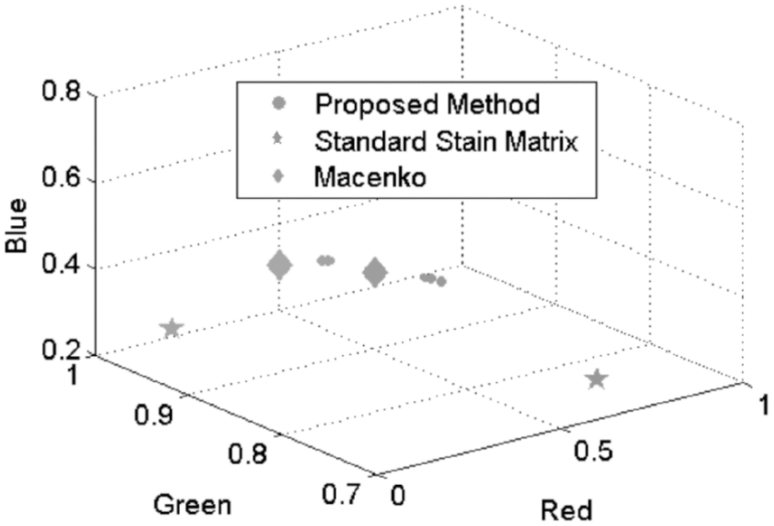

Stain vectors (for two stains H&E) estimated for a tissue specimen using $\hbox{seven}$ different values of T_p (0.7,0.75,0.8,0.85,0.9,0.95,0.99) represented with increasingly big size of circle. The color of each symbol corresponds to what would be produced by the stain vector. The stars represent the standard stain vectors [20]. Diamonds represent stain vectors estimated using [9].

ıtext in source publication

Context 1

... significant increase (≈ 16%) in classification accuracy if 1-D SCD is used along with RGB pixel information. It was further observed that the results do not show any statistically significant improvement in classification accuracy if 2-D or 3-D SCDs are used (see [19] for further validation). Therefore, in all of our experiments, we used 1-D SCD. Fig. 8 demonstrates the sensitivity of the threshold value T p used to estimate stain matrix. Stain vectors (for two stains H&E) are estimated and plotted for a tissue specimen using differ- ent values of T p . Notice that all the recovered stain vectors form tight clusters which lead us to conclude that the proposed method is not sensitive ...

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ıtions

... The adherence to a defined protocol for H&E and IHC staining is crucial to minimize the variability between batches of slides, but some level of variability will still occur due to imperfections in tissue sectioning or changes in tissue composition. Staining variability can be compensated for after image acquisition by normalization to a standard using several suggested methods (Macenko et al., 2009; Khan et al., 2014; Bejnordi et al., 2016;Alsubaie et al., 2017;Roy et al., 2018;Anghel et al., 2019). Stain normalization is especially important when incorporating external datasets due to potential differences in staining protocols and image capture systems. ...

Deep Learning of Histopathology Images at the Single Cell Level

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Sep 2021

Kyubum Lee · John H Lockhart · Mengyu Xie · Ritu Chaudhary · Aik Choon Tan

The tumor immune microenvironment (TIME) encompasses many heterogeneous cell types that engage in extensive crosstalk among the cancer,…

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... I max and I min are the maximum and the minimum in the image. Then, the anisotropic filtering method [42] [43][44] is used to process the image. The filtering method is the nonlinear spatial transformation based on the partial differential equation. ...

Superpixel/voxel medical image segmentation algorithm based on the regional interlinked value

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Aug 2021 · Pattern Anal Appl

Lingling Fang · Xin Wang · Mengyi Wang

Medical image segmentation can effectively overcome human perception with strong personal limitations. The superpixel/voxel segmentation method has strong…

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... Thus, we trained a support vector machine (SVM) for each individual's collection of stained images. Four features were used to train and predict: the pixel's RGB values, and descriptor (SCD) (Khan, Rajpoot, Treanor, & Magee, 2014) . In all cases, the accuracy of each SVM was above 90%. ...

Immunosuppressive niche engineering at the onset of human colorectal cancer

Preprint Full-text available

Aug 2021

Chandler Gatenbee · Ann-Marie Baker · Ryan Schenck · Maximilian Strobl · Alexander Anderson

The evolutionary dynamics of tumor initiation remain undetermined, and the interplay between neoplastic cells and the immune system is hypothesized to be critical in…

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... This evident request drives an active research. Conventional image processing such as color deconvolution or lookup tables with the need for selecting a reference template slide for normalization are widespread [1][2][3] [4] [5][6]. A particular but quite similar issue is stain quantification [7,8]. ...

Normalization of HE-stained histological images

Article Full-text available

Aug 2021 · Diagn Pathol

Marlen Runz · Daniel Rusche · Stefan Schmidt · Martin R. Weihrauch · Cleo-Aron Weis

Background Histological images show strong variance (e.g. illumination, color, staining quality) due to differences in image acquisition, tissue processing,…

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... The pathologists have been beneficiated directly by these applications because they could propose tailored therapies based on individual profiles and spend more time focusing on more complicated cases that are not as quickly diagnosable. Even though the number of digital images generated for diagnostic and therapeutic purposes is increasing rapidly (65), extensive experimental comparisons and stateof-the-art surveys are difficult tasks because most data are not public (66) and because there are substantial differences in acquisition protocols, tissue preparation and stain reactivity (67). ...

What is new in computer vision and artificial intelligence in medical image analysis applications

Article Full-text available

Aug 2021

Jimena Olveres · Germán González · Fabian Torres · José Carlos Moreno-Tagle · Boris Escalante-Ramírez

Computer vision and artificial intelligence applications in medicine are becoming increasingly important day by day, especially in the field of image technology. In this…

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... Use of image pre-processing and augmentation prior to developing deep learning models can regularise the input images, thereby, mitigating the potential for bias in the training of the CNN, or other deep learning models, and its independent validation [13][14][15][16]. Among these, the most common techniques include class-balancing [17], image normalisation [18] , and image augmentation [19]. These techniques often involve the use of multiple coding libraries, which in turn

requires knowledge of the documentation before implementation. ...

... Herein we present HistoClean; an open-source, high-level, graphical user interface (GUI) for image pre-processing. HistoClean aims to complement other open-source software and deeplearning frameworks in the bio-image analysis ecosystem [18, 19] . HistoClean's image preprocessing toolkit is divided into five functional modules based on computational methods frequently used in histological image pre-processing; image patching, whitespace thresholding, dataset balancing, image normalisation and image augmentation (Figure 1). ...

... Batch effects in staining (Figure 4a) can significantly influence model performance [13]. Image normalisation can be used to bring uniformity to the images in the dataset by adjusting the range of pixel values of an input image, according to that of a target image [18] . For this reason, HistoClean includes an image normalisation module based on histogram matching from the Python library scikit-image [28].

HistoClean: Open-source Software for Histological Image Pre-processing and Augmentation to Improv…

Article Full-text available

Aug 2021

Kris D. McCombe · Stephanie G. Craig · Amélie Viratham Pulsawatdi · Javier I. Quezada-Marín · Jacqueline A. James

The growth of digital pathology over the past decade has opened new research pathways and insights in cancer prediction and prognosis. In particular, there has been …

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... The StainGAN model (Shaban et al., 2019) uses a CycleGAN to map between domains in the MITOS-ATYPIA dataset (Roux et al., 2014) containing pairs of tissue images where each pair corresponds to images of the same tissue specimen that have been captured using different digital slide scanners. When measuring structural similarity (SSIM) between synthetically transferred images and the corresponding ground truth image, StainGAN was found to be more effective than many traditional methods such as those presented in (Reinhard et al., 2001;Macenko et al., 2009b; Khan et al., 2014; Vahadane et al., 2016). This demonstrates that CycleGANs are effective at transferring the colour appearance of images from different scanners. ...

Multi-Channel Auto-Encoders and a Novel Dataset for Learning Domain Invariant Representations of…

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Andrew Moyes · Richard Gault · Kun Zhang · Ji Ming · Jing Wang

Domain shift is a problem commonly encountered when developing automated histopathology pipelines. The performance of machine learning models such as…

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... Whole slide images in CPath are inherently susceptible to small changes due to factors like compression, rescanning, differences in scanning equipment, staining protocols and environment, etc. [17, 18]. Even when there is no malicious intent to deliberately fool a system, a model may encounter examples that are visually similar to the samples it was tested on but contain slight variations in intensity values. ...

Now You See It, Now You Dont: Adversarial Vulnerabilities in Computational Pathology

Preprint Full-text available

Jun 2021

Alex Foote · Amina Asif · Ayesha Azam · Nasir Rajpoot · Fayyaz Minhas

Deep learning models are routinely employed in computational pathology (CPath) for solving problems of diagnostic and prognostic significance. Typically, the…

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... Use of image pre-processing and augmentation prior to developing deep learning models can regularise the input images, thereby, mitigating the potential for bias in the training of the CNN, or other deep learning models, and its independent validation [13][14][15][16]. Among these, the most common techniques include class-balancing [17], image normalisation [18] , and image augmentation [19]. These techniques often involve the use of multiple coding libraries, which in turn requires knowledge of the documentation before implementation. ...

... ; https://doi.org/10.1101/2021.06.07.447339 doi: bioRxiv preprint Herein we present HistoClean; an

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Kristopher D McCombe · Stephanie G Craig · Amélie Viratham Pulsawatdi · Javier I Quezada-Marín · Jacqueline A James

The growth of digital pathology over the past decade has opened new research pathways and insights in cancer prediction and prognosis. In particular, there has been …

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... where represents the intensity in OD space, represents the intensity in RGB space, and represents the illuminating intensity incident on the sample [45]. Khan et al. proposed a method to use stain colour descriptors to compute image-specific stain matrices for stain normalisation [46] . Then, stain separation is applied to obtain different stain concentration values from the image and provide a nonlinear (spline based) mapping function; meanwhile all images will be replaced using the normalised stain channels [46]. ...

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meanwhile all images will be replaced using the normalised stain channels [46]. Unsupervised method for stain separation: Training is not required because it is expected to learn itself [47]. ...

A Review of Computer-Aided Expert Systems for Breast Cancer Diagnosis

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Jun 2021

Xin Yu Liew · Nazia Hameed · Jeremie Clos

A computer-aided diagnosis (CAD) expert system is a powerful tool to efficiently assist a pathologist in achieving an early diagnosis of breast cancer. This…

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