Brain Source Localization

Simon K. Warfield
Children’s Hospital Boston
Harvard Medical School
**Scientific Goals**

*Epilepsy:*
- Affects 2.5 Million Americans
- 75% have 1st Seizure in Childhood
- 20-30% will ultimately be poorly controlled with drug therapy

**Surgical Interventions:**
- A last resort in refractory cases
- Resection of lesional tissue can completely eliminate seizures
- Requires accurate identification of the seizure focus.
Scientific Goals

Current Standard:
• Pre-operative MRI
• Invasive Electrocorticography
  • Involves Significant Risk
  • Only performed on the most promising surgical candidates

Non-invasive Screening w/ EEG
Source Localization:
• Can be performed on ALL patients
• Need to demonstrate equal or greater accuracy than electrocorticography
Scientific Goals

Three Clinical Goals:

• Increase the number of refractory epilepsy cases who receive curative surgery

• Decrease the number of unsuccessful surgeries performed

• Introduce screening for surgical potential as standard clinical care, to offer surgical interventions earlier in disease progression.
Role of CIBC To Date

3D Mesh Generation:
• Automated generation from segmentations

Visualization:
• Examination of 3D Models
  • Anisotropic Conductivities
  • Inverse Solutions
  • Multi-Modal Visualization
  • Volumetric Rendering
**Future Work**

**Full 3D Model Generation:**
- Mesh Generation with Cleaver
- Bioelectric Propagation using FEM

**Visualization:**
- Spatiotemporal evolution of source activity
- Smart averaging of spikes based on non-linear mapping
- Visualization of movement of cortical surface electrodes on the cortical surface for pre-surgical planning
- Enhanced interpretation of multi-modality data

**Novel inverse problem solvers:**
- Spatiotemporal source localization
- Novel regularization approaches