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- Laboratoire des signaux et systèmes (L2S)

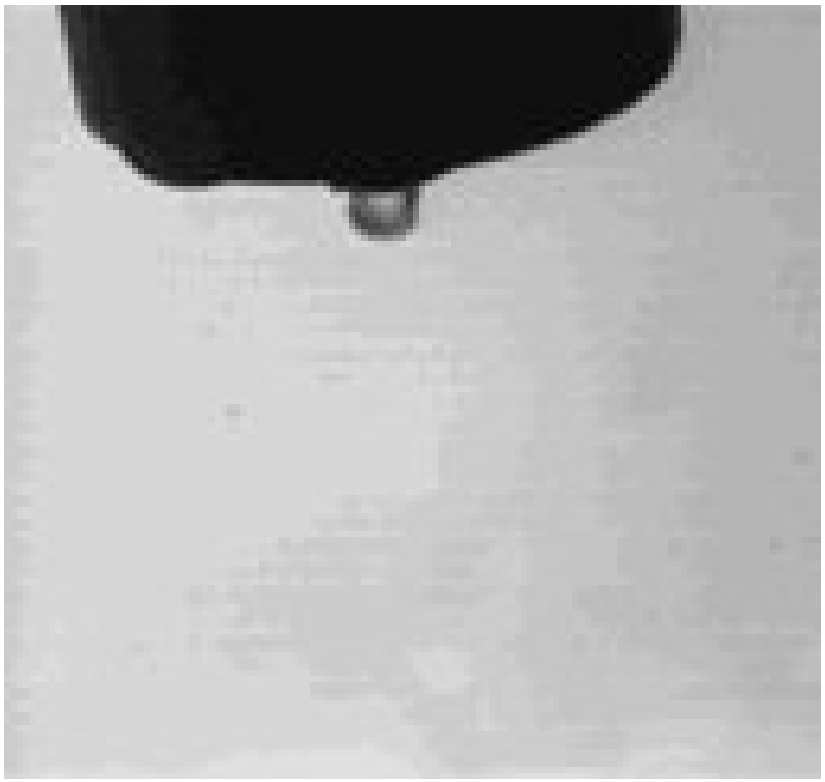
  UMR 8506 CNRS-SUPELEC-UNIV PARIS 11
- Signals and Systems Laboratory
- Signal & Image Processing
- Inverse problems in Imaging and Computer vision
- Deterministic regularization and Probabilistic Bayesian inference for inverses problems in signal processing, imaging systems and computer vision

Vision 2020

- High speed imaging for Non Destructive Testing (NDT) and Evaluation (NDE)
- Mobile imaging and wireless transmission
- Extended color (multi- and hyper-spectral)
- Health related imaging systems
  Human body, Live cells, proteins, genes and other biological imaging challenges
- Safety related imaging systems
- Environmental (Earth, Oceans, Space) observation
- Micro and nano objects observation

High speed imaging

for Non Destructive Testing (NDT) and Evaluation (NDE)



Conventional
1/4,500 second

Laser illumination
1/40,000,000 second
(25 ns)

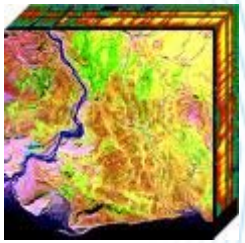
http://www.oxfordlasers.com/imaging/high_speed/?gclid=CL2D-uPBzaECFRYN3godJDc8ng

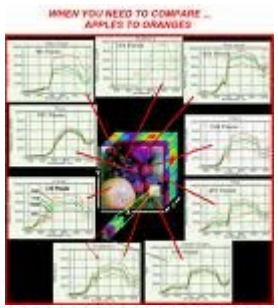
Mobile imaging and wireless transmission

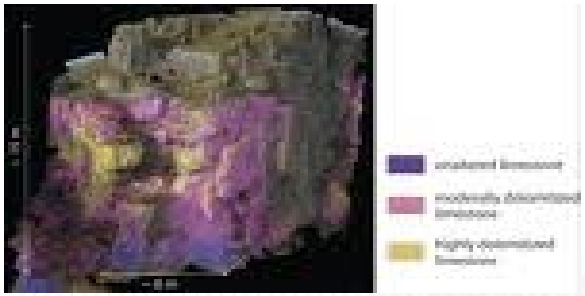
- High resolution 2D and 3D mobile imaging
- Super-resolution and fast image processing
- Fast pattern recognition and tracking
- Fusion of GPS localization information and real time HR 2D and 3D images
- Very high speed wireless transmission
- Multi-perspective imaging

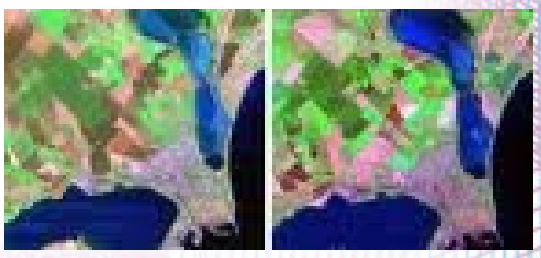
Extended color imaging multi- and hyper-spectral

- Huge need of memory and speed for 2D, 3D, 4D, 5D (4D and time), ...
- Fast image unmixing, segmentation and classification of patterns
- Fast pattern recognition and tracking







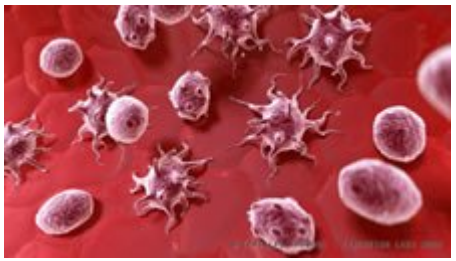


Health related imaging

- 3D real time imaging
- 3D and 4D Genomics
- Telesurgery

Planmeca ProMax 3D concept

http://www.planmeca.com/index.php?lng=1&page=00301



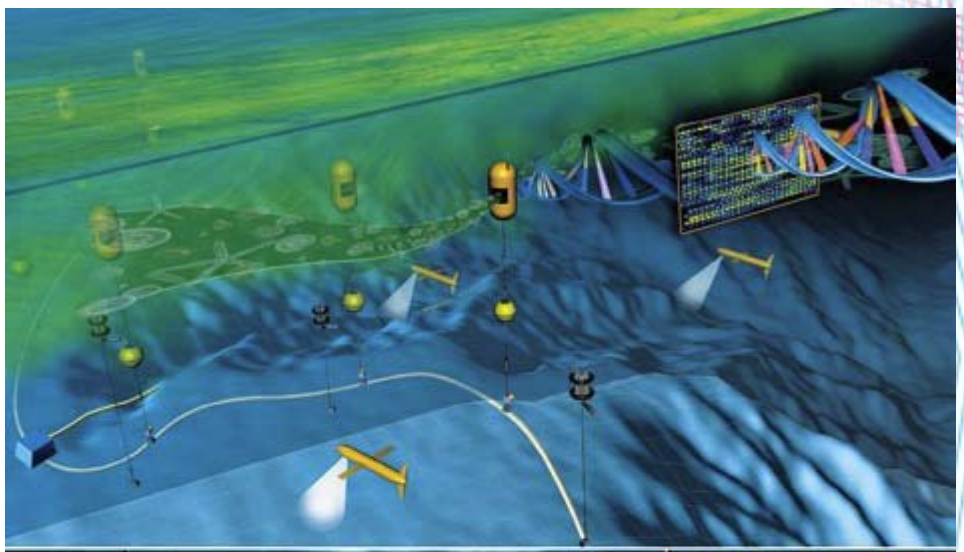
http://www.corticalstudios.nl/animation.html

Health related imaging

- Image reconstruction: Tomography (X rays, PET, SPECT, ultrasound, MRI, ...)
- Image formation : microscopy, fMRI, echography, fluorescence imaging, ...
- Cells identification and tracking
- Real time tele-surgery, endoscopy, ...
- In-vivo and in-vitro imaging and vision systems

Environmental observation

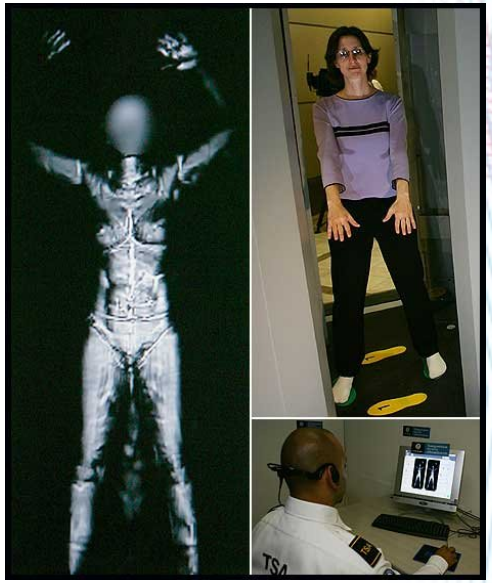
- Oceans observation
- Earth observation
- Space observation

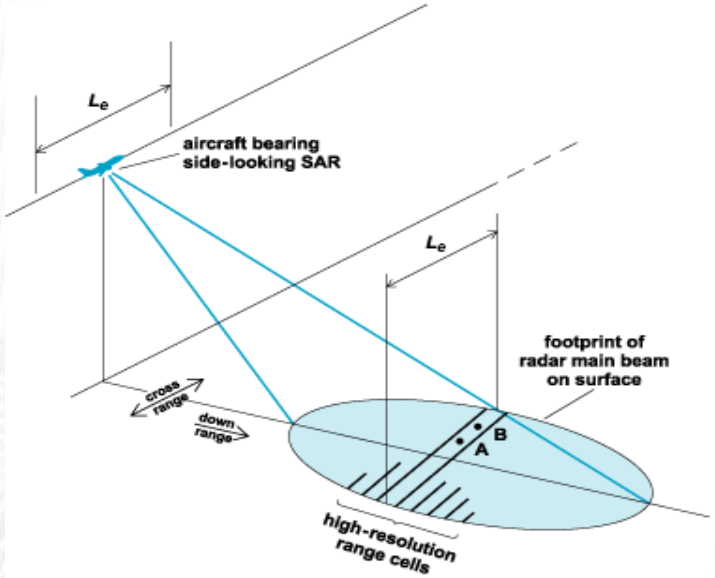


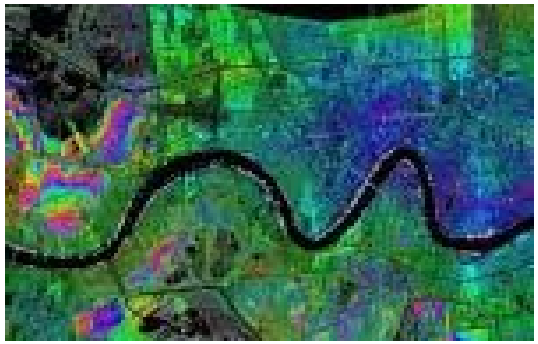
http://www.earthzine.org/2010/03/22/observing-the-oceans-a-2020-vision-for-ocean-science/

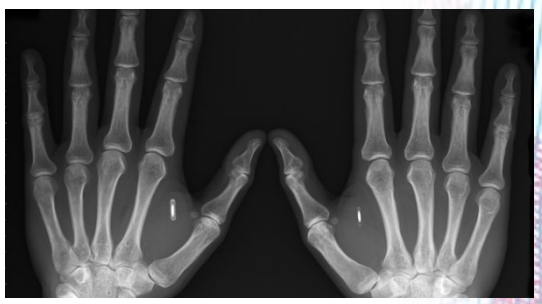
Safety related imaging systems

- Night Vision Systems
  Thermal imaging
- Passive milimeter waveimaging
- Radar, SAR, ISAR, LIDAR, …







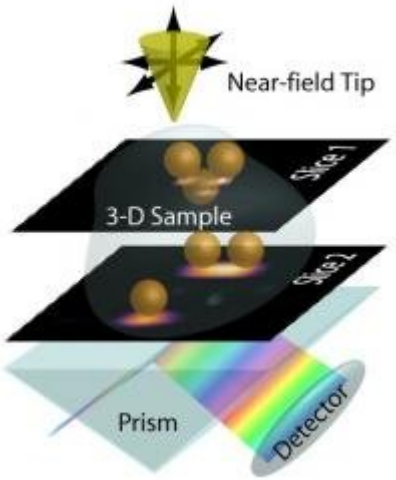


http://aftermathnews.wordpress.com/

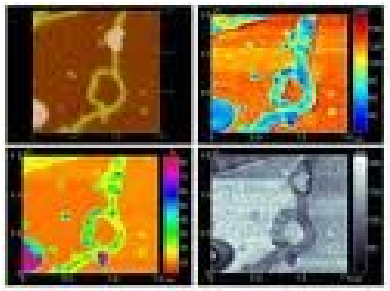
http://www.geos.ed.ac.uk/homes/s0094539/CE757765FG0010.gif

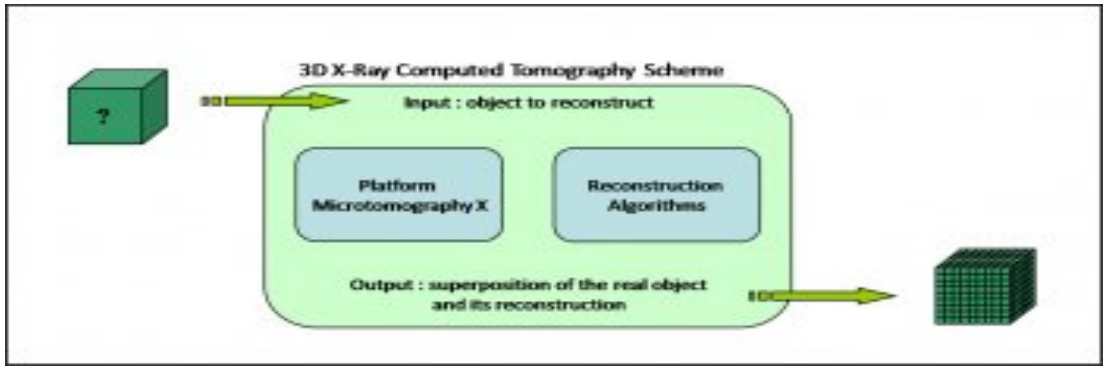
Micro and Nano observation

- Biological imaging:
  Cells, Molecules, Proteins,
  Genes, ...
- Nano objects observation
  and manipulation

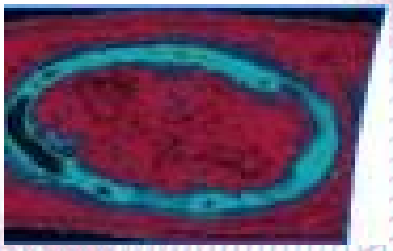


http://www.nanotech.upenn.edu/news.html





http://www.digiteo.fr/entrepot/5jaiqyqng4/5jaiqyqng4_medium.png



Conclusions

- Our community has a lot to contribute
- We need a good combination of Mathematics, Physics and Engineering skills to develop new methods for these vision problems
- Inventing new imaging systems needs good physics knowledge, good forward mathematical modeling and good inversion methods and algorithms.
- To get an overview come to my Keynote Lecture on Wednesday, May 19, 2010.