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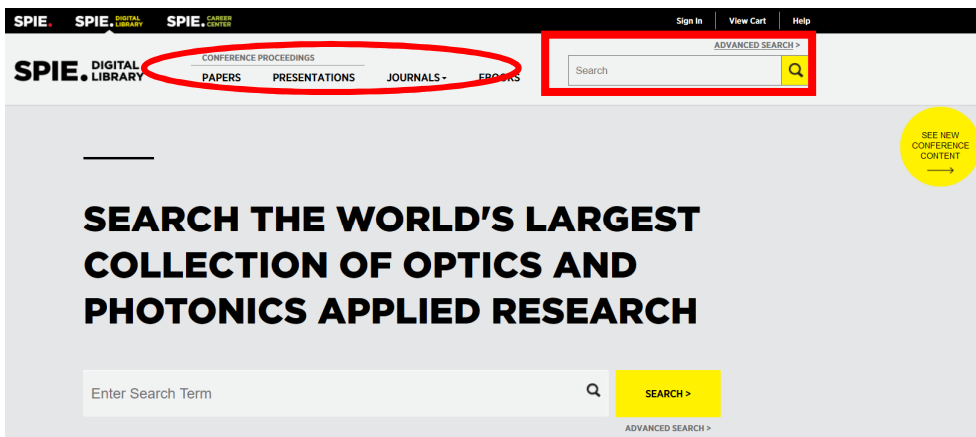
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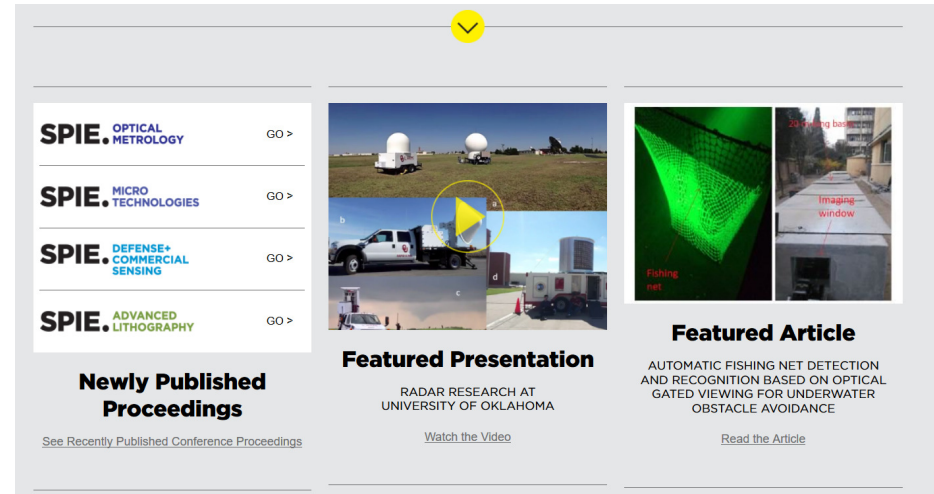
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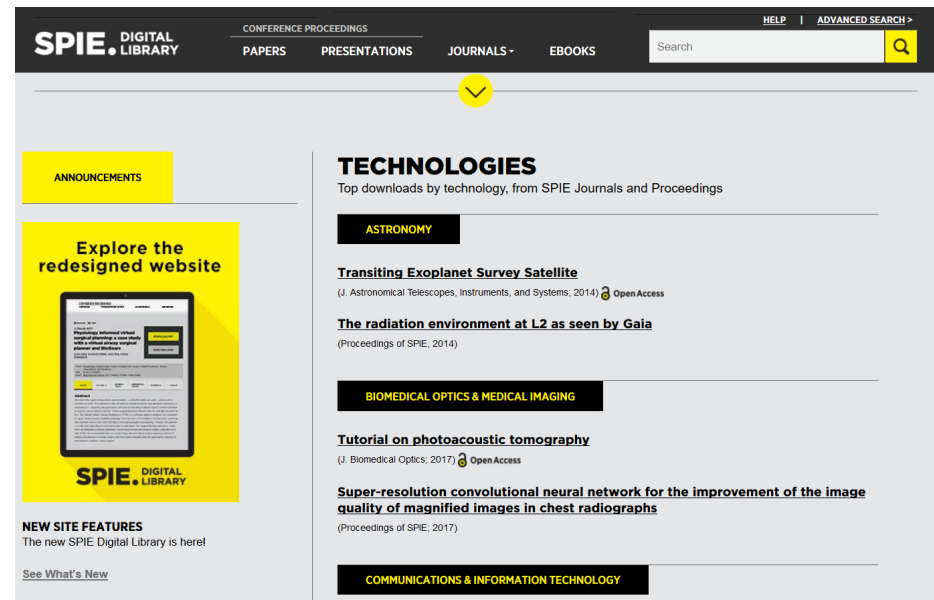
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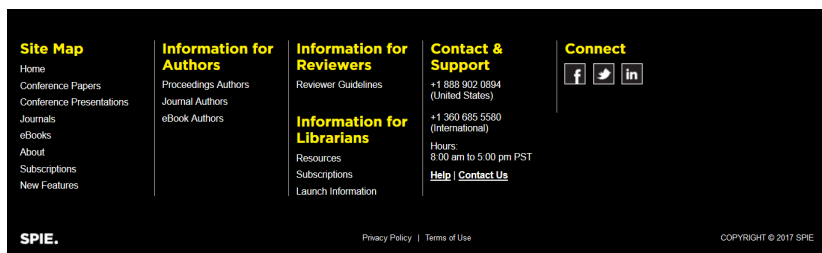
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The image shows a screenshot of the SPIE Digital Library search results page. The page is titled 'SEARCH RESULTS' and shows 1,283 results found for the search term 'Visual cortex'. The page is divided into several sections: a top navigation bar with 'ADVANCED SEARCH' and a search input field; a 'REFINE BY' sidebar on the left with filters for PUBLICATION, YEAR, KEYWORDS, ACCESS, AUTHOR, AFFILIATION, and CONFERENCE NAME; and a main content area on the right displaying search results. Each result includes the title, authors, keywords, and options to 'DOWNLOAD PDF' or 'SAVE FOR LATER'. The results are sorted by 'Relevance' and displayed 25 per page. The first result is 'The placement of visual alerts in a shared display system' by Eric Heft, Denise Aleva, and Lisa Douglas. The second result is 'Simultaneous visualization of anatomical and functional 3D data by combining volume rendering and flow visualization' by Friedemann Rödler, Daniel Weiskopf, Thomas Ertl, and Tobias Schafitzel. The third result is 'Subjective and objective measurements of visual fatigue induced by excessive disparities in stereoscopic images' by Yong Ju Jung, Dongchan Kim, Hosik Sohn, Seong-il Lee, Yong Man Ro, and Hyun Wook Park. The fourth result is 'Research for the design of visual fatigue based on the computer visual communication' by Hu-Bin Deng and Bao-min Ding. The fifth result is 'A simulator for surgery training: optimal sensory stimuli in a bone pinning simulation' by Stefan Daenzer and Klaus Fritzsche. The sixth result is 'From vision to synthesis: a new approach to the integration of image analysis, computer vision, and image synthesis' by Axel Hildebrand and Wolfgang Mueller. The seventh result is 'Parallel pathways from whisker and visual sensory cortices to distinct frontal regions of mouse neocortex' by Varun Sreenivasan, Alexandros Kyriakatos, Celine Mateo, Dieter Jaeger, and Carl C. Petersen.

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15 June 2016

Stimulus and optode placement effects on functional near-infrared spectroscopy of visual cortex

Nasser H. Kashou; Brenna M. Giacheri

Neurophotonics, 3(2), 025005 (2016). <https://doi.org/10.1117/1.NPh.3.2.025005>

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Abstract

Functional near-infrared spectroscopy has yet to be implemented as a stand-alone technique within an ophthalmology clinical setting, despite its promising advantages. The present study aims to further investigate reliability of visual cortical signals. This was achieved by: (1) assessing the effects of optode placements using the 10–20 International System of Electrode Placement consisting of 28 channels, (2) determining effects of stimulus size on response, and (3) evaluating response variability as a result of cap placement across three sessions. Ten participants with mean age 23.8±4.8 years (five male) and varying types of hair color and thickness were recruited. Visual stimuli of black-and-white checkerboards, reversing at a frequency of 7.5 Hz were presented. Visual angles of individual checker squares included 1 deg, 2 deg, 5 deg, 9 deg, and 18 deg. The number of channels that showed response was analyzed for each participant, stimulus size, and session. 1-deg stimulus showed the greatest activation. One of three data collection sessions for each participant gave different results ($p<0.05$). Hair color and thickness each had an effect upon the overall HbO ($p<0.05$), while only color had a significant effect for HbD ($p<0.05$). A reliable level of robustness and consistency is still required for clinical implementation and assessment of visual dysfunction.

1. Introduction

Over the course of its development thus far, functional near-infrared spectroscopy (fNIRS) has been employed in the areas of neurology, psychiatry, and psychology as well as in basic research with a long list of topics such as diseases, disorders, rehabilitation, reasoning, and sleep.¹ It has been used alone or in tandem with other modalities such as functional magnetic resonance imaging (fMRI).

Initially, demonstrated by Jöbsis in 1977, the first fNIRS studies were not carried out on human subjects until late 1991 and into 1992. After more than 20 years of research, much work remains to be done in this field. For example, although fNIRS may be lower in cost, noninvasive, nonionizing, and portable, it has yet to be proven as a feasible, stand-alone alternative to fMRI within many clinical settings, such as ophthalmology.

fNIRS operates on the premise that light in the near-infrared (NIR) range can be transmitted through tissue, is partially absorbed by certain chromophores—namely, oxygenated (HbO) and deoxygenated (HbD) hemoglobin—and is received by a detector at some distance from the source.² When a region of the brain is activated, or used, the oxygen demand in that region increases and it receives a corresponding increase in blood flow to (over)compensate. The overall increase in blood flow can be caused by dilation of blood vessels or possibly opening of additional vessels. This large increase in oxygenated blood flow supplied by the arteries causes a washout of HbD. It is for this reason that HbD is observed to decrease whether metabolic rate increases as has been suggested for the visual cortex or not. Typically, this is shown by an increase in the level of HbO and a corresponding decrease in HbD that is smaller in magnitude. The relation between cortical activation and blood flow is known as neurovascular coupling.

A limiting factor in fNIRS is the optode placement. Greatest levels of activation, and therefore increase in HbO, as a result of visual stimuli, have been observed from optodes that overlie the primary visual cortex^{3–5} with a greater response typically seen in the left hemisphere.^{5–8} The amount of activation measured tends to

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Visual cortex

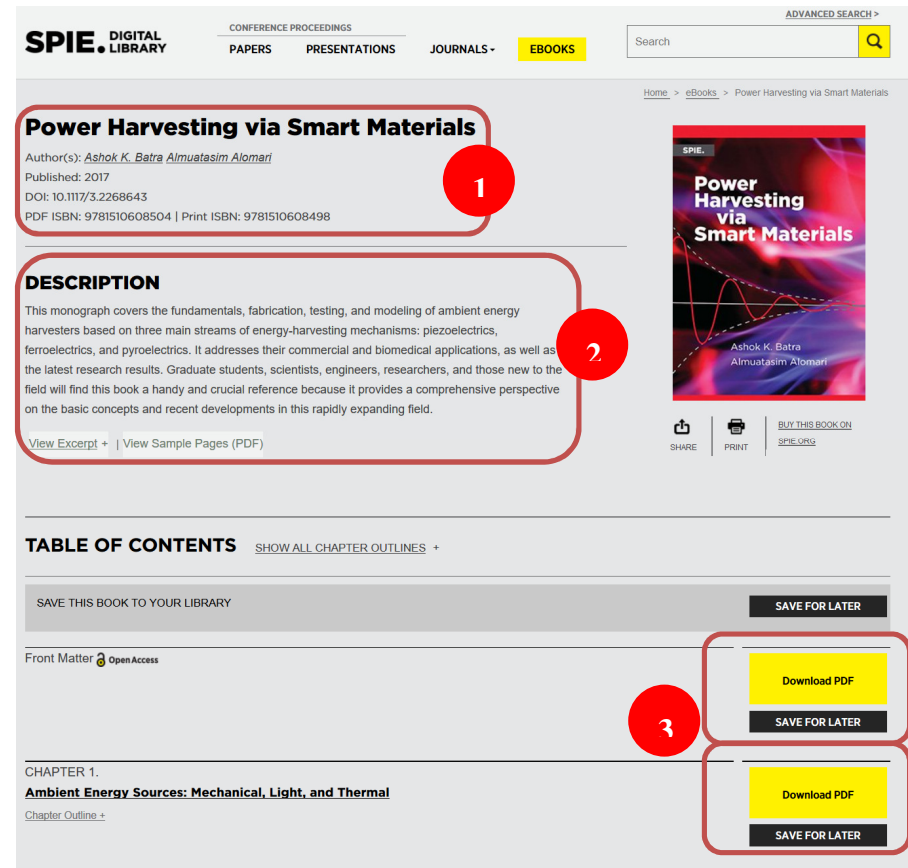
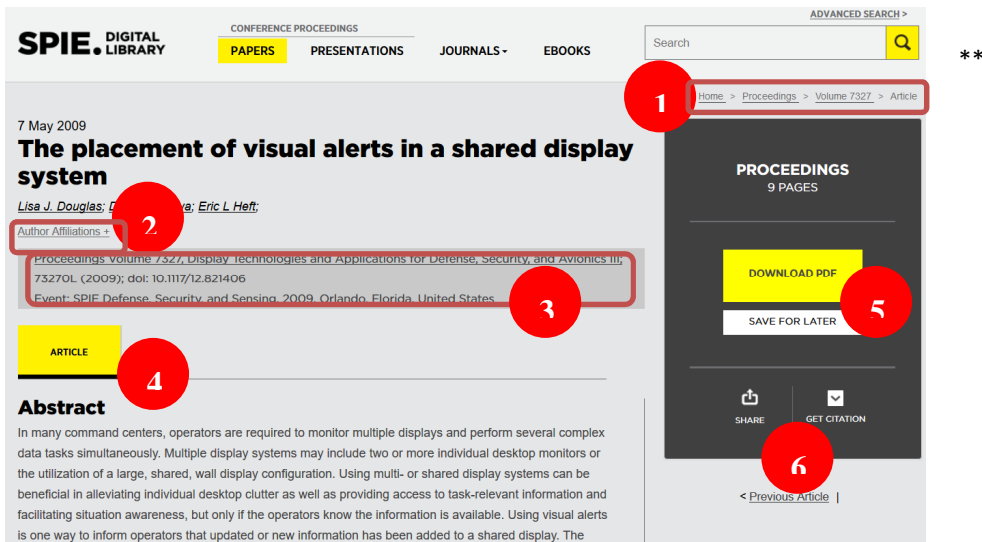
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Near infrared spectroscopy

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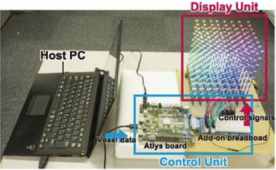
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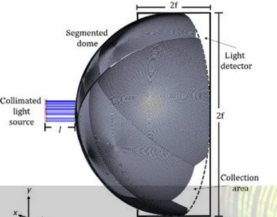
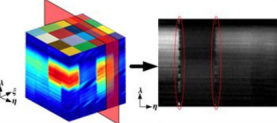
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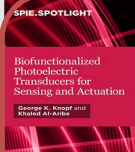
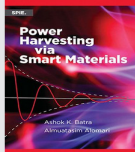
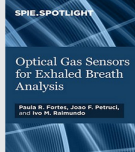
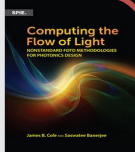
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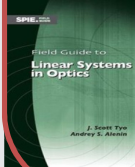
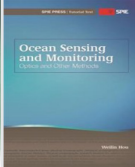
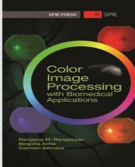
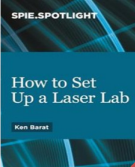
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