

Faster 3-D imaging could aid diagnosis of cardiovascular, gastrointestinal disease

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Researchers have developed a faster way to acquire 3-D endoscopic optical coherence tomography (OCT) images. With further development, the new approach could be useful for early detection and classification of a wide range of diseases.

The new [method](#) uses computational approaches that create a full 3-D image from incomplete data. In the Optical Society journal *Applied Optics*, the [researchers](#) report that useful 3-D images could be constructed using 40 percent less data than traditional 3-D OCT approaches, which would decrease imaging time by 40 percent.

OCT is a biomedical imaging technique that has seen expanding clinical use in recent years thanks to its ability to provide high resolution images of tissue microstructures. Today, endoscopic OCT imaging is routinely used to classify plaques and lesions in the blood vessels and is finding more use in diagnosing gastrointestinal diseases.

"Although 3-D OCT images are very useful for medical diagnosis, the significant amounts of imaging data they require limits imaging speed," said research team leader, Jigang Wu from Shanghai Jiao Tong University. "Our new method solves this problem by forming 3-D images from much less data."

Getting the whole picture

Creating 3-D OCT images with current methods requires a data-intensive process of stitching together a series of 2-D images taken at equal measurements. In the new work, the researchers used a method known as sparse sampling to acquire considerably fewer 2-D images and then applied compressive sensing algorithms to fill in the missing information needed to create 3-D images.

The researchers tested the new method using a magnetic-driven scanning OCT probe to image inside of an extracted pigeon trachea. The probe, which the team developed previously, uses an externally-driven tiny magnet to scan 360 degrees. The design minimizes the OCT scanning mechanisms enough to fit inside a device just 1.4 millimeters in diameter.

Creating 3-D images of a 2-millimeter portion of the human trachea would typically require imaging every 10 microns to obtain 200 image frames. Using sparse sampling, the researchers acquired 120 frames at random positions ranging from 0 to 2 millimeters and then used the compressive sensing algorithms to create 3-D images.

Moving toward the clinic

"Our tests verified that a greatly reduced amount of experimental data can be used to reconstruct reasonable 3-D OCT [images](#)," said Wu.

"After we perform enough experiments to demonstrate that our probe and imaging method are useful for observing malignant features, our technique will be ready for clinical trials."

The researchers plan to use their new approach to image additional biological samples related to specific diseases. They also plan to improve the endoscopic OCT probe so that it will be more robust in a variety of situations and in the context of repeated contact with biological tissues.

"This work is just one example of applying computational techniques to imaging applications," said Wu. "We expect that similar approaches may be helpful for improving the experiment designs and data acquisition for many imaging modalities."

More information: Jie Wang et al, Three-dimensional endoscopic OCT using sparse sampling with a miniature magnetic-driven scanning probe, *Applied Optics* (2018). [DOI: 10.1364/AO.57.010056](https://doi.org/10.1364/AO.57.010056)

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