Classica: The future of AI-assisted cancer surgery

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Artificial Intelligence (AI) is becoming an indispensable tool in healthcare, improving diagnostics, treatment planning, and patient outcomes. As AI systems handle sensitive health data and make critical decisions, ethical considerations, including patient privacy, data security, and the transparency of AI decision-making processes, are paramount.

The CLASSICA project (Horizon Europe Programme) is at the forefront of integrating AI with medical technology to tackle colorectal cancer, the third most common type of cancer worldwide. CLASSICA transforms a research prototype into a vital tool for surgeons, utilising tissue fluorescence dynamics to effectively distinguish between cancerous and non-cancerous tissues.

The technology leverages the differential fluorescence intensity of tissues when exposed to indocyanine green (ICG), a fluorescent dye, and excited by near-infrared (NIR) light. This method captures and analyses the intensity curves from video frames, allowing for real-time AI-based classification of tissues during colorectal cancer surgery.

By providing surgeons with immediate insights into tissue status, CLASSICA significantly enhances the precision of tumour removal and minimises the risk of leaving cancerous tissue behind. This not only improves surgical outcomes but also reduces the need for repeat procedures.

The aim is to expand CLASSICA's impact by initiating its deployment in five leading cancer surgery centres across Europe. This includes countries like Ireland, Belgium, Austria, Italy, and the Netherlands, enhancing our platform's reach and utility in critical clinical decision-making for cancer surgery. We're embarking on a comprehensive multi-country study involving 500 patients to assess the platform's effectiveness in improving clinical outcomes. The insights gained from our clinical study will be instrumental in developing new clinical guidelines, fostering CLASSICA's integration into healthcare systems, and establishing a strong foundation for AI-supported surgical operations. Moreover, we are committed to developing comprehensive training materials for surgeons, facilitating CLASSICA's widespread adoption across European hospitals and clinics.

AI holds the promise of transforming healthcare by enabling more accurate diagnoses, personalized treatments, and ultimately, improving the quality of life for patients worldwide. Projects like CLASSICA demonstrate the potential of AI to make significant advances in the fight against cancer, marking a step forward in our journey towards a healthier future for humanity.

Interpretable AI is poised to do for NIR perfusion analysis what the compass did for navigation: provide a precise, reliable tool that enhances decision-making with a fraction of the complexity. The latest CLASSICA publication reveals our approach to embedding AI within the surgical toolkit. It focuses on the essential technical and functional design considerations crucial for developing systems for in situ cancer characterisation and tissue perfusion assessment that also adhere to medical device regulations.

Technical and functional design considerations for a real-world interpretable AI solution for NIR perfusion analysis (including cancer is a CLASSICA project publication contributed by partners, including Arctur.

In this article, published in the European Journal of Surgical Oncology, Moynihan and co-authors present practical strategies for implementing interpretable AI in NIR perfusion analysis for enhanced cancer detection and tissue health assessment.

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Introduction:

Near infrared (NIR) analysis of tissue perfusion via indocyanine green fluorescence assessment is performed clinically during surgery for a range of indications. Its usefulness can potentially be further enhanced through the application of interpretable artificial intelligence (AI) methods to improve dynamic interpretation accuracy in these and also open new applications. While its main use currently is for perfusion assessment as a tissue health check prior to performing an anastomosis, there is increasing interest in using fluorophores for cancer detection during surgical interventions with most research being based on the paradigm of static imaging for fluorophore uptake hours after preoperative dosing. Although some image boosting and relative estimation of fluorescence signals is already inbuilt into commercial NIR systems, fuller implementation of AI methods can enable actionable predictions especially when applied during the dynamic, early inflow-outflow phase that occurs seconds to minutes after ICG (or indeed other fluorophore) administration. Already research has shown that such methods can accurately differentiate cancer from benign tissue in the operating theatre in real time in principle based on their differential signalling and could be useful for tissue perfusion classification more generally. This can be achieved through the generation of fluorescence intensity curves from an intra-operative NIR video stream. These curves are processed to adjust for image disturbances and curve features known to be influential in tissue characterisation are extracted. Existing machine learning based classifiers can then use these features to classify the tissue in question according to prior training sets. The use of this interpretable methodology enables accurate classification algorithms to be built with modest training sets in comparison to those required for deep learning modelling in addition to achieving compliance with medical device regulations. Integration of the multiple algorithms required to achieve this classification into a desktop application or medical device could make the use of this method accessible and useful to (as well as useable by) surgeons without prior training in computer technology. This document details some technical and functional design considerations underlying such a novel recommender system to advance the foundational concept and methodology as software as medical device for in situ cancer characterisation with relevance more broadly also to other tissue perfusion applications.

Read the whole article here.

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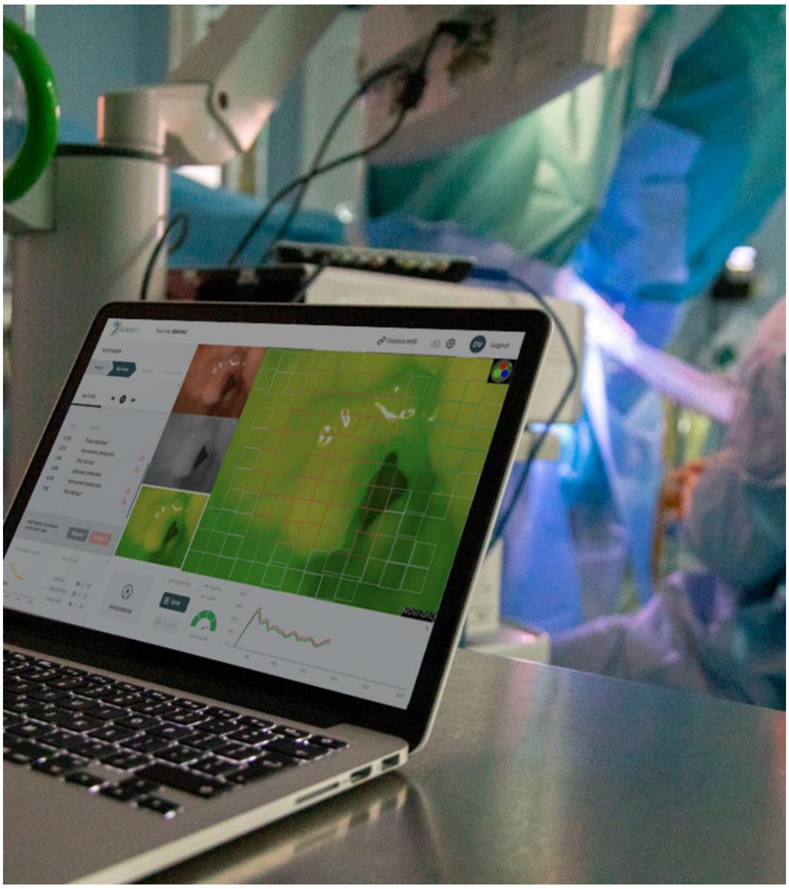

CLASSICA

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