

Importance of Shock filter and Segmentation process in pore properties determination of NAA membranes

An image of disordered NAA membrane with asymmetric pores has been chosen intentionally for demonstrating the importance of shock filter and segmentation processing. Figure S1 (a) shows a raw image of the NAA membrane which is noisy and blurred (assuming a shift invariant out-of-focus blur). The resulting image after shock filter application, is shown in Figure S1 (b). One can clearly observe that the clarity and noise reduction have improved.

Figure S1 (c) shows the image of pores segmented using the raw image(Figure S1 (a)). Performing the segmentation on the raw image causes undesired connections between pores and too many nearby pores combine to form spurious bigger pores. This severely affects the pore diameter calculation.

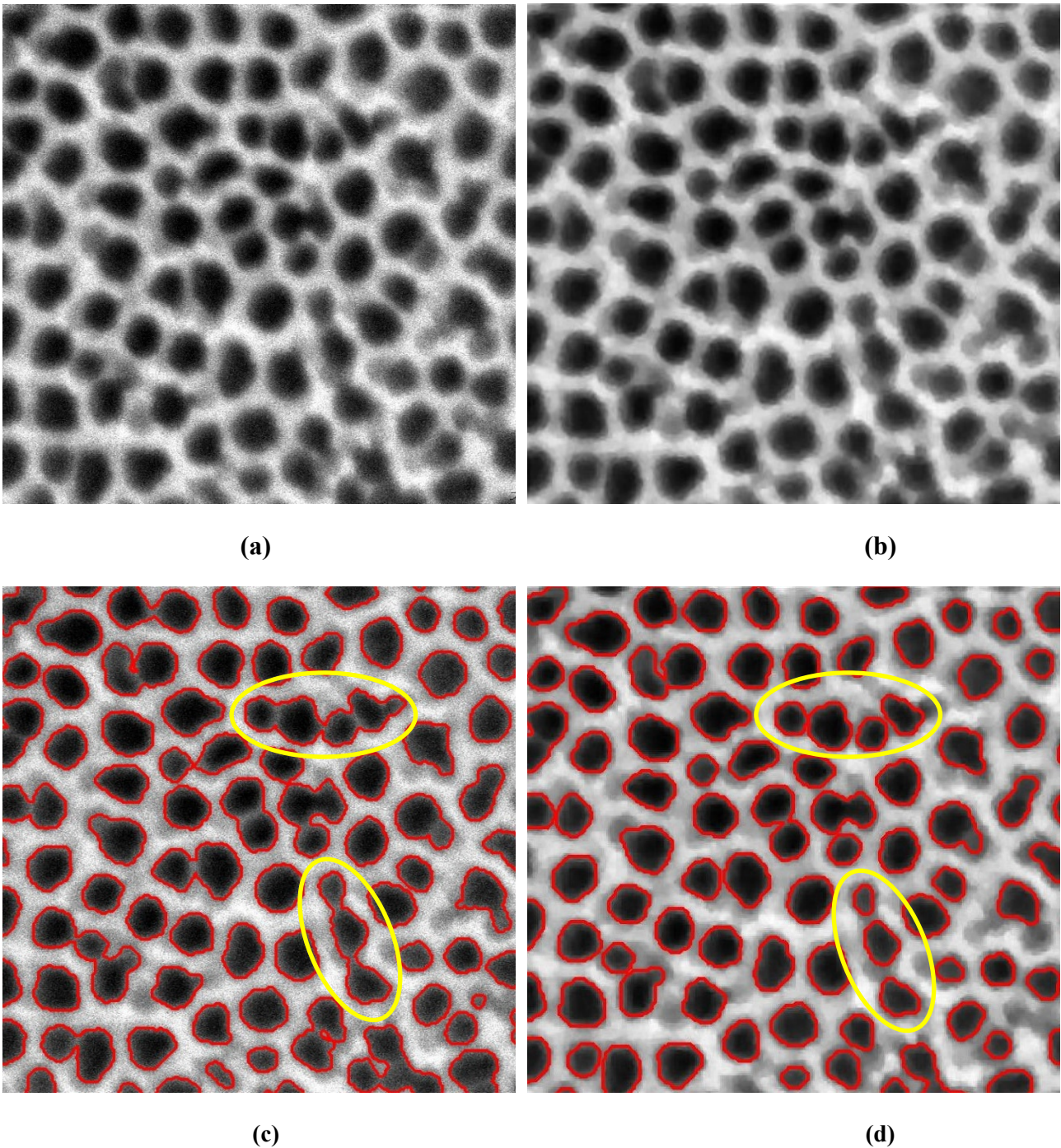


Figure S1(a). The original (raw) image (blurred and noisy) (b) the image processed using the shock filter (c) the pores segmented using the original (raw) image (d) the pores segmented using the shock filtered image.

We can see that multiple pores are identified jointly as a single large pore (Figure S1(c)), leading to significant errors in determining pore properties. In fact, these pores exist as separate pores and ideally any image processing technique is expected to identify these individually. After the use a of shock filter to eliminate noise and bluriness, (Figure S1(d)), the same pores are now identified as individual pores irrespective of their shape and symmetry. This can be evidenced by comparing the highlighted portions of the image, Figure S1(c) and (d). Thus shock filtering is an inevitable step in effective pore analysis. This also demonstrates that our new algorithm can be used to analyze the pore properties of samples with asymmetric pores.