Bachelor end project: Correction of blocking artifacts in histological images

Context: Pathology departments use specific scanners to digitize histological slides for archiving and analysis purpose. Although such acquired images appear like slides observed through a conventional light microscopy, some subtle artifacts can be noticed.

In particular, subtle blocking artifacts (or stitching artifacts) can be found in digital images and it can be assumed they stem from the hardware (robotics, dynamic focusing), and software (stitching, registration, compression) of the scanners.

The goal of the project is to develop an algorithm for automated correction of block artifacts in digital slides and evaluate if such corrections can bring some improvement to state-of-the-art analysis algorithms.

Suggested approach (guideline):
The project aims at focusing on small image patches of interest extracted from whole slide images which contain block artifacts. The developed algorithm would be 2-folded:

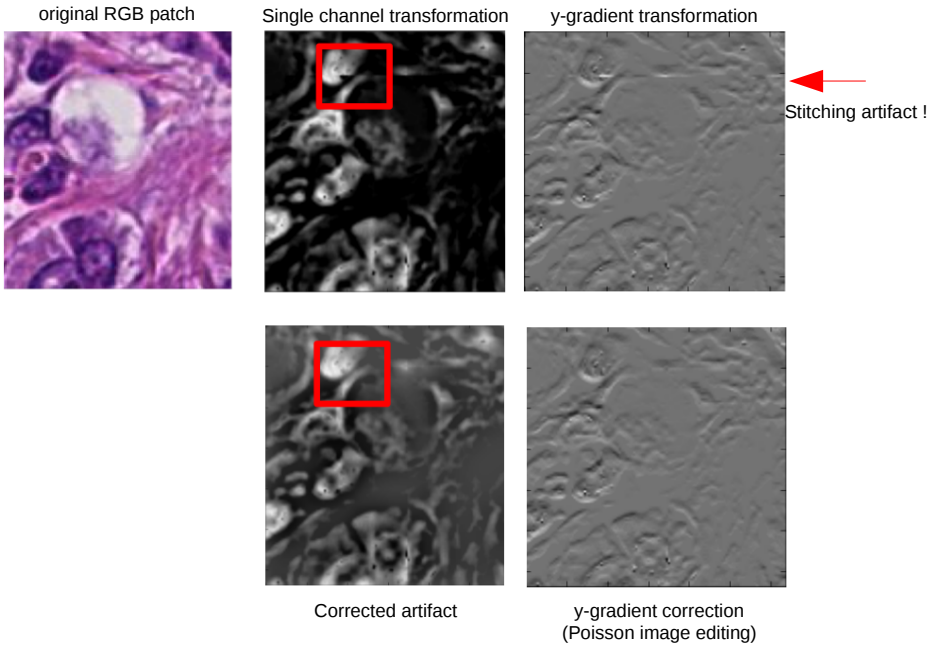
1) Automated detection of block artifacts:

Block artifact can be detected by statistical analysis of image gradients (gradient transformation, total variation) and simple statistical methods (robust thresholding approach).

2) Automated correction of block artifacts:

Methods derived from *Poisson equation* are efficient to correct images based on their gradient, and seem suitable for this problem. Such methods can be implemented using the *Gauss-Seidel* iterative solver for instance.

Example (proof of concept):



Final Evaluation: As a final goal, the carried out algorithm would be applied on a state-of-the-art mitosis detector in order to conclude if the implemented block artifact correcter could bring any improvement.

References:

1) https://en.wikipedia.org/wiki/Total_variation_denoising
2) Perez, P., Gangnet, M., & Blake, A. (2003, July). Poisson image editing. In ACM Transactions on Graphics
(TOG) (Vol. 22, No. 3, pp. 313-318). ACM.
3) Sadeghi, Mohammad Amin, Seyyed Mohammad Mohsen Hejrati, and Niloofar Gheissari. "Poisson Local Color Correction for Image Stitching." *VISAPP (1)*. 2008.

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