

上海交通大学、解放军总医院两位专家讲述消化道早癌检测与创新

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消化道早癌检测与创新

2025/09/16
周二
20:00

李成栋
上海交通大学

胡树轩
解放军总医院

iCANX Youth Talks Vol. 115

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科学网APP

<https://weibo.com/l/wblive/p/show/1022:2321325211522686648396>

(科学网微博直播间链接)



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北京时间9月16日晚八点，iCANX Youth Talks第115期邀请到了上海交通大学博士生李成栋、解放军总医院胡树钊担任主讲嘉宾，上海交通大学副教授苗鹏、清华大学教授曹良才担任研讨嘉宾，解放军总医院第五医学中心消化内科主任刘岩担任主持人，期待你一起加入这场知识盛宴。

【嘉宾介绍】

李成栋

上海交通大学

基于组织动态性单帧统计门控技术的消化内镜下肿瘤检测

【Abstract】

The propagation of coherent light in dynamic disordered media generates dynamic speckle patterns, wherein the multiple scattering component with fast dynamics exhibits a shorter decorrelation time (τ) than the single scattering component with slow dynamics (τ_s). We propose a single-frame statistical gating strategy that enables the statistical separation of these two components using only a single image in reflective wide-field imaging when the exposure time satisfies $\tau < \tau_s$. This method models the spatial matrix as the sum of a negative exponential matrix (representing single scattering) and a Gaussian matrix (representing multiple scattering), and utilizes the Marchenko – Pastur distribution and the Tracy-Widom distribution to calculate the moments of each component. The effectiveness of this method was validated through dynamic electric field Monte Carlo simulations and in vivo brain imaging experiments. Based on rotational invariance, we further proposed a rotational sampling strategy, which significantly enhances the imaging quality.

In clinical applications, we applied the single-frame statistical gating strategy to the early detection of gastrointestinal cancers. This technique differentiates malignant tumors from normal tissue by analyzing differences in tissue dynamics from a single image frame. In a clinical study involving 21 patients (including 5 with malignant tumors), the method achieved an AUC of 0.91 in receiver operating characteristic (ROC) analysis, and provided up to a 24.8-fold improvement in imaging contrast compared to conventional white

light imaging. We applied the general-purpose segmentation model SAM to the dynamic indicator parameter (DIP) maps, which yielded excellent segmentation performance. This computational technique significantly enhances tissue contrast and tumor demarcation without the need for hardware modifications or exogenous contrast agents. Its plug-and-play nature allows for seamless integration into existing digestive endoscopy systems, promising broad clinical applicability.

相干光在动态无序介质中传播会产生动态散斑图案，其中具有快速动态特性的多次散射成分的去相关时间会短于具有慢速动态特性的单次散射成分。我们提出一种单帧统计门控策略，能够在曝光时间满足的反射式宽场成像中仅使用单帧图像实现二者的统计分离。该方法将空间矩阵建模为负指数矩阵（代表单次散射）和高斯矩阵（代表多次散射）的叠加，并利用Marchenko – Pastur分布和Tracy – Widom分布计算各成分的矩。通过动态电场蒙特卡洛模拟和活体脑成像实验验证了该方法的有效性。基于旋转不变性，我们进一步提出旋转采样策略，显著提升成像质量。

在临床应用中，我们将单帧统计门控策略应用于胃肠道癌症的早期检测。该方法通过单帧图像分析组织动态性差异，从而区分恶性肿瘤与正常组织。在一项包含21例患者（其中5例为恶性肿瘤）的临床研究中，该方法在ROC分析中AUC达到0.91，成像对比度较传统白光成像提升24.8倍。我们将通用分割大模型SAM应用于动态性参数DIP图实现了优秀的分割性能。该计算技术无需硬件改造或外源性对比剂即可显著提升组织对比与肿瘤边界识别能力，可无缝集成于现有消化内镜系统，具有广泛的临床适用性。

【BIOGRAPHY】

Li Chengdong, a Ph.D. candidate at the School of Biomedical Engineering, Shanghai Jiao Tong University. Li Chengdong received the Bachelors degree from Beihang University in June 2021. Research Direction: Statistical gating mechanisms in matrix optics wide-field imaging and its application in digestive endoscopy imaging. His related work has been published in Applied Physics Letters, and he delivered an oral presentation at the 2025 China Biomedical Engineering Conference and Innovative Medical Summit.

李成栋，上海交通大学生物医学工程学院在读博士生，2021年6月获北京航空航天大学学士学位。研究方向：矩阵光学宽场成像中的统计门控机制及其消化内镜成像中的应用。相关成果发表在Applied Physics Letters期刊，参加2025中国生物医学工程大会暨创新医疗峰会并作口头汇报。

胡树钎

解放军总医院

破局·新生：消化道早癌内镜下全链条诊疗微创新

【ABSTRACT】

Gastrointestinal (GI) malignancies remain among the leading contributors to the global cancer burden. For early lesions, being seen early, and being treated well is pivotal to reducing mortality and healthcare costs. This lecture will present our team's end-to-end innovations in diagnosis and therapy, including: (1) on the foundation of multimodal endoscopy, we have validated and quantified the diagnostic performance of Linked Color Imaging for early GI cancer, contributing to consensus building and standardization. We further developed and implemented a data-gated imaging framework to enhance recognition and thereby improve diagnostic accuracy; (2) under rigorous risk control, we explored a judicious extension of indications and upgrades in technical pathways, while iteratively engineering in-house devices—namely, a novel endoscopic metal clip and an intestinal protection device—to strengthen tissue closure, streamline procedural efficiency, and improve postoperative outcomes; and (3) we initiated an integrated post-resection specimen processing paradigm by establishing a point-to-point endoscopist – pathologist workflow, yielding a learnable data feedback loop. Overall, we aim to delineate a pathway from technological innovation to real-world clinical value, providing a feasible paradigm for the scalable and reproducible dissemination of early detection and early treatment.

消化道肿瘤长期位居全球肿瘤负担前列，早期病变看得见、看得早、治得好是降低死亡率与医疗

负担的关键。本次演讲将系统呈现我们团队在全链条诊疗上的探索与实践，内容包括：（1）在窄带/染色等多模态基础上，我们验证并量化了联动成像对早癌的诊断效能，推动形成规范化共识，进一步合作实践数据门控成像，实现对难辨病灶的增强识别，提升早癌诊断能力；（2）在严格风险控制下，探索适应证的合理外延与技术路径升级，同步迭代自研器械——内镜下新型金属夹与肠道保护装置，以提升闭合强度、流程效率与术后结局；（3）开创术后标本一体化处理的新理念，建立内镜医生—病理医生点对点联动流程，形成可学习的数据闭环。本报告力图展示一条由技术创新走向临床价值落地的路径，为早诊早治的可复制推广提供可行范式。

【BIOGRAPHY】

Education

2018 – 2023 B.S., Clinical Medicine, School of Medicine, Nankai University

2023 – present M.S. Candidate in Gastroenterology, Joint Program of PLA General Hospital and Nankai University

Research Interest

Clinical translational application of novel endoscopic suturing techniques in gastroenterology

学习经历：

2018—2023 南开大学医学院 临床医学 学士

2023—今 解放军总医院与南开大学联合培养 消化内科 硕士在读

研究方向：

消化内镜下新型缝合技术的临床转化应用

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