Eye Tracking Application in Computer Aided Diagnosis and Image Processing in Radiology

Summary (1024-character limit)
The National Institute of Health - Clinical Center (NIH-CC) seeks licensing and/or co-development of a system and method for tracking eye movement to increase the efficacy of visual diagnoses by radiologists.

NIH Reference Number
E-118-2015

Product Type
- Devices
- Software

Keywords
- Eye tracking, Computer Aided Diagnostics, CAD, Image Processing, Device, Software, Radiology, National Institutes of Health, NIH, Clinical Center, CC, Wood

Collaboration Opportunity
This invention is available for licensing and co-development.

Contact
- John D. Hewes
  NCI - National Cancer Institute

  240-276-5515

  John.Hewes@nih.gov

Description of Technology
Medical imaging is an important resource for early diagnostic, detection, and effective treatment of cancers. However, the screening and review processes for radiologists have been shown to overlook a certain percentage of potentially cancerous image features. Such review errors may result in misdiagnosis and failure to identify tumors. These errors result from human fallibility, fatigue, and from the complexity of visual search required. Screening for early detection of cancers in visual images requires physicians to scan vast amounts of complex visual information thoroughly and interpret it correctly. Small abnormalities must be identified as potentially cancerous while avoiding false positive identifications. Fatigue and bias during this review can cause physicians to favor certain locations for review and overlook other regions that may contain important abnormalities.

The Centers for Medicare and Medicaid Services have recently approved screening computed
tomography (CT) scans for patients ages 55-75 with a 15-year smoking history, which is expected to drastically increase the number of radiologic image reviews. Computer aided diagnosis (CAD) tools may become more important for radiologists to reduce diagnostic errors when screening medical images. Scientists at the National Institutes of Health – Clinical Center (NIH-CC) have developed a technology that is a CAD and eye-tracking system suitable for real-world radiology reading room settings. The system consists of an eye-tracking interface and novel algorithms to unify eye-tracking data and a CAD system. The system coordinates eye tracking and processes gaze patterns simultaneously with a deep learning algorithm in a multi-task learning platform to segment and assist the diagnosis of suspicious image features. Testing of this system in a lung cancer screening experiment with multiple radiologists shows improved accuracy in reducing false positives. The system is also generalizable to more complex applications such as prostate cancer screening with multi-parametric magnetic resonance imaging. This CAD system is able to improve radiologist diagnostic decisions during screening/diagnosis performance by determining where they have looked and tracking where they have a history of under-looking.

Potential Commercial Applications
- Cancer screening
- Computer aided diagnosis (CAD)
- Software for coordinated human/computer vision tumor detection

Competitive Advantages
- Significantly improve detection of tumors

Inventor(s)
Bradford J Wood M.D. (NIH-CC), Haydar Celik Ph.D. (NIH-CC), Ulas Bagci (University of Central Florida)

Development Stage
- Pre-clinical (in vivo)

Publications
Khosravan N, et al. A Collaborative Computer Aided Diagnosis (C-CAD) System with Eye-Tracking, Sparse Attentional Model, and Deep Learning. [article]

Patent Status
- U.S. Provisional: U.S. Provisional Patent Application Number 62/466,516, Filed 03 Mar 2017
- U.S. Patent Filed: U.S. Patent Application Number 15/912,126, Filed 05 Mar 2018

Therapeutic Area
- Cancer/Neoplasm
- Cardiovascular Systems

NCI Technology Transfer Center