

Fisheye Video Imaging for Diagnosis and Monitoring

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Technology Summary

A variety of investigative settings, from medicine to law enforcement, rely on the clarity of wide-angle images in order to make accurate interpretations. At ORNL, researchers developed a computerized video imaging process that maps the coordinates of a moving image to computer-based reference coordinates. This helps to stabilize and align images for review.

The ORNL invention addresses several current imaging problems. Medical images usually have low contrast features. The borders of organs are not sharp and are difficult to locate using standard imaging techniques. Another problem is that movement occurs due to respiration, cardiac motion, and blood flow, resulting in poor alignment through the image sequence and making diagnostic temperature measurements impossible. Glare caused by lights reflecting off wet tissue surfaces, evaporative cooling, and random noise also affect clear visualization. Similar challenges exist in law enforcement, where images from traffic lights are affected by movement and moisture from adverse weather.

Fisheye lens imagery is a wide-angle lens technology for taking wide, hemispherical images by a mapping technique that evades rectilinear constraints. The ORNL invention anchors the moving images captured by the fisheye lens during surgery, making it possible to increase the clarity of organs in areas of low contrast and to minimize the effects of random motion. This enhances diagnostic accuracy. The invention registers an image by first segmenting a region and then repeating this process on multiple images in the same region. From this plurality of segments a reference image is made. The computer then maps the reference image with the individual image segments and their subpixel data is then interpolated.

ORNL researchers computed coordinate system maps for each individual image taken with the reference image. The method uses these coordinates to resample each image, aligning the reference image directly into the fisheye imaging space. The method also solves for traffic flow monitoring, vehicle counting, queue detection, and intersection management.

Advantages

- Stabilized images are computed directly in the fisheye image space
- Solves for low organ image contrast in diagnostic medical imaging
- Solves for motion during surgery, which affects the accuracy of diagnostic analysis of images
- Stabilizes images for traffic monitoring and intersection management
- Can be used with other wide-angle optics and/or catadioptric systems

Potential Applications

- Medical imaging
- Law enforcement

Patents

Timothy F. Gee and James S. Goddard, *Image registration method for medical image sequences*, U.S. Patent Application 12/117,478, filed on May 8, 2008.

Timothy F. Gee and James S. Goddard, *System and Method for Stabilization of Fisheye Video Imagery*, U.S. Patent Application 12/581,484, filed on October 19, 2009.

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