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Ultrasound Imaging

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PhD program in
Information Engineering

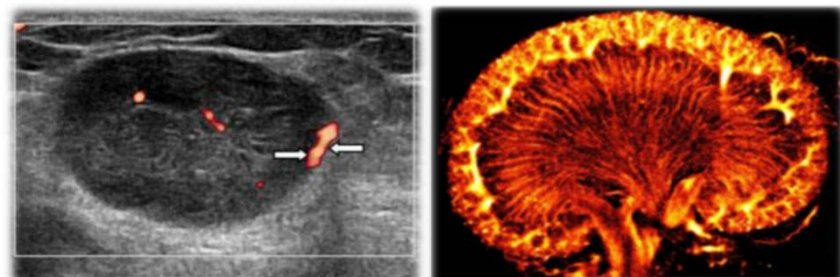


2-D and 3-D rendering examples



What is Echography?

Ultrasound echography adapts radar techniques to biomedical applications, exploiting sound waves to create images of body's internal structures. Medical doctors can thus accurately diagnose and treat a wide range of diseases (from cardiovascular diseases to cancer).



Breast lesion highlighted by vascular flow (in colors)

Super resolution ultrasound image of kidney vasculature

Compared to other imaging methods (e.g., magnetic resonance) ultrasound echography is characterized by:

- Lower cost and dimension
- Non-ionizing radiations
- Real time, bedside operation
- Immediate result reporting

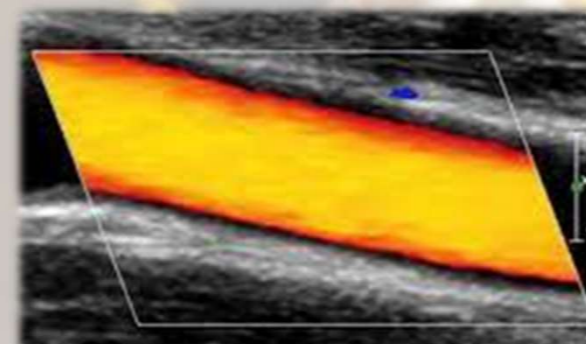
What is the research goal in this field?

Ultrasound research is focused to further increase the diagnostic capabilities of echography by improving the imaging quality. New applications of ultrasound technology can lead to better patient care (e.g., blood flow, 3-D imaging).

Portable ultrasound systems are also an important area of research, as they can increase access to medical imaging in remote or under-resourced areas.

Our PhD work will contribute to the improvement of ultrasound echography through the development of:

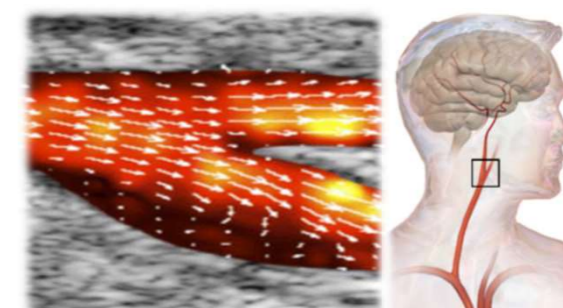
- **Advanced original electronic equipment**
- **Novel investigation methods**



Color Doppler image of a carotid obtained at high frame rate (4000 frames/s)

What are we doing?

We are currently building an innovative **powerful research echograph** for high-quality low-cost 3-D investigation. Such echograph can be programmed to work according to original modalities whose test was **so far limited to simulations**. Novel approaches, capable of producing impressive images of human organs and blood vessels at very high frame rates (thousands of frames/s), are investigated and will be **tested** by this echograph **before being proposed for translation to industrial** (even portable or ultra-portable) ultrasound systems. The novel equipment will also be made **available to the research community**: international laboratories will be enabled to experimentally test their methods by controlling it from remote.



Vector Doppler image of a carotid artery

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