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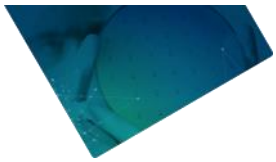


High resolution cameras and smart image analysis for faster diagnostics in digital pathology

A project within the EUREKA PENTA program

Paris, 10 June 2021 – This CAVIAR sub-project is developing a new digital camera and smart image processing for histopathology (the diagnosis & study of diseases of the tissues). These will speed up capture and analysis of scanned images, enabling faster histology slide digitization and supporting pathologists in making diagnoses and so, increased patient throughput in medical workflows. Smart processing will also help in the creation of databases of digitized microscope slides for study and training. Overall, the outcomes will address the fundamental need for improved digital pathology diagnostics at lower cost.

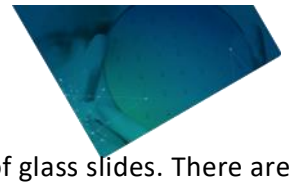
Histopathology is key to diagnosing disease (such as cancer) and to determining the biomarkers (biological molecules) which indicate the prognosis and response to specific therapies. The work involves examining tissue and cells taken from the patient in a biopsy. Traditionally, samples are placed on glass slides and viewed under a microscope. Today, digital scanners are increasingly replacing optical and digital microscopes. This project aims to further enhance the performance of these scanners and make it easier for pathologists to diagnose the huge number of images generated.

Indeed, with critical technical issues resolved – including rapid, high-resolution image acquisition, precise colour reproduction and fine detail preservation – digital microscopy is now standard in modern histopathology. Digital images of slides can be consulted onscreen, saved in hospital databases and shared over networks for primary diagnosis, teaching, tele-consultation and/or quality assurance.

The digital representation of a slide consists of discrete pixels with 'calibrated qualities' (measured characteristics). This allows for automated image analysis and signal quantification, enabling the computer to draw unbiased conclusions about samples for diagnostics and research. Data from digital tissue microarray (TMA) slides (with many samples on a single slide) and related sample data can also be collected in shared databases for high throughput, validated studies of biomarker screening at low cost and high standards. These studies help to better identify diseases on the cellular level, leading to improved patient outcomes through quicker, more reliable diagnoses.

The challenge now is to increase the throughput capacity of digital slide scanners to meet the needs of medical and research centres where thousands of glass slides are produced daily.

Project partner, 3DHISTECH, provides automated slide scanners targeting the needs of these large imaging centres. Its current camera technologies offer a top scanning rate of one minute per slide (480 slides for an eight-hour work period). The project aims to increase the camera resolution and frame acquisition speed to double this throughput, so reducing the time needed to collect patient data and facilitating faster diagnosis.



This higher slide digitization throughput will also be crucial for the digital archiving of glass slides. There are hundreds of thousands of slides awaiting digitalization, but with existing scanners the work could take many months – even with scanners working in parallel. Reducing scanning time would be a huge step towards feasible digitalization.

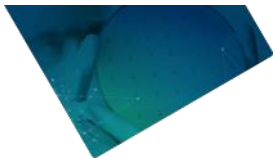
To achieve these goals, the project focuses on two key technology areas within CAVIAR: image acquisition throughput and pre-diagnostics through image processing.

Recent developments in 'CMOS area scan' sensor technology have led to sensors that deliver smaller pixels, faster frame readouts and improved image quality performance including higher sensitivity and better contrast – all of which helps reduce scan times. Plus, the new camera will support re-use of existing optical scanning technology while doubling the amount of image data per second. So, pathology labs will be able to increase their digitization capacity cost-effectively, without having to double their number of scanners.

The project is also developing smart processing algorithms and AI tools to support pathologists' analysis. In particular, the project will explore algorithms for real-time identification of suspicious cell tissue in digital images.

Further, the project aims to enable real-time analysis that can deliver results even before the scan is finished. It is creating an imaging pipeline capable of processing large medical scans patch-by-patch as they exit the scanner, supporting parallel image acquisition and processing, and faster results. The pipeline's flexible design allows for the addition of more processing hardware, so there is scope for even higher speeds. Images as large as 270 mega-pixel electron microscopy images could be processed while they are being generated, putting the most advanced computer vision algorithms at pathologists' disposal.

These new developments will bring many benefits for healthcare professionals and patients. Pathologists will be able to focus on diagnosis and the observation of large tissue areas will take less time, which is good for patients as well. Importantly, instead of a single randomly selected tissue segment, it will be possible to analyze several suspicious regions within a similar time ensuring better discovery of diseases. Plus, databases built from archived slides will help AI algorithms learn from earlier cases to support improved, more reliable diagnoses in the future.



About the PENTA programme

PENTA is a EUREKA cluster whose purpose is to catalyse research, development and innovation in areas of micro and nanoelectronics enabled systems and applications. Guided by the Electronic Components & Systems (ECS) Strategic Research and Innovation Agenda (SRIA) four technology layers, four cross-sectional technologies and six ECS key application areas, the PENTA programme enables the development of electronic solutions to help drive the digital economy through the formation of collaborative ecosystems along the ECS value chain. This creates the opportunity for rapid competitive exploitation and a strong impact on European societal challenges. PENTA supports SMEs, large corporations, research organisations and universities to work together in project consortia by facilitating access to funding, fostering collaborative work and creating consortia in areas of mutual industrial and National interest.
PENTA is managed by the Industry Association AENEAS

More on PENTA: http://www.penta-eureka.eu
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About the CAVIAR project
CAVIAR is a RD&I project consortium involving 9 partners from 4 countries. The project partners are: Grass Valley Nederland BV (Project leader), 3DHISTECH Ltd, AMS Sensors Belgium, Adimec Advanced Image Systems BV, EVS Broadcast Equipment Brussels (Belgium), EVS Broadcast Equipment SA, MS EYE TECH, TNO and Université de Bourgogne. Belgium, France, the Netherlands and Hungary Public Authorities are funding the project.

More about CAVIAR: https://caviar-project.org/