NEURAL ENGINEERING SEMINAR SERIES

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Neuroergonomics: Towards Ubiquitous and Continuous Measurement of Brain Function during Everyday Life

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ABSTRACT: The understanding of the brain functioning and its utilization for real world applications is the next frontier. Existing studies with traditional neuroimaging approaches have accumulated overwhelming knowledge but are limited in scope, i.e. only in artificial lab settings and with simplified parametric tasks. As an interdisciplinary new field, neuroergonomics aims to fill this gap: Understanding the brain in the wild, its activity during unrestricted real-world tasks in everyday life contexts, and its relationship to action, behavior, body, and environment. Functional near infrared spectroscopy (fNIRS), a noninvasive brain monitoring technology that relies on optical techniques to detect changes of cortical hemodynamic responses to human perceptual, cognitive, and motor functioning, is an ideal candidate tool. Ultra-portable wearable and wireless fNIRS sensors are already breaking the limitations of traditional neuroimaging approaches that imposed limitations on experimental protocols, data collection settings and task conditions at the expense of ecological validity. This talk will discuss emerging trends for fNIRS applications, from aerospace to medicine, with diverse populations and towards clinical solutions. We will review recent studies, such as mental workload assessment of specialized operators performing standardized and complex cognitive tasks and development of expertise during practice of complex cognitive and visuomotor tasks (ranging from aircraft piloting and robot control). Various recent synergistic fNIRS applications for human-human and human-machine interaction, interpersonal neural synchronization, and brain computer interfaces, highlight the potential use and are ushering the dawn of a new age in applied neuroscience and neuroengineering.

BIOGRAPHY: Dr. Hasan Ayaz is a Provost Solutions Fellow and Associate Professor at the School of Biomedical Engineering, Science and Health Systems with affiliations at the Department of Psychological and Brain Sciences, and Solutions Institute at Drexel University, Adjunct Professor at the University of Pennsylvania, and a core member of the Cognitive Neuroengineering and Quantitative Experimental Research Collaborative. He received his BSc. in Electrical and Electronics Engineering at Boğaziçi University, Istanbul, Türkiye with high honors and MSc. and PhD degrees from Drexel University where he developed enabling software for functional Near Infrared Spectroscopy based brain monitoring and FDA approved medical devices. His research interests include understanding human brain functioning using mobile neuroimaging in realistic and real-world environments, across the lifespan and from healthy (typical to specialized groups) to diverse clinical conditions (mental health to neurological). His research aims to design, develop, and utilize (i.e., to measure->elucidate->enable) next generation brain imaging for neuroergonomic applications over a broad spectrum from aerospace to healthcare. He organized and chaired international conferences on this topic and co-founding Field Chief Editor of the new journal Frontiers of Neuroergonomics, that focuses on mobile neurotechnology methods and applications.

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