Modelling the Flow of Contrast Agents

The modelling of the evolution of contrast agents through the vessels and the parenchyma of the tissues of the abdominal cavity can lead to an accurate characterization of the histology and the nature of tumour masses in the liver. The mere inspection of the bright levels of MRI images reveals to be inaccurate in a significant number of cases, requiring more complex studies or real biopsies.

However, the analysis of the evolution of a bolus of a contrast agent can lead to the identification of the physical models which can be used to produce parametric images (see figure 1) that can outline areas with high degree of vascularity and oxygen consume, which are common to most malignant lesions.

Computing those images requires obtaining a time series of 3D medical images of a patient along different break-holds (see figure 2). Patient movements produce strong artefacts that severely affects the process. Thus, a deformable co-registration of the images is needed.

The co-registration process is highly time consuming, requiring 40 CPU days for computing a typical clinical trial of 20 patients with 13 volume series each, using conventional state-of-the-art computers.

With the use of Grids, this process has been reduced down to 8 CPU hours. This process is completed with the identification of the constants that govern the model which constitute the measure to plot in the parametric image (figure 1).
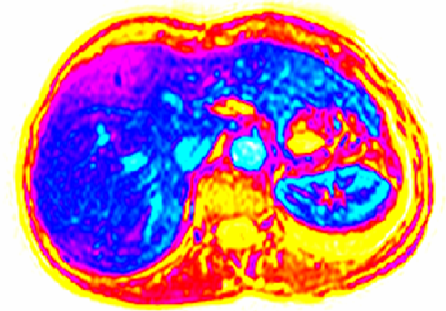

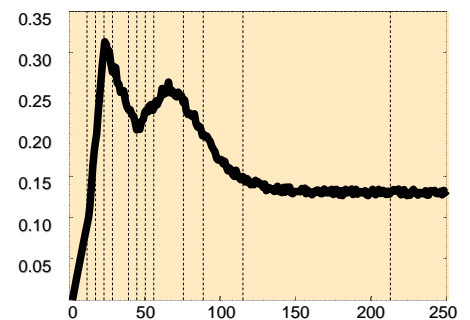Figure 1: Parametric Image of the Liver. Light Cyan Denotes More Contribution of Contrast.

Figure 2: Bright Evolution of a Focal Lesion of the Liver along the Time. Image Acquisition Periods.

GRyCAP – UPV: iblanque@dsic.upv.es