Knowledge Transfer Office
香港城市大學
City University of Hong Kong

Multistream Fusion Encoder for Prostate Lesion Segmentation and Classification

Health & Wellness

Computer/AI/Data Processing and Information Technology

Opportunity

MRI-targeted biopsy, pivotal for diagnosing prostate cancer, is transitioning to a standard of care in developed nations. Essential to this process is the task of lesion segmentation, which underpins procedures ranging from MRI-targeted biopsy to localized prostate cancer therapies. The current procedure, while manual, is not only labor-intensive but also subject to observer inconsistencies. Additionally, lesion classification, integral to pre-biopsy workflow, presents challenges due to variability in mpMRI interpretations even when using standardized guidelines like PI-RADS. Furthermore, while PI-RADS scores offer insights into lesion significance, assigning a precise Gleason grade, which is vital for accurate risk assessment, remains elusive without biopsy. The introduction of biparametric MRI (bpMRI) as an alternative to multiparametric MRI (mpMRI) offers time and cost savings. However, contemporary approaches utilizing convolutional neural networks (CNN) for bpMRI-based prostate segmentation tend to overfit due to image stacking, complicating model interpretation. Given these challenges, there exists a profound opportunity for an innovative solution that can efficiently and accurately perform lesion segmentation and classification.

IP Status
Patent filed

Technology Readiness Level (TRL) ? 4

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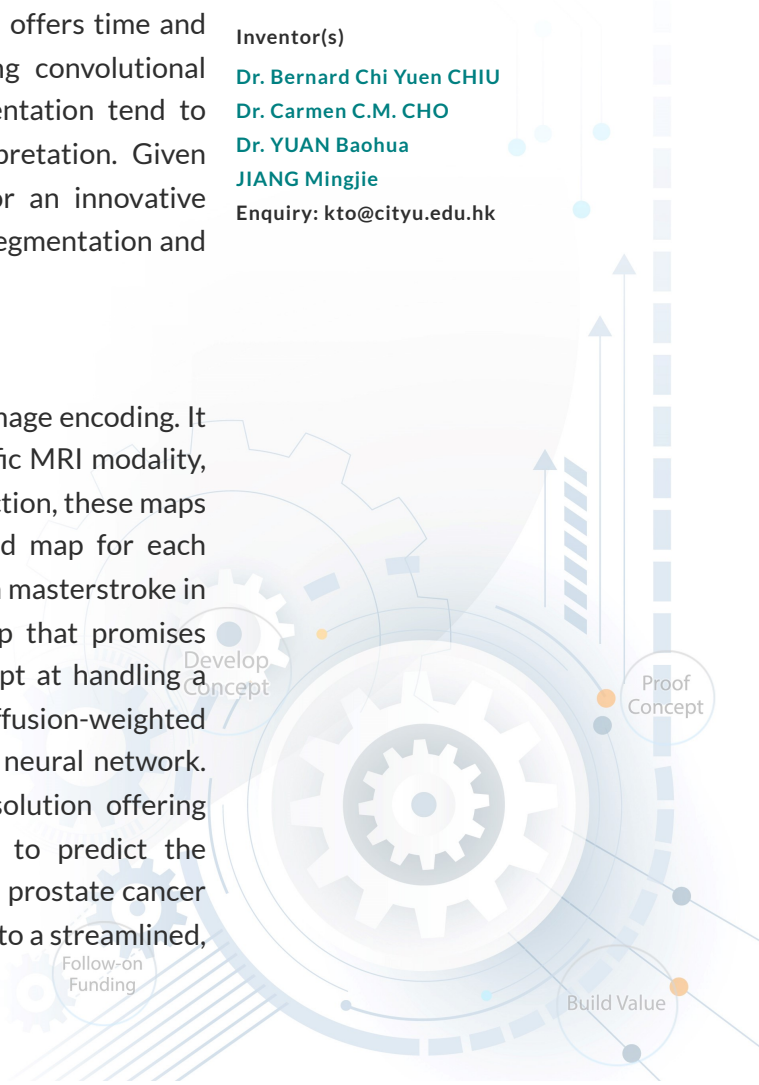
Technology

The multistream fusion encoder is a game-changer in MRI image encoding. It has multiple feature extractors, each fine-tuned for a specific MRI modality, which drastically refines feature map extraction. Post-extraction, these maps undergo an innovative fusion process, yielding a weighted map for each modality. The most standout feature is the fusion operator, a masterstroke in combining feature maps, producing a fusion-encoded map that promises unmatched precision. What's more, this technology is adept at handling a variety of MRI images, including T2-weighted and diffusion-weighted imaging images. Building on this, we have the multistream neural network. Not just a layer-by-layer encoder, it's a comprehensive solution offering advanced lesion segmentation and, crucially, the ability to predict the Gleason grade. In essence, we're looking at a seismic shift in prostate cancer diagnosis - transitioning from manual, inconsistent methods to a streamlined, precise, and automated system.



Advantages

- Automated segmentation and classification of prostate lesions, reducing the reliance on manual segmentation.
- Improved accuracy in segmenting and classifying prostate lesions compared to previous methods.
- Prediction of Gleason grade without human intervention, benefiting patient management.
- Flexible and computationally efficient architecture that can be integrated into existing multistream networks.
- Potential for substantial time and cost savings compared to traditional multiparametric MRI.

Applications

- MRI-targeted biopsy for diagnosing prostate cancer.
- Focal prostate cancer therapies such as high-intensity focused ultrasound, cryotherapy, or brachytherapy.
- Pre-biopsy workflow for triaging patients for biopsy.
- Prostate cancer research and clinical trials.
- Development of new imaging techniques and protocols.