Temporal Filtering Approaches

EIT has relatively low spatial resolution, but has high temporal resolution. 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 ($\hat{m}$ image, $d$ data, $J$ Jacobian, $\Sigma_n$ noise covariance, $\Sigma_m$ image prior)

$$\hat{m} = \Sigma_m T'J' (J\Sigma_m T'J' + \Sigma_n)^{-1} Fd$$

(1)

where $T$, $F$ are temporal and interpolation filters. Proposed approaches are:

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