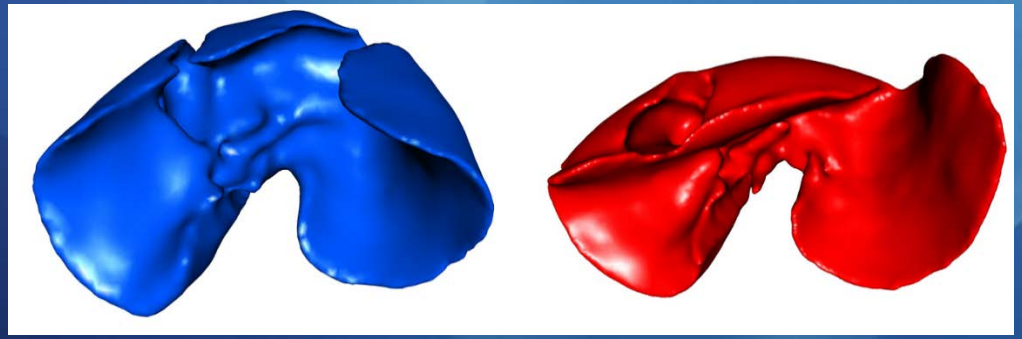


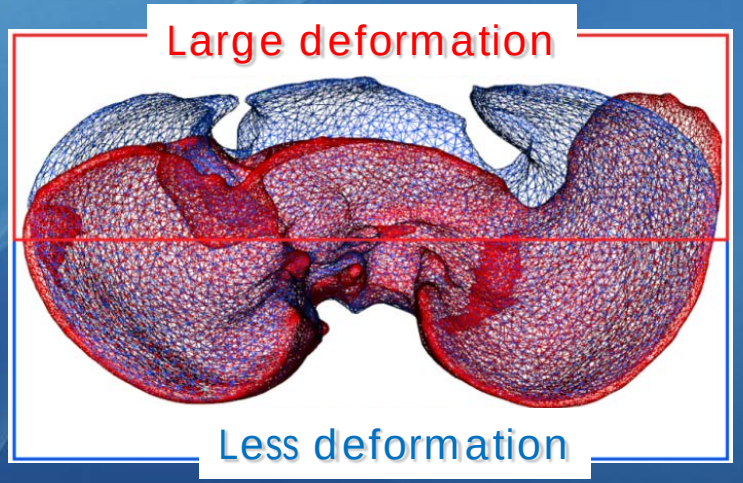
Shape and Location Modification
due to the surgeon interaction

➔ Pneumoperitoneum, OP-Table displacement, etc…

Pneumoperitoneum effect

deformation due to pneumoperitoneum is inhomogeneous



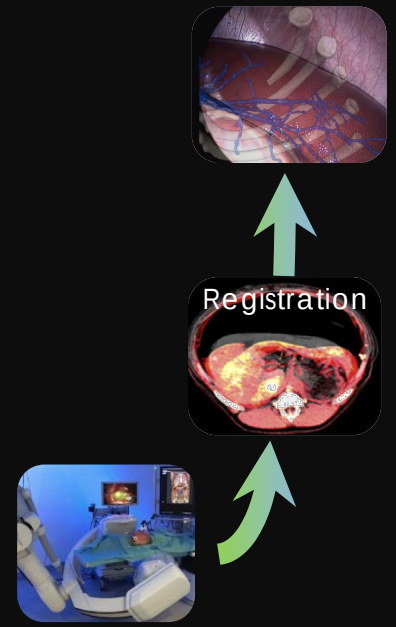


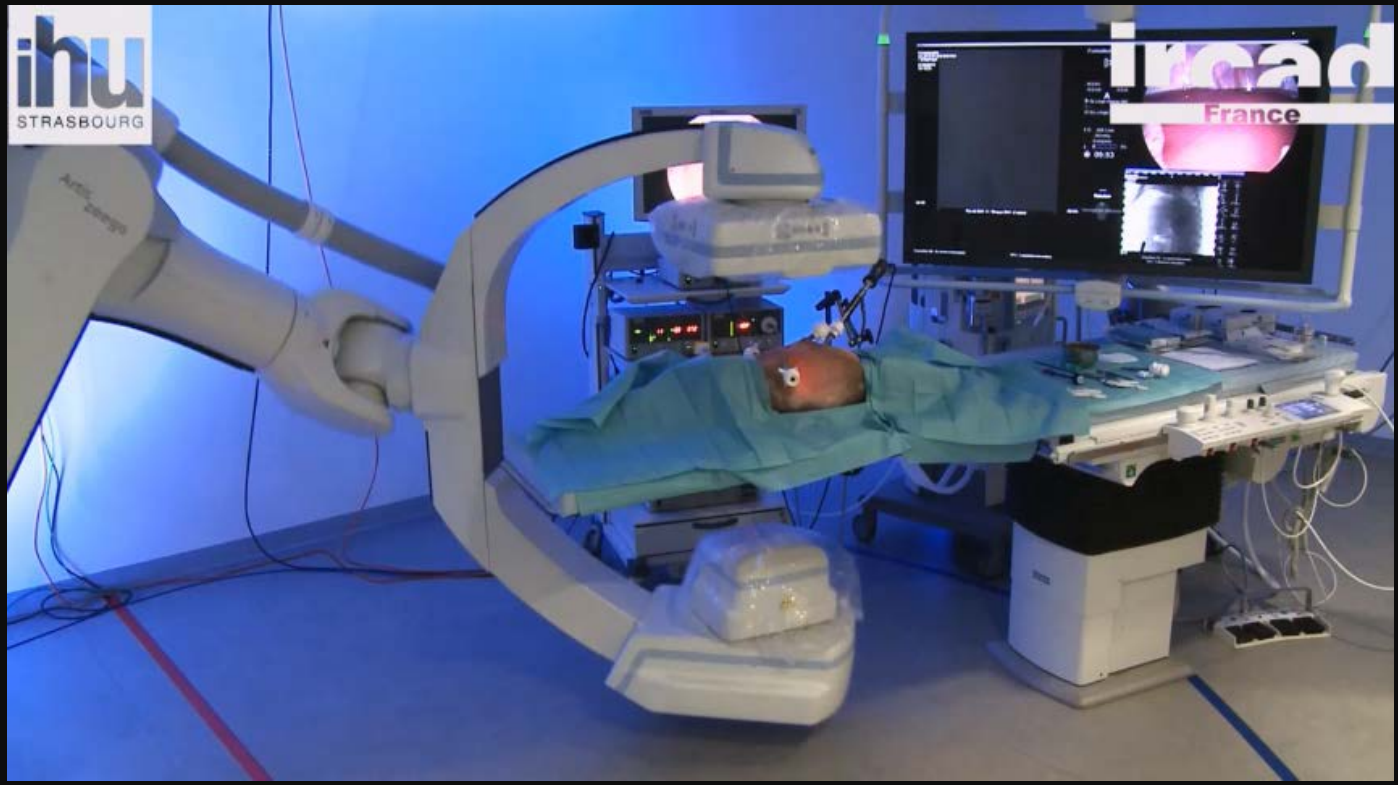
Large deformation of shape : not only translation

Aeronautics solution for surgery

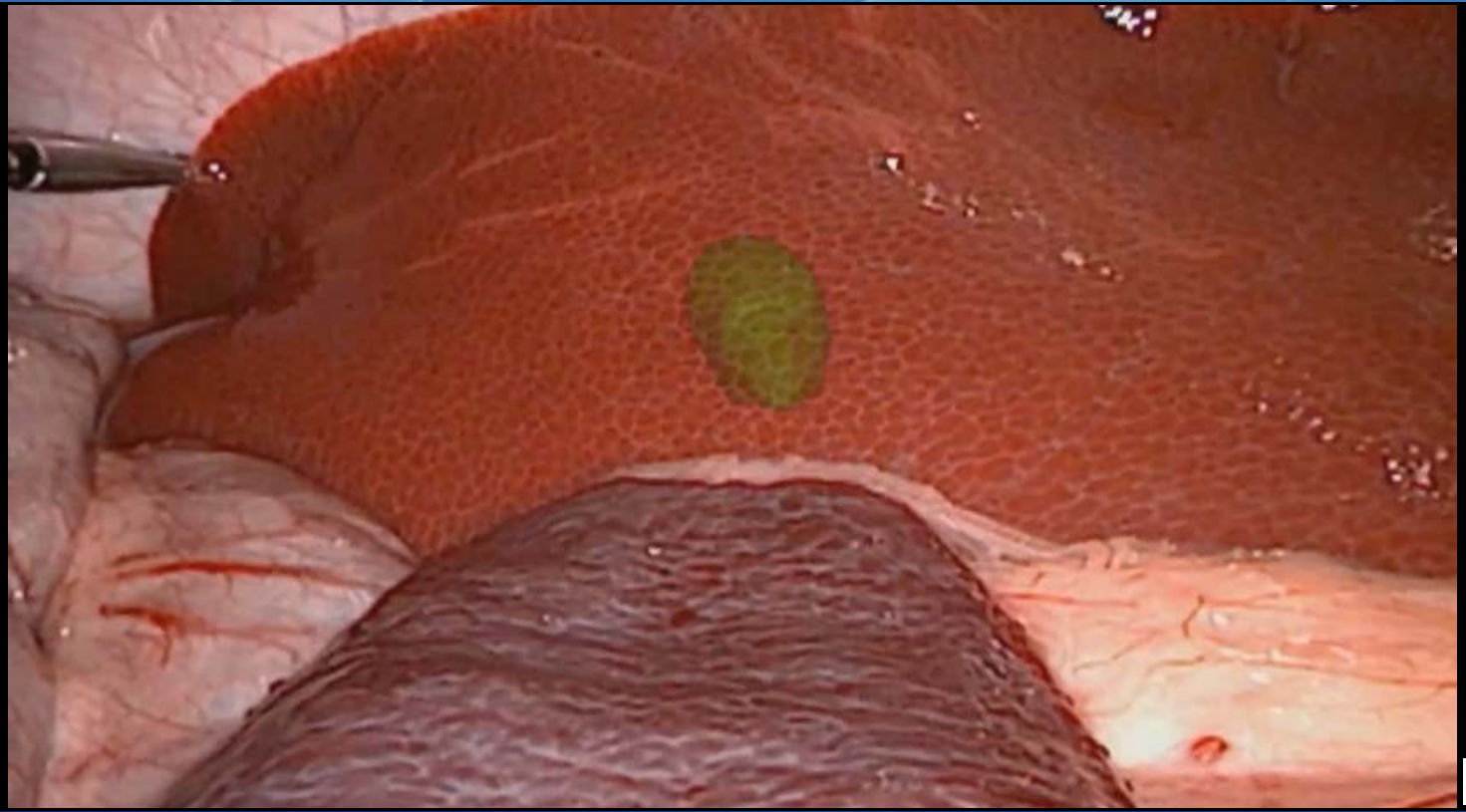
Intraoperative Image Guidance

Main Project: Lasar





Automated Augmented Reality on soft tissue

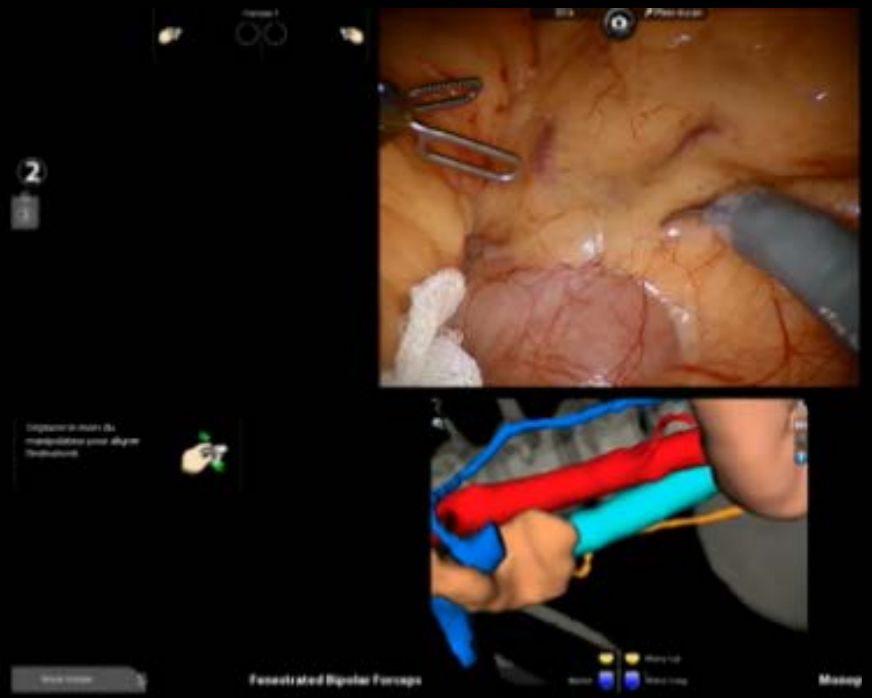


An Augmented Reality Framework for Soft Tissue Surgery
Mountney P, Fallert J, Nicolau S, Soler L and Mewes P.W. , MICCAI. 2014, pp 423-431

Aeronautics solution for surgery

Robotics

Robotics & Visible Patient : Plug & Play



Robotized colorectal Surgery, Prof. Armando Melani

ircad

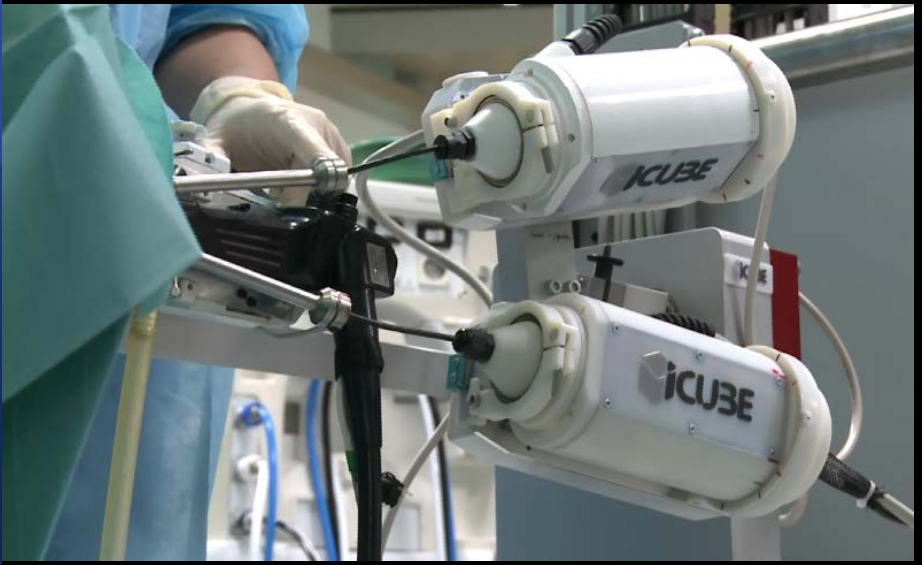
Augmented Reality Guided Personalized Surgery

Robotic Liver Surgery + AR-Surg©IRCAD 2010 : P. Pessaux et al. 2014

Augmented Reality Guided Personalized Surgery

Robotic Liver Surgery + AR-Surg©IRCAD 2010 : P. Pessaux et al. 2014

Platform: ISISCOPE ® (iCube)

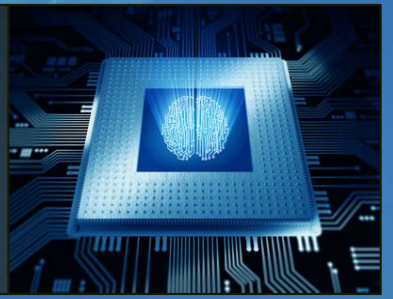


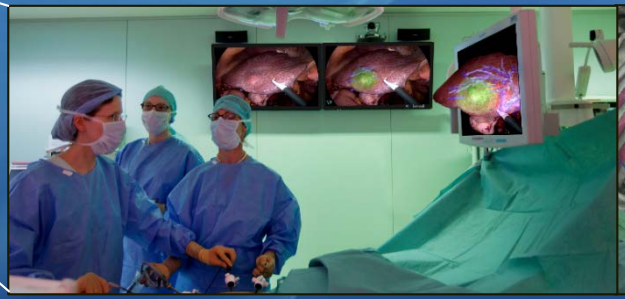
Icube Robotic team (Strasbourg University) + IRCAD + Karl Storz

Computer Assisted Image-Guided Surgery

Future based on Hybrid Surgery

Augmented Surgery





CONDOR + Fast Path : deep learning

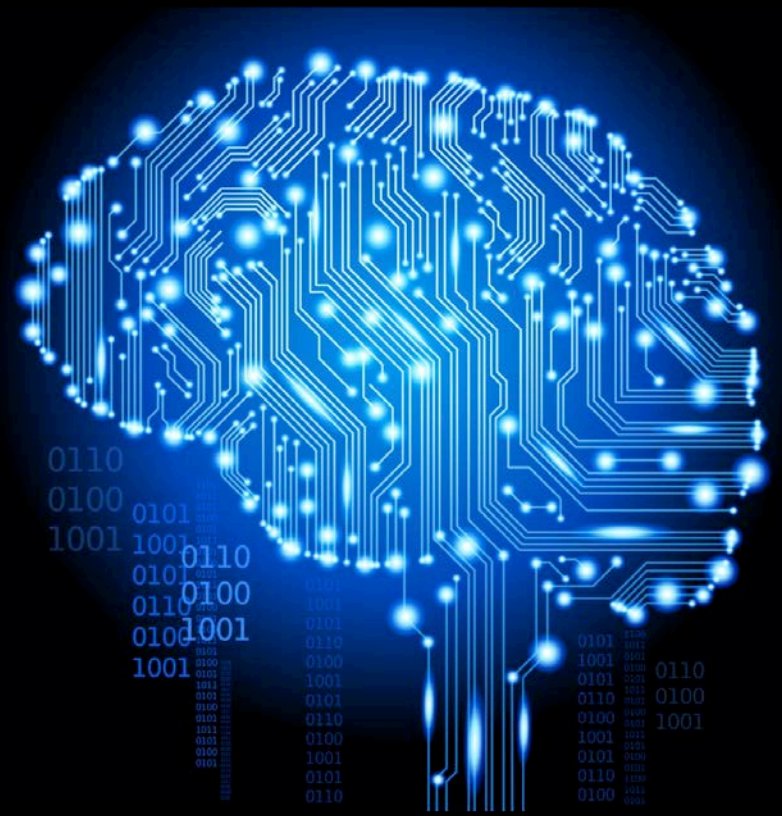
Alphabet

IBM Watson

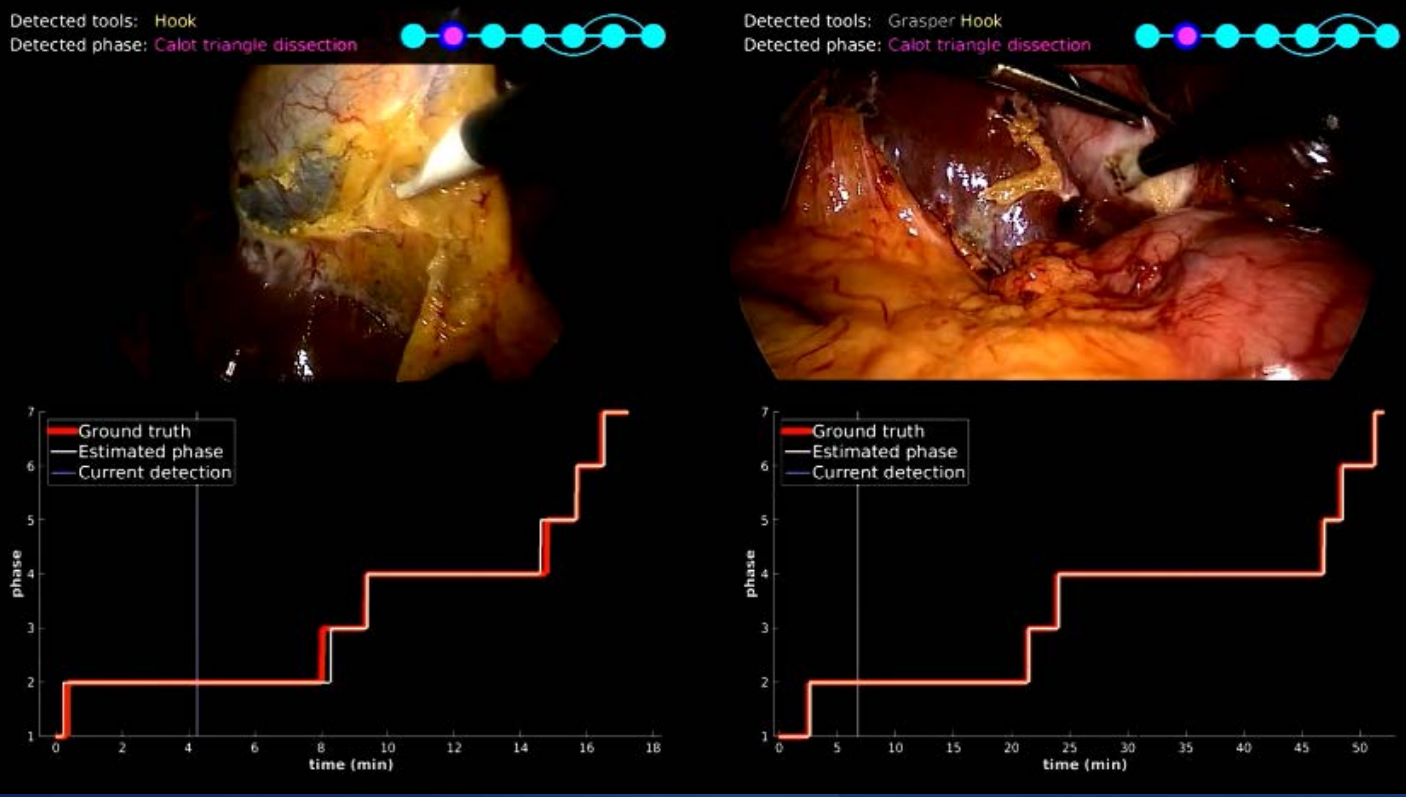
Projet CONDOR

bpifrance

Harmonic + IRT-B-Com
+ IHU + IRCAD + Unistra
INSERM + Medtronic



A.I. analysis of Surgical Video



A.P. Twinanda, S. Shehata, D. Mutter, J. Marescaux, M. de Mathelin, N. Padoy.
EndoNet: A Deep Architecture for Recognition Tasks on Endoscopic Videos. IEEE Transactions on Medical Imaging, 2016

Thanks for your attention !

IRCAD-IHU R&D Team 2017