2019 MENTOR LIST for ERI FELLOWS

The following scientists have expressed interest in mentoring fellows at the Envision Research Institute. Mentors not listed are also eligible to participate.

Factors limiting spatial vision in central vision loss, cortical adaptation and plasticity in response to vision loss

Name: Susana Chung, OD, PhD
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Research Focus: Research in our lab focuses on the understanding of how the visual system works in people with normal vision, as well as in people with uncorrectable subnormal vision (visual impairment). We combine various non-invasive techniques to study vision of people with normal or impaired vision. These techniques include standard (e.g., signal detection theory) and more contemporary psychophysical methods (e.g., reversed-correlation method), eye-movement measurements, retinal imaging using optical coherence tomography (OCT) and scanning laser ophthalmoscope (SLO) combined with psychophysical tasks, and functional magnetic brain imaging (fMRI). The ultimate goals of our research program are to understand the various limiting factors on visual performance in people with visual impairment, and to devise methods, devices or rehabilitative strategies to improve the functional vision of these people, thereby improving their quality of life.

How sensory loss affects brain and behavior: linking function to neuroanatomy

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Research Focus: My goal is to understand plasticity in the human brain by linking changes in function to changes in neuroanatomical structure, with a focus on the effects of early sensory loss. If humans become blind early in life, they only regain very limited ability to make use of vision if it is ever restored in adulthood (Interest 1) and there is "cross-modal plasticity" - brain regions that normally serve the missing sense are colonized by the remaining senses (Interest 2). These changes in the functional role of deprived cortex are accompanied by dramatic changes in both neuroanatomy and neurochemistry (Interest 3). All these factors have implications for the ability to restore sight using retinal prosthetics (Interest 4).

Using SLO/OCT measures to predict performance in tasks of daily living

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Research Focus: The use of Optical coherence tomography and scanning laser ophthalmoscope (OCT/SLO) to identify the cause of visual impairment is becoming more common. Yet how the output measures from the OCT/SLO map onto performance in tasks of daily living (e.g., reading, face perception, search) is less known. This project will use measures from the OCT/SLO (e.g., microperimetry, drusen density, eye movements) to see if they are linked to task performance (e.g., time to completion, accuracy), and how changes occur over time due to disease progression and rehabilitation.

Studies of visual perceptual phenomena in normal and in disease

Name: Vasudevan (Vengu) Lakshminarayanan, PhD
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Research Focus: My research focus combines rigorous methods of physics, applied mathematics and computation as well as visual psychophysics to study various facets of visual information processing in both normal individuals as well as in various pathologies. In my laboratory we also engage in visual psychophysics experiments as well as in computational methods. For example, we currently have a study on motion perception in autism spectrum disorders, a second study on reverse phi motion, and studies on convolutional neural networks. Another area is in developing algorithms for automatic diagnosis of glaucoma and other disorders from fundus pictures using deep learning methods as well as in the development of image segmentation and other techniques for OCT images. The work is multidisciplinary and I would like potential members to be reasonably acquainted with programming in Matlab, or Python. We are initiating some new research on using the new VR and AR devices in low vision.

Visual question answering system for the visually impaired

Name: Erik Learned-Miller, PhD
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Research Focus: My research focus is on computer vision and machine learning. I have worked on many different problems including face recognition and recognizing text in the environment for the visually impaired. I have also worked on modeling motion from video, or detection of moving object in video. I have a strong interest in statistical models and deep learning.

Advanced materials for enhancing functionality of visually impaired

Name: Anil Mahapatro, PhD
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Research Focus: The research focus of our laboratory is in biomaterials and tissue engineering. Current and past projects have included work in biodegradable metallic implants, surface modification of bio-metals for

osteointegration and therapeutic delivery, scaffolds for bone tissue engineering, multifunctional theranostic biodegradable nanoparticles for cancer therapy and wearable biosensors for detecting osteoporosis and other physiological parameters (temp and blood flow). Potential areas of interest relevant to this solicitation include but are not limited to development and evaluation of retinal prosthesis materials to assist and enhance the functionality of the visually impaired person.

Wayfinding and navigation systems for the blind, visually impaired and disoriented

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Research Focus: Dr. Namboodiri is currently working with the ERI on designing and developing indoor wayfinding and navigation systems for the blind, visually impaired and disoriented. Such work is desperately needed as technologies developed for outdoor environments such as GPS and mapping are very inaccurate for indoor environments.

Enhancing peripheral visual function

Name: Ben Thompson, PhD
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Research Focus: My research is concerned with human visual cortex development and plasticity. With regard to vision rehabilitation, I am interested in the possibility of enhancing peripheral visual function in patients with central vision loss using techniques such as non-invasive brain stimulation and visual perceptual learning. I am also interested in exploring the possible use of non-invasive brain stimulation techniques to promote recovery of vision in patients with hemianopia.

Electrophysiology and psychophysics approaches to evaluate hand-eye coordination, reading performance, balance, and mobility

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Research focus: J. Vernon Odom, Ph.D. is Professor of Ophthalmology at West Virginia University Eye Institute where he oversees the West Virginia Lions Visual Function Laboratory. His research has centered on assessment of visual function using electrophysiology and psychophysics in normal and abnormal vision and relating visual function to structure. He has several related interests and active projects. The first is evaluation of hand-eye coordination and

reading performance as function of vision asymmetry (reduced binocular function in low vision). The second is the role of vision in the control of balance and mobility, including heading discrimination.