Digital distortion correction in OpenWSI

We correct the distortion by the following steps:

First, we use a known binary hole-array mask as the sample and capture the corresponding brightfield image in Fig. 1.

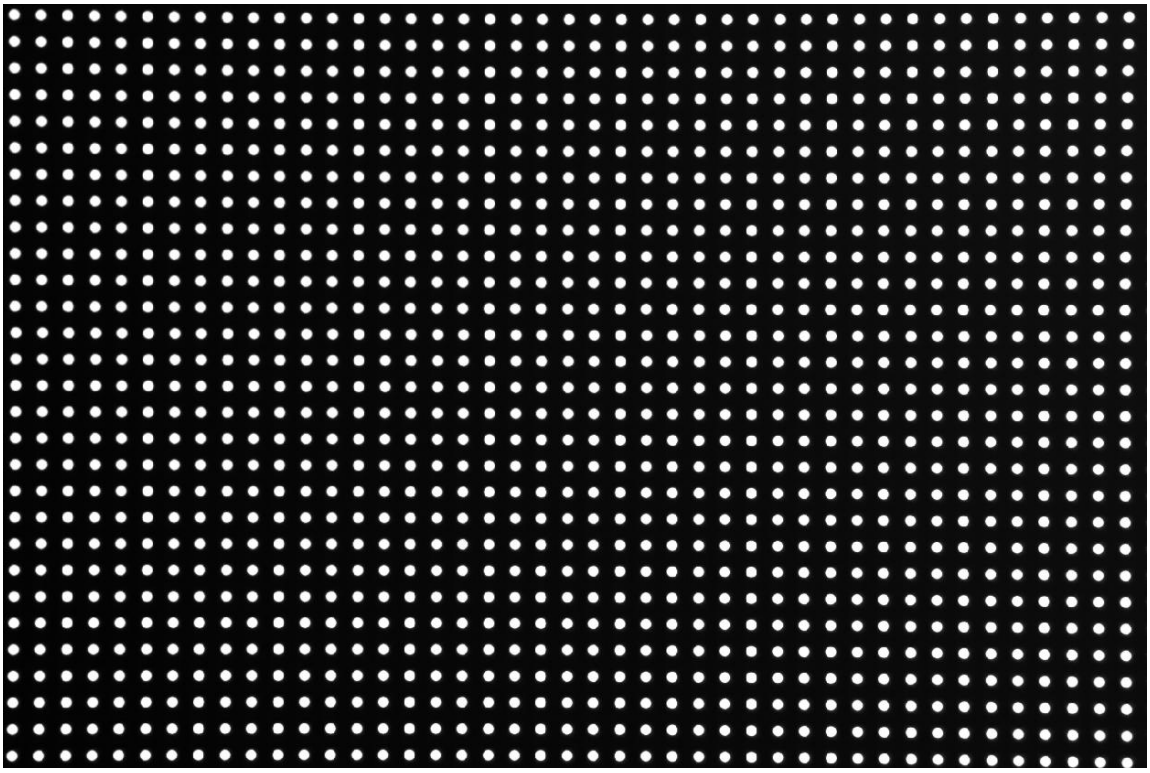

Figure 1: Captured distorted hole-array mask.

Second, we match the central holes with that of the ground-truth mask. At the edge of the captured hole array image, we can see the position mismatch between the ground-truth mask and the captured image, as shown in Fig. 2(a).

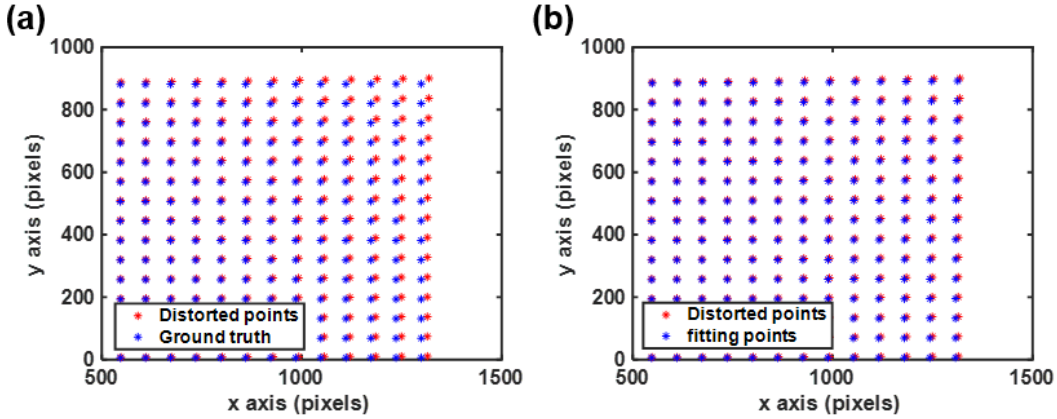

Figure 2: (a) Hole positions of the captured raw image (red points) and the ground-truth mask (blue points). (b) Hole positions of the captured image after the fitting process.

Third, we fit the distorted hole-positions using those of ground-truth hole positions:

$$x_{distort} = x(1 + k_1(x^2 + y^2) + k_2(x^2 + y^2)^2)$$

$$y_{distort} = y(1 + k_1(x^2 + y^2) + k_2(x^2 + y^2)^2)$$

where x and y are the ground-truth pairs, $x_{distort}$ and $y_{distort}$ are the distorted pairs, k_1 and k_2 are the coefficients for calibration. In Fig. 2(b), we can see that the fitted hole positions are well aligned with the positions of the ground truth mask.

Fourth, we apply the coefficients to correct the distortion of the raw captured images. We correct the distortion of all tiles we captured. For each image, the processing time is ~0.13 seconds. In Fig. 3, we show the stitching performance with and without the reported distortion correction process. We can see that there are no stitching artifacts after performing distortion correction. The demo code can be found in 'Demo code'.

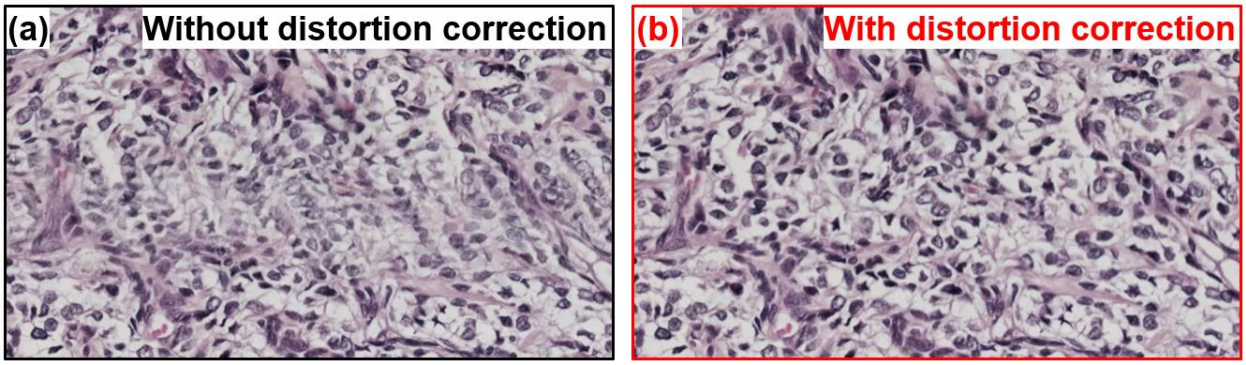

Fig. 3. Stitching performance without (a) and with (b) distortion correction.