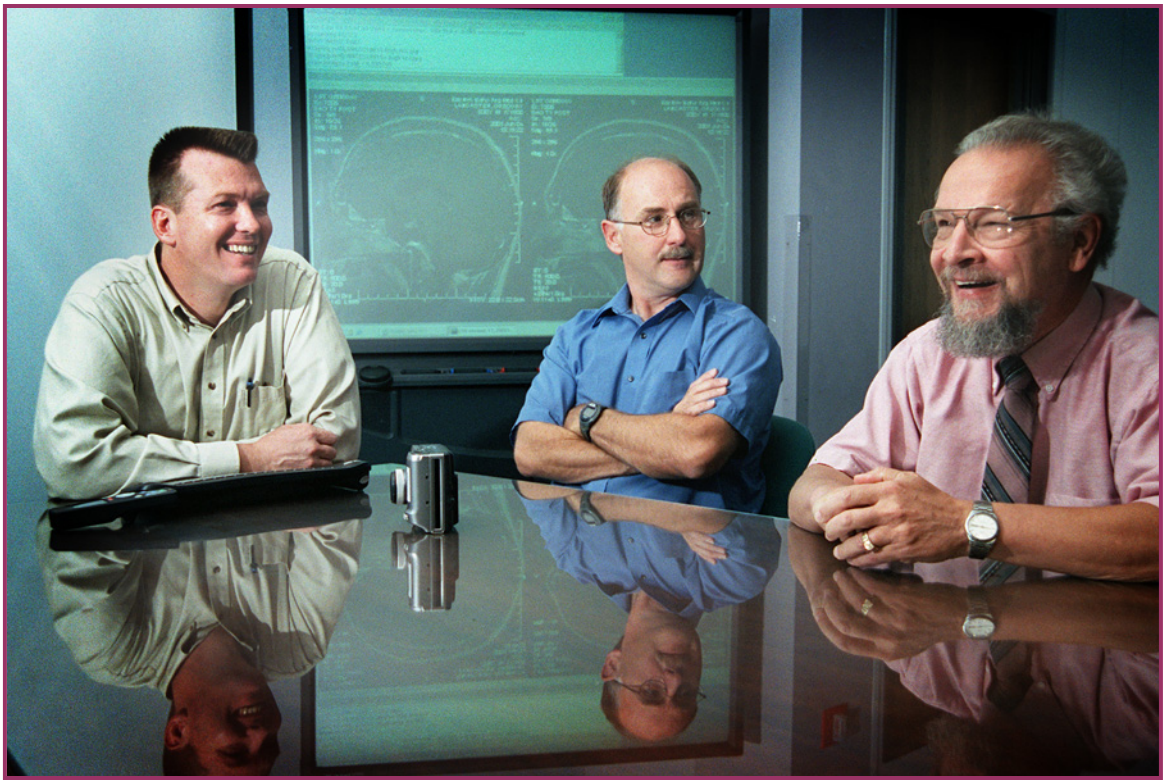


INEEL researchers Greg Lancaster, James Jones and Gordon Lassahn (retired) developed CDS, an image analysis software with revolutionary potential in medical diagnostics, national security, industrial quality control and a host of other fields. (INEEL photo)

System that won 2003 R&D 100 Award offers powerful tool

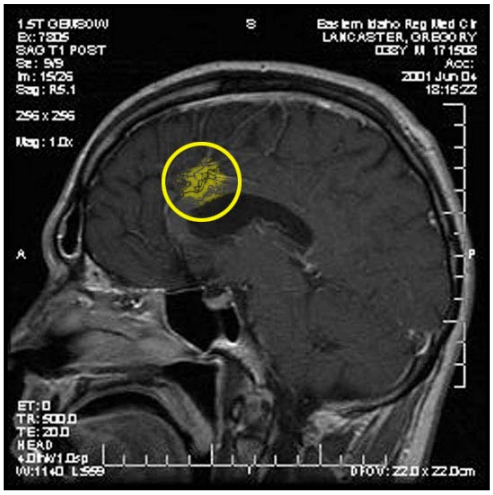
INEEL Researchers develop security imagery breakthrough

From home security to homeland security, things just got a lot tougher for bad guys hoping to go undetected. Telltale signs of mischief are often minuscule changes that are nearly invisible to the eye, even when comparing before and after images. But such signs become clear as day with the help of a new computer program that complements the natural power of the human visual system.

The **Change Detection System** (CDS) developed by scientists at the U.S. Department of Energy's Idaho National Engineering and Environmental Laboratory deftly bypasses hurdles that can complicate comparison of similar images. Be they photos of forged documents or surveillance images of container locks and seals, subtle changes are often impossible to spot by comparing side-by-side pictures. And the task is too laborious for computers, which can scrutinize every pixel but are often bogged down by trivial differences in camera angles or lighting.

The CDS technology was developed by the National Security division of the INEEL and initiated through funding from the DOE Applied Technology Program. The CDS program is already translating into other applications, including medicine and forensics.

In the past, the best technology available for comparing images has been a computerized flip-flop approach, which capitalizes on the visual reflex that draws our eyes toward motion. Rapid computerized alternation between two similar digital images creates an animation effect where identical elements seem stationary and any differences appear as movement. But the flip-flop approach requires that both pictures be shot from the exact same position using a mounted camera. Since stationary cameras are impractical in many cases, flip-flop comparisons are often impossible.



The yellow highlight above shows the hard-to-detect changes in an MRI image, that the INEEL's Change Detection System can quickly detect. (Courtesy Greg Lancaster)

Now, the CDS program developed by the INEEL's **Greg Lancaster**, **James Litton Jones** and **Gordon Lassahn** combines the strengths of rote computer analysis with the powerful human reflex elicited by flip-flop analysis. The CDS software can align images, to within a fraction of a pixel, from hand-held digital cameras. The alignment compensates for modest differences in camera angle, height, zoom or other distractions that previously confounded flip-flop comparisons.

The alignment process takes only seconds and the software is simple enough to be operated by a 10-year-old child. What's more, the 350 KB program can operate on a standard PC or even a handheld computer. The software is so quick, easy and affordable that it now boasts a spot among the 100 most technologically significant products introduced in the past year. R&D Magazine editors notified the winners in July and will feature the winning products in the September issue.

Flipping between two seemingly identical images aligned by CDS reveals once imperceptible differences—tiny defects in container locks betray tampering, infinitesimal imperfections expose counterfeit bills, footprints appear in a gravel road.

The program's utility makes it attractive to everyone from security guards to working parents, field researchers to physicians. Potential applications for this technology include surveillance (detect whether doors have been opened or cars have been moved), forensics (compare tire or shoe prints), medicine (detect early stages of disease in medical scans), home security (divulge whether drawers or rooms were disturbed), and field research (monitor environmental

changes).

As CDS hits the marketplace, it joins 28 previous R&D 100 winners developed at INEEL in the last 18 years. This is the 7th year in a row that INEEL has won a spot in the R&D 100 ranking.

The INEEL is a science-based, multiprogram national laboratory dedicated to supporting the U.S. Department of Energy's missions in environment, energy, science and national defense. The INEEL is operated for the DOE by Bechtel BWXT Idaho, LLC.

03-053

More photos: http://www.inel.gov/featurestories/08-03cds-photos.shtml

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