Estimating quantitative parameters from Dynamic Contrast Enhanced UltraSound (DCE-US) sequences

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A presentation of the "Laboratoire d'Imagerie Paramétrique" and its research activities will open this lecture. Then we will focus on estimating quantitative parameters from Dynamic Contrast Enhanced UltraSound (DCE-US) sequences.
DCE-US offers the possibility of obtaining perfusion information in tumors or organs by assessing contrast-uptake. However, flow parameters cannot be reliably estimated and compared unless robust measurements of the echo-power are obtained from the DCE-US sequences. Several ultrasound systems (e.g., Toshiba Aplio 50) provide echo-power information in DICOM RawData files or as compressed video images stored in DICOM JPEG files. High-quality information stored in DICOM RawData files can only be accessed with dedicated manufacturer software (e.g., Toshiba CHI-Q software) and only provide limited capabilities. Video data stored in DICOM JPEG files easily can be accessed, but cannot be quantitatively interpreted as echo-power. Therefore, analyses and comparisons of DCE-US sequences are difficult to perform. This presentation will show how video data can be processed to extract echo-power information [1]. After obtaining reliable echo-power information, the perfusion parameters must be estimated. The estimation procedure usually relies on locally fitting mathematical models to the time-echo-power curves derived from an US cine loop. However, the least-squares method generally used to fit a parametric perfusion model to experimental data is not well suited for fitting to the DCE-US signal. A more-suitable maximum-likelihood estimator will be described [2]. Results on simulated data show improvements in the precision and accuracy of commonly estimated perfusion parameters. Results based on *in vivo* data will also be presented.

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References

[1] T. Payen, A. Coron, M. Lamuraglia, D. Le Guillou-Buffello, E. Gaud, M. Arditi, O. Lucidarme, and S. L. Bridal, "Echo-power estimation from log-compressed video data in dynamic contrast-enhanced ultrasound imaging.," *Ultrasound Med. Biol.*, vol. 39, no. 10, pp. 1826–37, Oct. 2013.

[2] G. Barrois, A. Coron, T. Payen, A. Dizeux, and L. Bridal, "A Multiplicative Model for Improving Microvascular Flow Estimation in Dynamic Contrast-Enhanced Ultrasound (DCE-US): Theory and Experimental Validation," *IEEE Trans. Ultrason. Ferroelectr. Freq. Control*, vol. 60, no. 11, pp. 2284–2294, 2013.