

Cognition and Neuroergonomics
(CaN)
Collaborative Technology Alliance
(CTA)



Enabling Technologies for Brain and Body
State Assessment and Modeling for
System Interfaces

- Basic science research and technology transition program in the neurosciences
- Consortium lead by DCS Corporation, in alliance with ARL-HRED
- Includes University of California San Diego, University of California Santa Barbara, National Chiao Tung University, University of Michigan, University of Osnabrück, University of Texas San Antonio, Columbia University, and others.

Technology Transition Goal : System as Human Extension



- Facilitate the development of technologies that integrate with the user and offer a user interaction structured and shaped by ever changing user condition.
- Extend the human user capability and optimize and enhance the user's effectiveness.

- System can observe user behavior, and surface changes (i.e. electro-dermal activity, pupil dilation, eye movement, facial expressions, gait, etc.) and estimate user intention, attention allocation, affective state, etc.
- System cannot always be certain of what is really going on in the user's head.

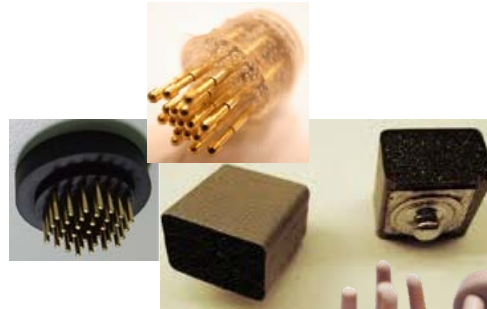
System as Human Extension : CaN CTA Approach



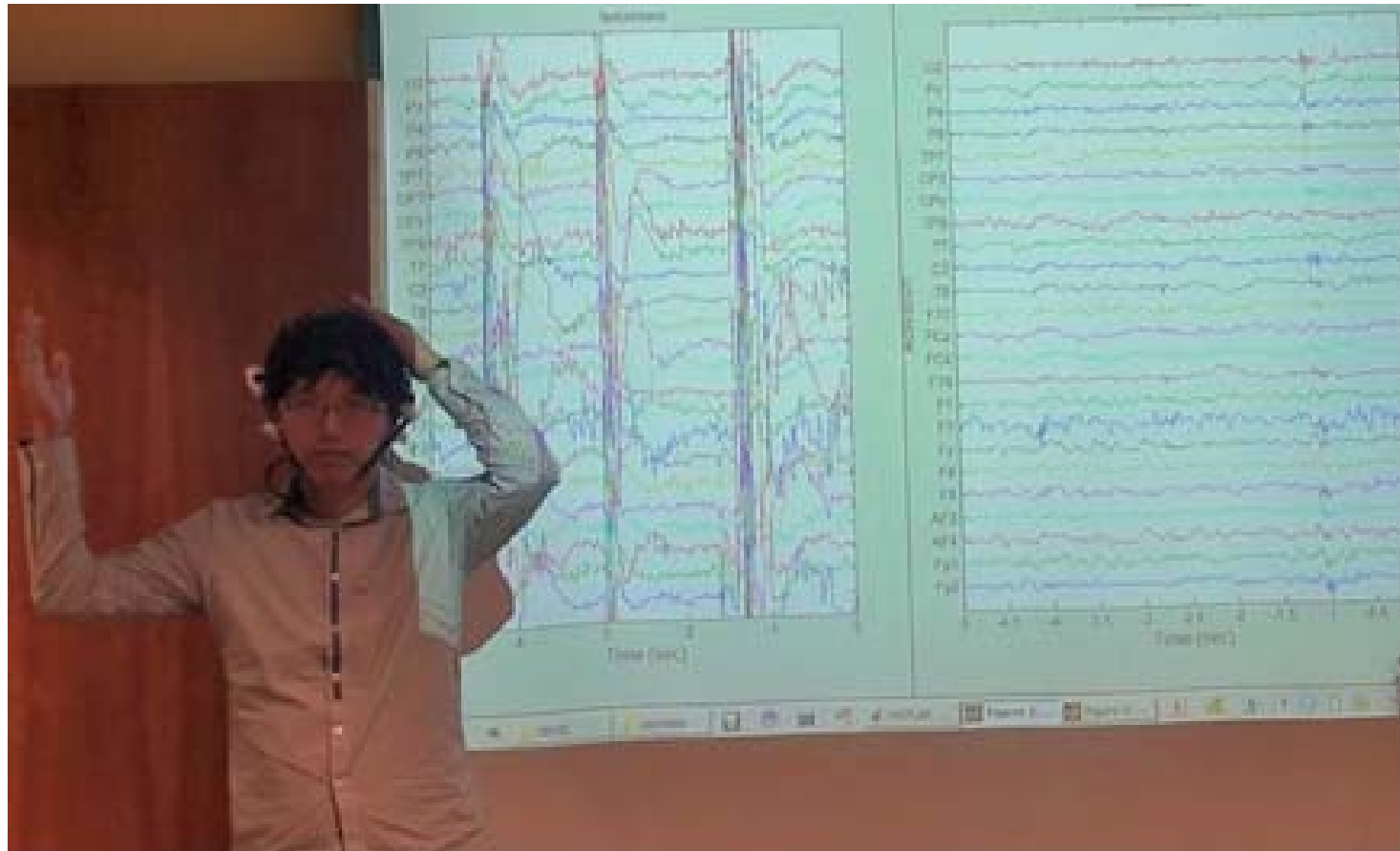
- Explore methods of using electric fields emanating from the brain and measured on the scalp (aka electroencephalogram – EEG) to estimate moment to moment cognitive state
- Combine with other methods of sensing human brain-body state
- Tackle key technological challenges to enable the above

Challenge : Sensors for Real World (NCTU, UCSD, ARL HRED)

Wired, Wet EEG to Wireless, Dry EEG



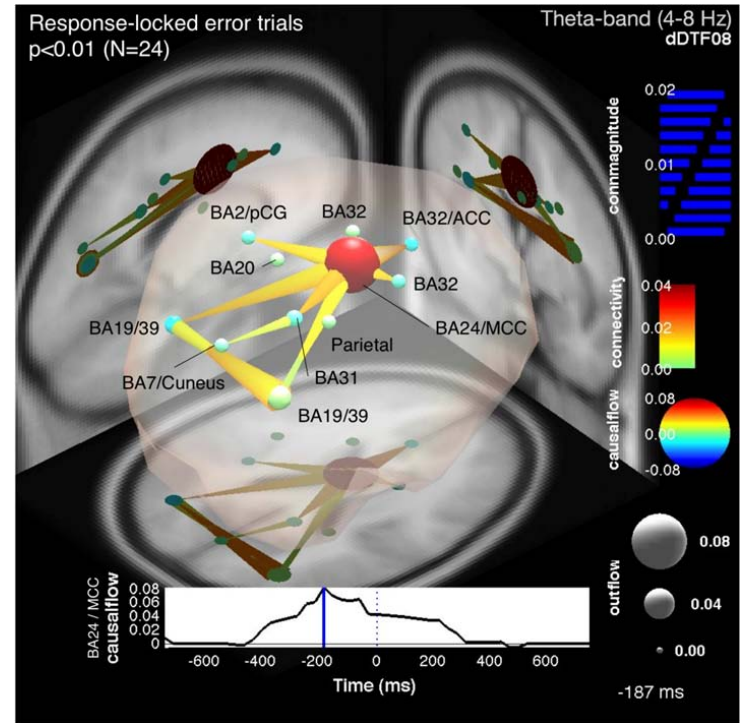
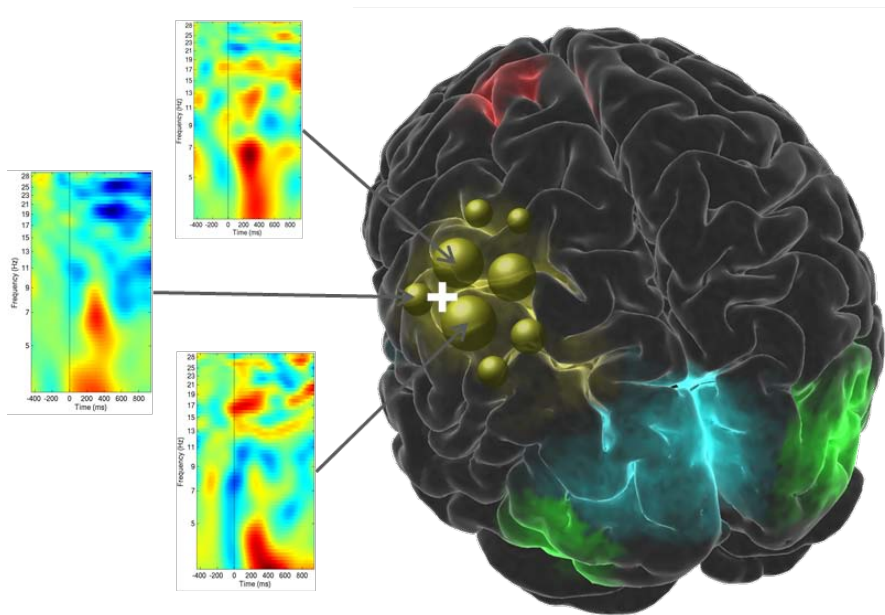
Challenge : Real-World Noise (UCSD, NCTU, UTSA)



Real-time Noise Cancellation

Challenge : Estimate internal processes using surface signals (UCSD)

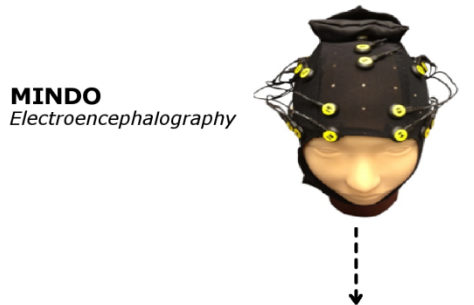
Component Space Analyses



Measure
Projection
Analysis

Granger Causality Analysis
of Source Information Flow

Challenge : Combine with other sensors in real-life situations (ARL HRED, DCS, UMI)



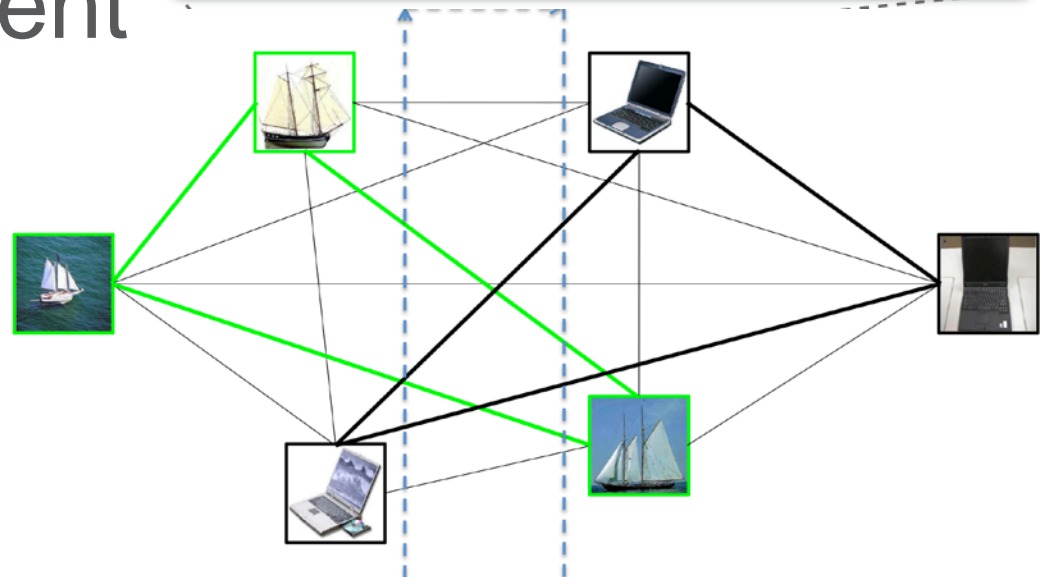
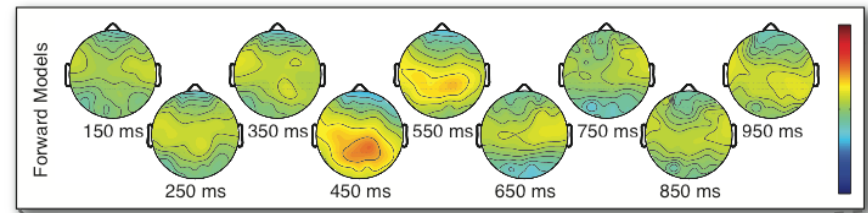
Q Sensor 2 (Affectiva)
Electrodermal Activity (EDA),
Movement, Skin Temperature



Adapted from McDowell et al., *IEEE Access*, 2013.

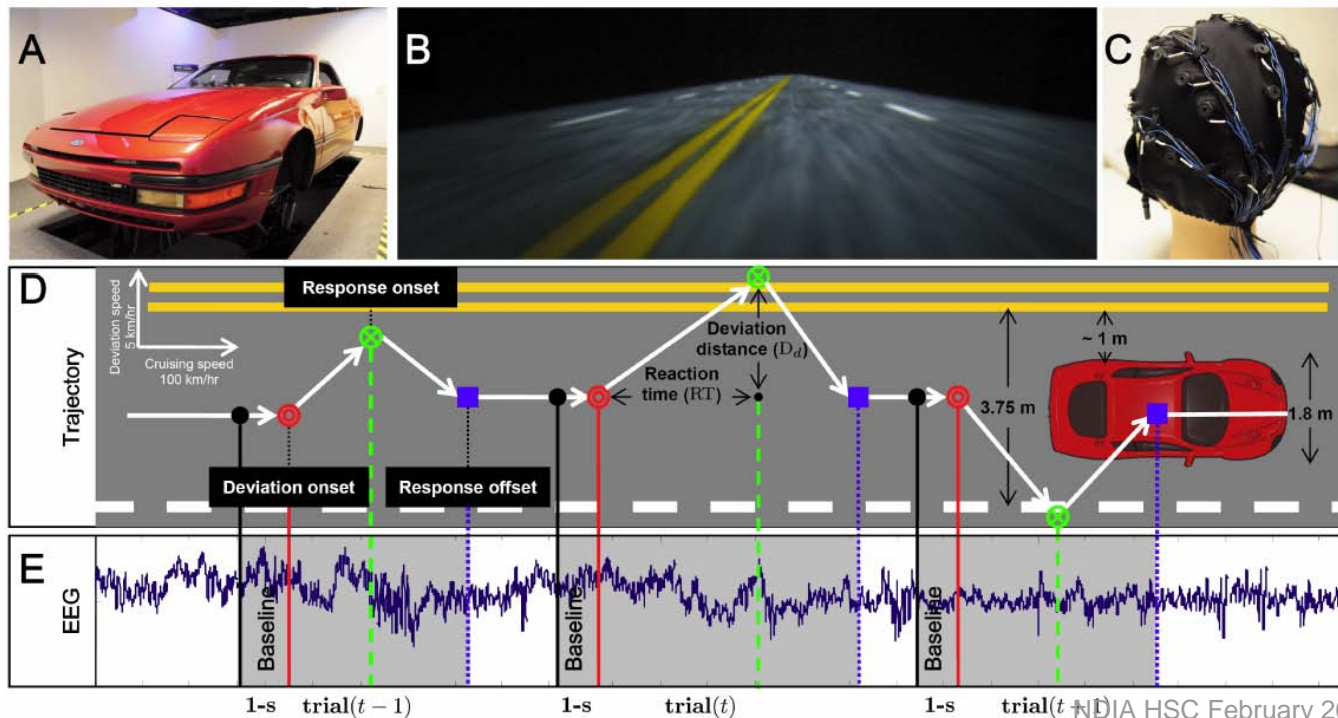
Challenge : Novel Applications : Hybrid Brain Computer Interface (Columbia)

Rapid Serial Visual Presentation and EEG paradigm with other modes of interest assessment combined with computer vision



Challenge : Novel Applications : Vehicle Driver Alertness, Attention Monitoring

Exploit individualized EEG spectral patterns of fatigue, alertness, attention focus, attention shift.



Presenter Contact



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Additional Information :

www.cancta.net