**Project Title:** Wearable Visual Aid as Treatment for TBI Associated Visual Dysfunction  
**Principal Investigator:** James Weiland, PhD  
**Organization:** University of Southern California  

**Background:** The overall goal of the proposed study is to develop and test a wearable low vision aid for task specific assistance for patients with impaired visual function after traumatic brain injury (TBI) and/or eye injury. The proposed system will analyze the visual environment of the user and communicate orienting cues without the overwhelming sensory feedback that limits current systems. This proposal is based on the testable hypothesis that a wearable system with advanced image sensors and computer vision algorithms can provide the desired and relevant information to individuals with TBI related injuries. The proposed wearable camera system, with an interactive interface, would be useful in cases where retinal damage includes the massive death of inner retinal neurons. The PI reviews existing electronic systems used to aid blind individuals, points out their weaknesses, and concludes that current electronic travel aids are inadequate, as these technologies are not widely adopted.

**Design:** The investigators will optimize a simultaneous localization and mapping (SLAM) algorithm for use in multiple object detection and identification to assist in ambulation and navigation, further develop neurally inspired attention algorithms that detect important objects in an environment to assist in search tasks, develop an algorithm for determining the gist of the user’s environment to assist in the selection of the most suitable task-specific algorithmic aid, implement a prototype wide-field, wide-dynamic-range camera for image capture and integrate it into a wearable system with a patient cueing interface, and test the portable system on visually impaired volunteers in real-world situations.

**Relevance:** TBI-associated visual dysfunction is a critical area of study. This project addresses important issues of algorithm development and hardware implementation that have both specific and broad impact (i.e., individuals suffering from vision loss as a result of other diseases such as age related macular degeneration (AMD), glaucoma, diabetes, etc.). The completion of the study has a reasonable likelihood of leading to important advances and impacting patient care in the short term. The project could benefit potential users early in the study.

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