TransLumen Technologies, LLC

Advanced Visualization Tools Screening, Testing and Training

TransLumen Overview

TransLumen Technologies, LLC - TransLumen Technologies, LLC ("TransLumen") is a Service Disabled Veteran Owned Small Business company (SDVOSB). The company was incorporated in February, 2000. TransLumen spent its early years developing its technology, filed for its patents at the beginning of 2000 and was awarded US patents #6,433,839 and #6,580,466, and Canadian Patent #CA 2,404,292. TransLumen has been awarded NASA, Homeland Security and Office of Naval Research (ONR) grants. TransLumen completed a two year contract with the Office of Naval Research, applying TransLumen's STEGC technology to Perceptual Training. This technology has been embedded into existing Lockheed combat convoy training simulators and other training systems to improve observational skills in areas with IEDs and other threat situations. TransLumen's patented technology is, Subthreshold Extreme Gradual Change (STEGC) which when applied to data-information or images/video is an unobtrusive form of visual data delivery. This provides a contiguous image display that allows display-to-display imagery without introducing visual distraction (Visual Noise).
http://www.translumen.net/index.html

Applications for Visual Disabilities and m-TBI conditions

Traumatic Brain Injuries (TBI) can range from mild to severe. Unless very obvious at the time of injury, some of these injuries that are mild, manifest symptoms later in time, such as functional changes affecting thinking, sensation, balance, movement, language, and/or emotions. Some symptoms may appear immediately after the injury and other symptoms may not appear until much later in time rather than being more manifest as in the more severe case.

TransLumen is proposing new techniques and technology for using dynamic augmented photography and video sources to enhance the ability to identify individuals with visual impairments due to

Traumatic Brain Injuries. Application of time-based contrast changes, including gradual change blindness or slower evolutions of imagery, with TransLumen's STEGC technology will provide a simpler early warning test. The proposed test will augment the current visual testing from programs such as MACE- Military Acute Concussion Evaluation and NCAT- Neurocognitive Assessment Tool among other current tool sets.

The potential benefit is to very quickly develop the next evolution of simpler tests for early diagnosis for recognition of visual and cognitive impairments that were caused by TBI. Integration with hardware, software and advanced clinical methodologies will have a prolific impact for helping to identifying a greater number of the current population with potential for this disability.

TransLumen through the development of a TBI training module that consists of time-based contrast, augmented photographic and gaming imagery, will create relevant metrics to identify potential observational and cognitive impairments. The selected imagery will provide in-context and be designed with STEGC to cover the temporal and visual spectrum from sub-gradual change blindness – low contrast levels to high contrast environmental changes. Visual elements temporally and dynamically will change below the level of perception until relevant imagery cues are identified and interpreted by the observer. Techniques require the knowledge of sub-gradual change blindness to effectively establish observational benchmarks for accurate detection and times to first response. Anomaly detection should be designed for challenging the observer to detect the obscure elements of a scene with layered levels of difficulty.

Applications should consider through the use of temporal video those cognitive variables involved in a task of visual recognition of meaningful and meaningless imagery as documented in Poppelreuter's literature. The work should take into account visual aspects for various visuo-spatial impairments and cognitive understanding as manifested through TBI.

Other Applications using STEGC

Sports Visual Testing and Training
Sport testing and training, using perceptual techniques for visual skills is a relatively new area of study. It is believed that perceptual training can be used to shorten reaction times in sport activities allowing the individual trained using perceptual techniques to be in the right spot at the right time by becoming more sensitive to subtle cues without exhibiting visual bias because of predetermined knowledge. In sports, having a finer tuned perceptions in gathering visual information within complex

movement patterns over time would offer the trained individual with earlier cues for better and more accurate player evaluations. As in TransLumen's work with the Department of Defense, if a warfighter cannot see the threat, the service member cannot react. The subtle temporal aspects of learning how to scan is TransLumen's unique patented offering. The technology can home an individual's abilities to see peripheral changes as well as environmental changes impacting an athlete's abilities.

Post-Traumatic Stress Disorder
PTSD training modules utilizing STEGC, consisting of time-based augmented photographic imagery can be generic or custom designed for PTSD patients. Modules will drive relevant content to design and measure observational, emotional and cognitive triggers. The solution entails training the patients' reasoning processes to desensitize them from prior traumatic incidences. Through the use of patented technology embedded into videos and proprietary eye tracking visual methodologies, the modules will identify those aspects of images that create anxiety in the patient. The time based videos will also be a method used to desensitize the patient through Subthreshold Extreme Gradual Change (STEGC). Videos will be personalized and effectively measure the time of first response to adverse stimuli.

By providing more calibrated data to derive information such as First Awareness Response times against evolving imagery, some patients, disturbed by viewing such videos, will be able to provide information for therapies even if they cannot communicate their issues through verbal response. Via relevant information in visual scenes controlling subtle scene management will enable the therapist to accumulate more granulated visual testing information and better data points. Increased diagnostic information will then be used by our tools to provide better remediation methods.

Technical Objectives

Visual elements will be inserted and changed over approximately 5 minutes (depending upon the testing use) with imagery changes occurring below the level of perception. Relevant imagery will be identified and interpreted through time markers. Test requirements, operating specifications, interface and simulation design along with the metrics to define the baseline for both anomaly and change detection.

Modules will be tested to calibrate the ranges for optimal timing and object identification. Using operational metric assessment criteria, baseline performance level identification, and scenario design

and validation study should be incorporated into current testing protocols for testing and training programs resident on digital displays in addition to training manuals for therapists.

Distributed Testing and Training

The testing modules will be digital files for download, DVD, or other methods for distribution such as through web-based to mobile, laptop, tablet and ultimately into in-home and medical outposts. The deliverable is to create a package of integrated offerings that include a description of the test, training materials, hardware and software capability and the technical readiness. The product is a digital file, a training document with a manual and demos, and follow-up assistance.

Methodologies need to be consistent with similar testing tools, but augmented for enhanced determination for visual impairments. Test requirements, operating specifications, interface and simulation design along with the metrics will define the baseline for both anomaly and change detection.

Heterogeneous subgroups or populations should have methodologies to allow for more effective diagnostic categorization and treatment and more effective training and education. Such efforts as perceptual processing of visual information with functions such as attention, concentration, short term visual memory, tracking ability, differentiation, integration and executive functioning will be considered in the framework of the investigation.

The embedded technology will perform the visual test and measurement via rules-based and autonomous analysis for technical assessment. Expanded assessment programs are to include software enabling incorporation of technicians' menus for additional graphical menus for almost zero delay insertion. Testing materials will be designed for fast update incorporation and deployment.

Theory of Scene Perception

It is now generally thought that observers use covert visual attention and overt eye-movements to orient the high-resolution parts of the retinas (the foveas) towards salient parts of their visual environment. The conventional view is that processing related to recognition of objects then 'takes over' in a serial manner after this exploration. Despite the apparent separation of these attentional and recognition processes, they are still critically dependent on one another, especially in the context of the perception of a complete scene.

The main visual phenomena; STEGC and as a subset- gradual change blindness are observational principles. When returning to scans, one compensates for the distraction by creating an understanding of the scene using expected images. Developing and honing advanced observational abilities will improve the students' abilities to anticipate and accurately discern relevant information from observations made.

Cognitive abilities are different from observer to observer and therefore, will work toward a range where one can obtain consistent interpretation of results among individuals. Metrics will be defined to measure and document users' ability to react to visual cues. Visual discrimination also lets us see differences between objects that are similar. Good visual discrimination helps keep us from getting confused.

TransLumen's Historical Results

TransLumen's Perceptual Training initiative was financially supported by the Office of Naval Research through a two year Broadcast Agency Announcement (BAA) contract in collaboration with Lockheed Martin. Initial independent testing by the Naval Research Laboratories yielded results that STEGC can improve trainees' observational awareness by more than 20 percent.

TransLumen can apply STEGC into operations training which can enhance a person's ability to use their own unaided capabilities, for perceptual training including watch standers, security surveillance and operators. STEGC can also be used to improve operator controls training and to develop temporal fatigue benchmarks.

TransLumen's Perceptual Training application benefits include:

* Helping trainees recognize subtle cues in complex environments, enhancing perceptual skills for improved scene perception
* Providing seamless, repetitive, virtual training environments which mirror natural events
* Reducing the time to differentiate between threat or non-threat conditions, decreasing response time
* Developing testing to identify individual observational abilities or deficiencies
* Improving an operation's security surveillance capability

Conclusion

Imperceptible change in vision related simulations (STEGC) is built upon the following:

1) People perceive scenes differently from one another. For example an individual's capability to discern such visual attributes as a) color (color blindness), b) motion/change detection and c) ability to attend to objects in their field of view.

2) Training applied to existing environments will demonstrate that imperceptible change imagery driven by the STEGC can be used to a) screen for the ability to detect minimal temporal changes, b) be used to develop attentional abilities, c) be used to increase dwell times where desirable and d) mimic real world dynamics.

3) That a) static scenes (Find Waldo) lack real world type changes, b) scanning can be ritualized and c) attention can be directed at an object indefinitely for analysis.

4) Full motion video scenes provide stimuli that may capture observer's attention and determine observers' scanning pattern due to saccades.

With STEGC, a new visual innovation, slowing visual change may actually speed up information comprehension and sustain the knowledge over time. The STEGC video can bring into view multiple visual scenes that combine graphics, text and audio; and utilize more screen real estate; engaging the participant to look for additional information in proper context including backgrounds. Creating temporal imaging could prove to identify an individual's ability to visualize against norm, diagnosis and potentially remediate with the STEGC approach as opposed to disassociated symbols and still images. STEGC will create the base for a new science to mitigate deficiencies for limited contextual information, object discrimination and recognition.