



Computational Lensfree Microscopy

PATENTS
25
PATENTS

Imaging technology for point-of-care analysis and pathology screening

What is Lensfree?

Thanks to its extra-wide field of view and compact footprint, combined with artificial intelligence-based algorithms, CEA-Leti's lensfree imaging allows healthcare professionals to perform point-of-care tests that previously were done in the lab. In addition, the technology is more than 10 times less expensive than an optical microscope and can image up to 10,000 microscopic biological objects at a time. This innovation is protected by 25 patents.

How does it work?

The light (from visible to near infrared) emitted by a LED is diffracted by the biological object being analyzed to generate a holographic pattern that is captured by a CMOS image sensor. Holographic reconstruction algorithms digitally recreate the image of the object on a display. Artificial intelligence software can then detect, analyze, and even classify biological objects by tracking metrics of interest. All of these steps are automated and, therefore, non-operator-dependent.

Applications

Point-of-care testing:

The technique, using only generic hardware, can be adapted to different medical diagnostics by developing specific data-processing chains for tests like:

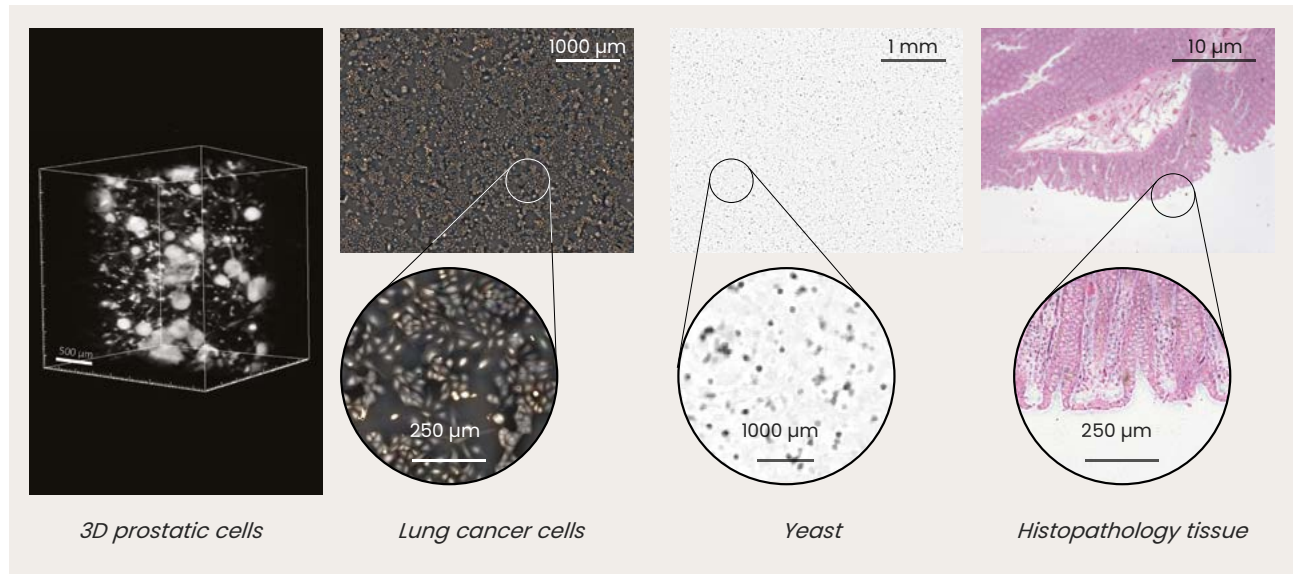
- Complete blood count
(developed in partnership with Horiba)
- Meningitis screening from spinal fluid
(developed in partnership with Marseille-Méditerranée University Medical Center)
- Blood coagulation test
(developed in partnership with startup Avalun)

Other healthcare applications:

- Monitoring of bioprocesses in bioreactors for the pharmaceutical industry: cell counts, cell viability
(developed in partnership with startup Iprasense)
- 2D imaging for standard biological research and drug screening: cell counts, motility, viability, dry mass, cell-cycle duration, etc.

What's new?

- Compact, robust, low-cost, automated system suitable for point-of-care analysis
- Large field of view of approximately 30 mm² covering more than 10,000 cells per image
- Multi-scale observation of the main morphological characteristics of cell tissues (> 100 μm) and cells (>5 μm) & bacteria detection (1 μm)
- Coupling artificial intelligence to lensless microscopy allows to image and analyze large biological datasets in a few seconds for detection, segmentation, classification, and even prediction in time



What's next?

- Further system miniaturization and development of a patient self-testing kit
- 3D microscopy for basic biological research and drug screening: spatial organization of cells, interaction of cellular and extracellular matrices at a large scale, cell migration
- Coupling with microfluidics for organ-on-chip imaging

Interested in this technology?

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