# Interactive Multimodal Visualization for 3D Neuroimage Exploration

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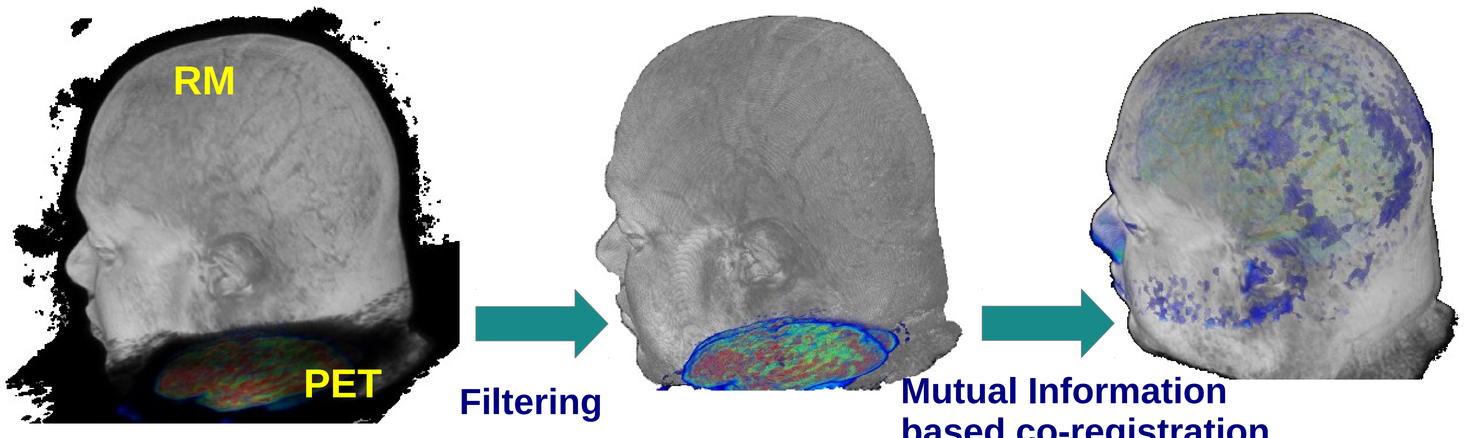
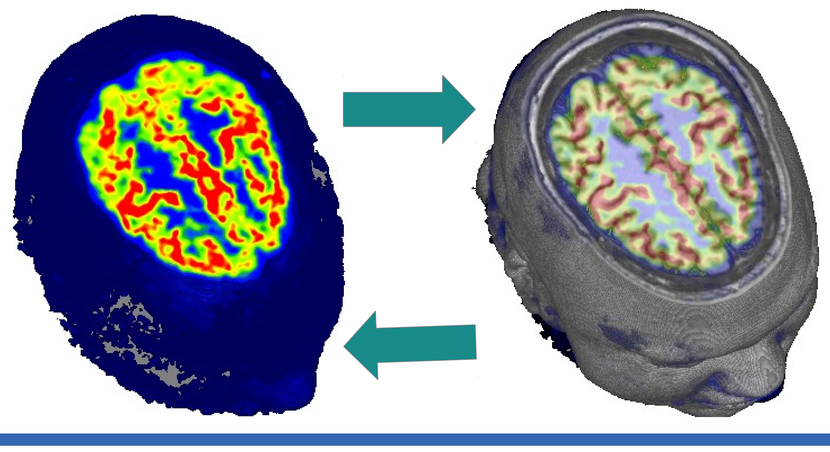
**Rationale:** Approximately 30% of patients with focal epilepsies have seizures resistant to antiepileptic drugs and surgical treatment is the best option for seizure control in these cases. The precise localization of epileptogenic focus and the brain structural abnormalities related to it are essential for both surgical planning and good postoperative outcome. However, in some patients the brain abnormalities related to the epileptic focus are subtle and difficult to be detected in the conventional visual analysis of the MRI studies. This work presents a 3D interactive multimodal environment which allows the co-registration of different structural and functional neuroimaging and enables a neuroscientist to intuitively localize possible dysfunctional areas.

**Materials and Methods:** We implemented our 3D interactive visualization environment on top of open source libraries. All the rendering procedure runs on GPU (graphics processing unit). We have conducted our experiments with CT (computed tomography), MR (magnetic resonance) and PET (positron emission tomography) images. The MR images were acquired in the Philips Achieva 3T scanner and the CT and PET volumes in the Siemens s5vb20b multimodal imaging scanner.

## Pre-processing

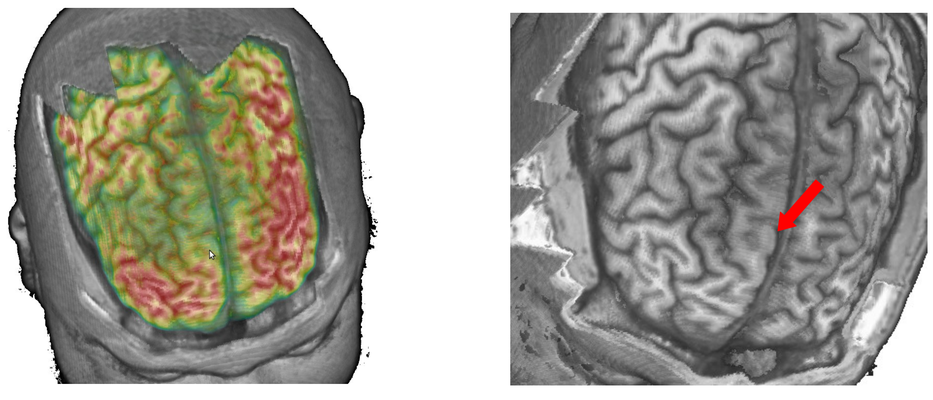



## Delineation of Region of Interest



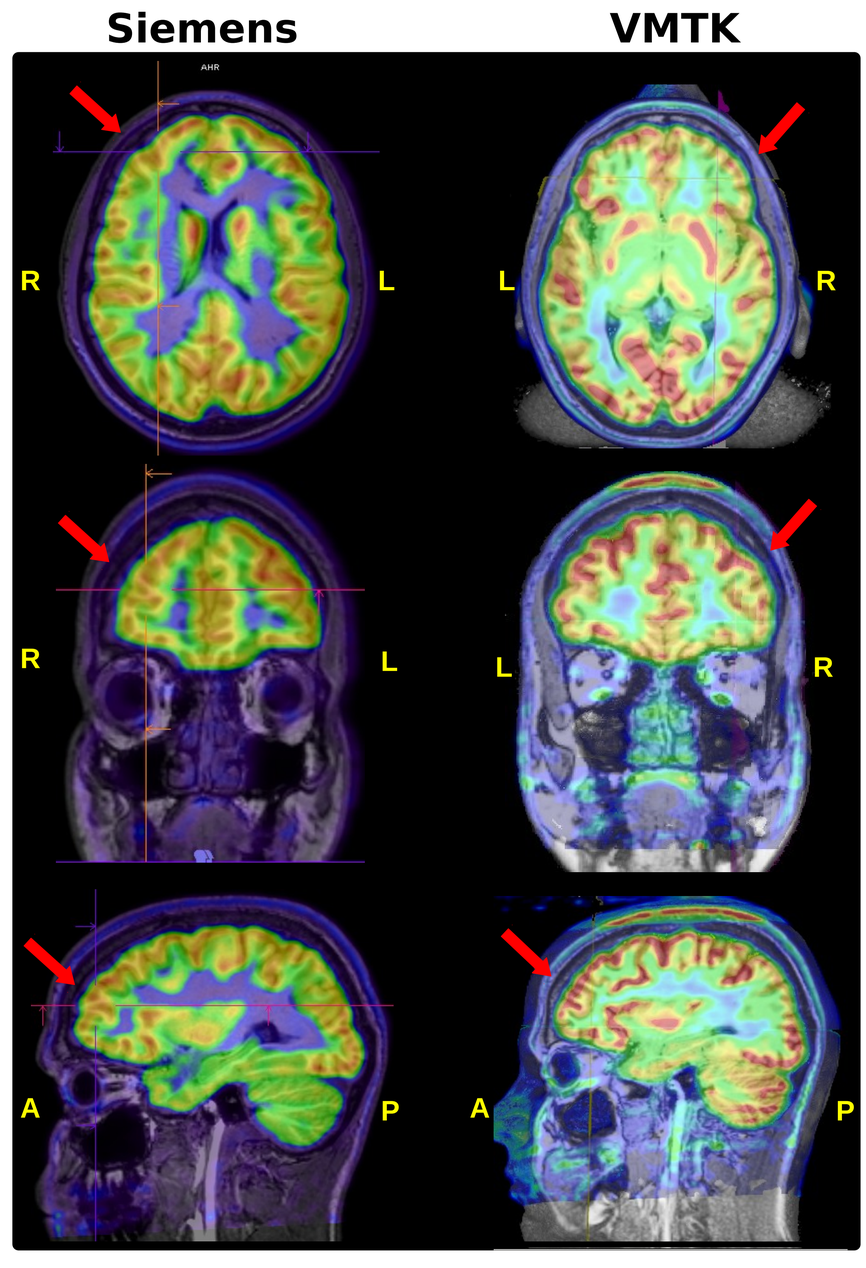
PET volumes are useful for evaluating brain metabolic activity, while MR brain data are for certification of anatomical localization of such metabolic changes. Interactive overlay visualization allows us to identify regions of interest that present dysfunctions.

## Identification of subtle lesions



Curvilinear cropping on a suspicious region permits us to restrict the search for subtle lesions in MRI data.

**Comparative analysis with Siemens Scenum:** There is a concordance between the outcomes of our software and the ones from a commercial software: a suspicious lesion in the right frontal lobe. Note the cortical surface in grayscale is underlying the regions colored in accordance with brain metabolism. Rainbow color palette is employed: red indicates a higher metabolism, while blue shows decreased activity or none at all.




**Further work:** For assessing the reliability of our technique we plan to do intracranial EEG (electroencephalography) recordings and to investigate the potential of the presented visualization technology for surgical prognosis.

**References:** [1] Valente AC, Wu S-T. Registration and Fusion with Mutual Information for Information-preserved Multimodal Visualization. Accessed on April 2014;
[2] Wu S-T et al. Interactive Curvilinear Reformatting in Native Space. IEEE Transactions on Visualization and Computer Graphics, 18(2):299–308, February 2012.