Temporal Reconstructions in EIT

Andy Adler[1], Hervé Gagnon[1], Jörg Dittmar[2], Bartłomiej Grychtol[3,4]

[1]Carleton University, Ottawa, Canada, [2]Universitätsmedizin Göttingen, Germany, [3]German Cancer Research Center, Heidelberg, Germany, [4]Fraunhofer Project Group for Automation in Medicine and Biotechnology, Mannheim, Germany

Temporal Filtering Approaches

EIT has relatively low spatial resolution, but has high temporal resolution[1]. The measurements which constitute an EIT frame are not taken simultaneously. Approaches to interpret such data haven't been systematically compared.

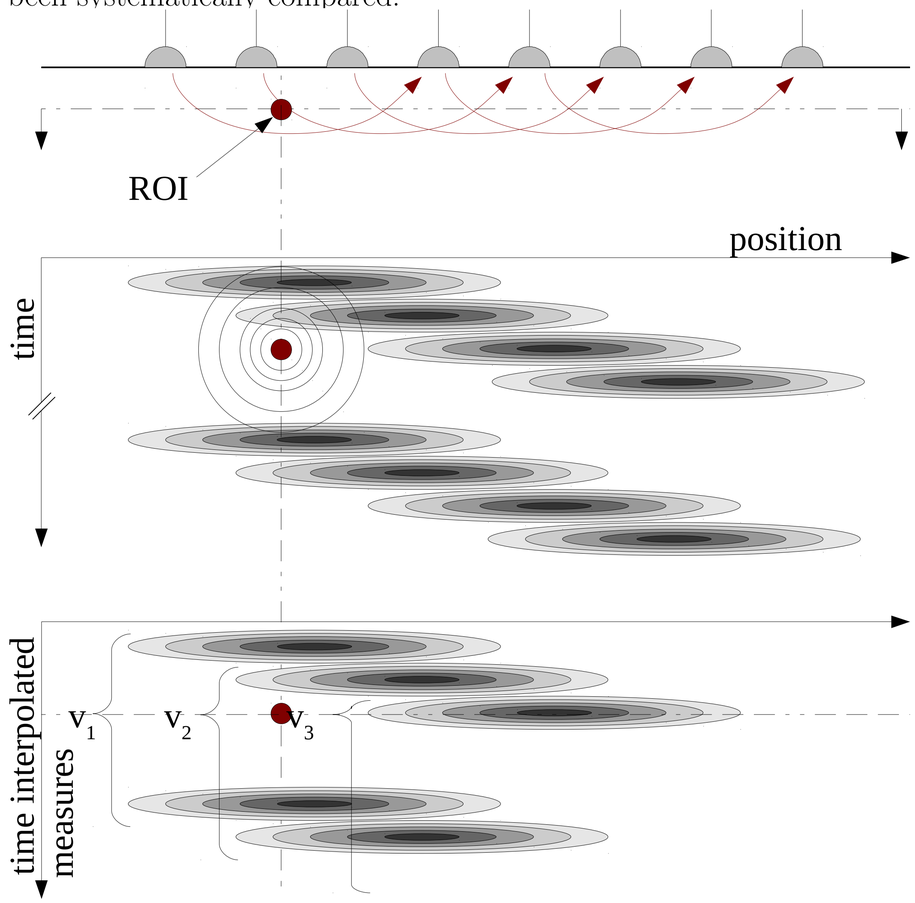

Fig. 1: Block diagram of a geophysical EIT system with a temporal effect.
Top: horizontal plane beneath surface electrodes
Middle: Temporal Reconstruction
Bottom: Temporal Interpolation

Results and Discussion

Given EIT image reconstruction ($\hat{\mathbf{m}}$ image, $\mathbf{d}$ data, $\mathbf{J}$ Jacobian, $\mathbf{\Sigma}_n$ noise covariance, $\mathbf{\Sigma}_m$ image prior)

$$\hat{\mathbf{m}} = \mathbf{\Sigma_m T}^t\mathbf{J}^t(\mathbf{JT\Sigma_m T}^t\mathbf{J}^t + \mathbf{\Sigma_n})\mathbf{Fd} \quad (1)$$

where $\mathbf{T}$, $\mathbf{F}$ are temporal and interpolation filters. Proposed approaches are:

- *Temporal ignorance* (not shown). Assuming temporal effects are negligible. ($\mathbf{T} = \mathbf{F} = \mathbf{I}$)
- *Temporal reconstruction* [2]: prior has temporal and spatial model ($\mathbf{T}$: temporal covariance, $\mathbf{F} = \mathbf{I}$)
- *Temporal interpolation* [3]: interpolated measurements, classic reconstruction ($\mathbf{F}$: filter, $\mathbf{T} = \mathbf{I}$)
- *Kalman filtering* [4] (not shown).

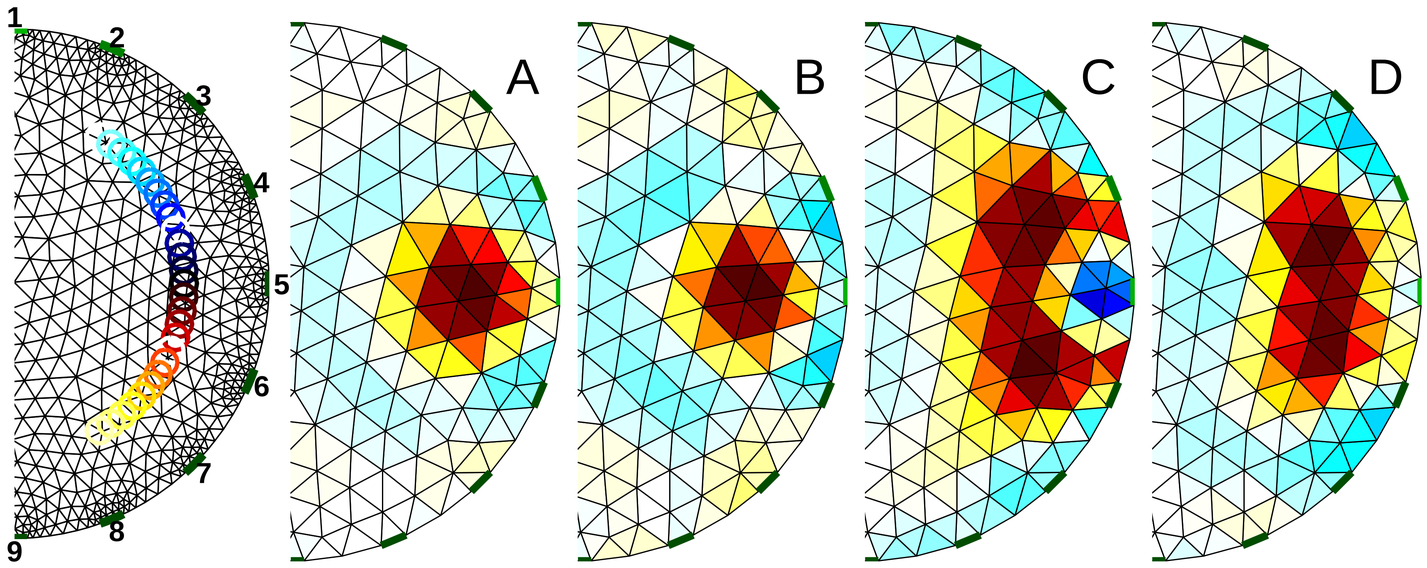

Fig. 2: Simulation and Reconstruction images (on circular domain, half shown). *Left*: Simulation matrix, with an object moving from top (blue) to bottom (red) during three acquisition frames; the first acquisition of each frame is marked white; *A:* Reconstruction of a frame of data with the object still at 90° (reference image); *B:* Temporal ignorance; *C:* Linear temporal interpolation; *D:* Temporal reconstruction [2].

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