

# Medical Image Processing for Diagnostic Applications

## Defect Pixel Interpolation – Examples

Online Course – Unit 18

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# Topics

## Examples

## Applications

## Summary

Take Home Messages

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## Interpolation Results

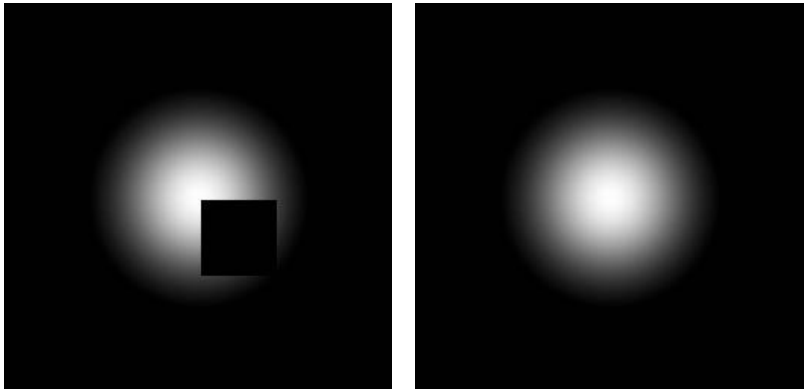


Figure 1: Synthetic image with a square artifact (left) and the result after 100 iterations (right)

## Interpolation Results

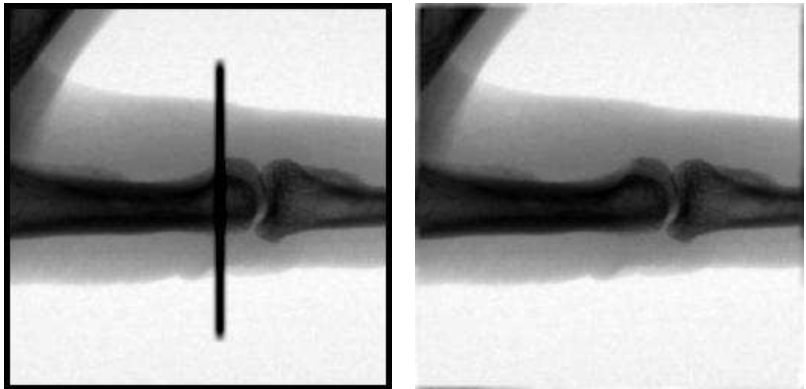


Figure 2: Original image including defects (left) and the result after 500 iterations (right)

## Interpolation Results



Figure 3: X-ray image with defects (left) and the result of interpolation after 500 iterations (right)

## Interpolation Results

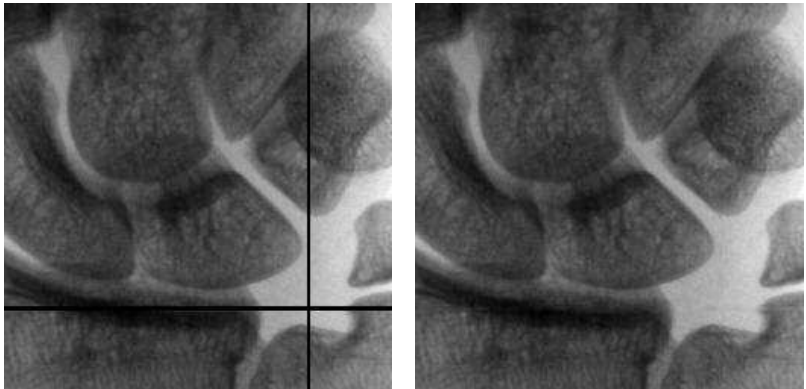


Figure 4: X-ray image with defects (left) and the result of interpolation after 1000 iterations (right)

## Interpolation Results

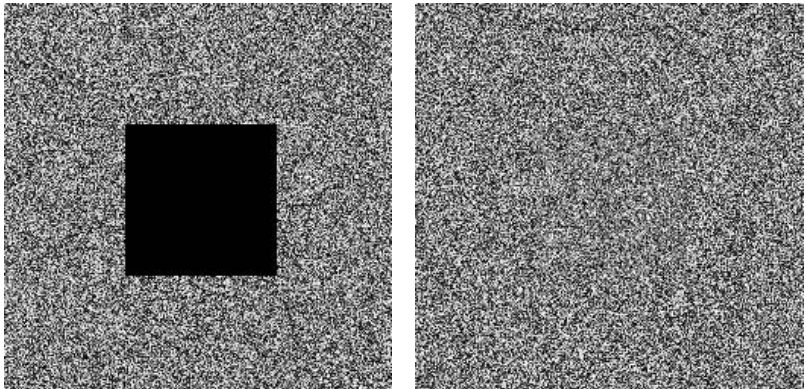


Figure 5: Artificial noise image with defect pixels (left) and the result of interpolation after 1000 iterations (right)

## Interpolation Results

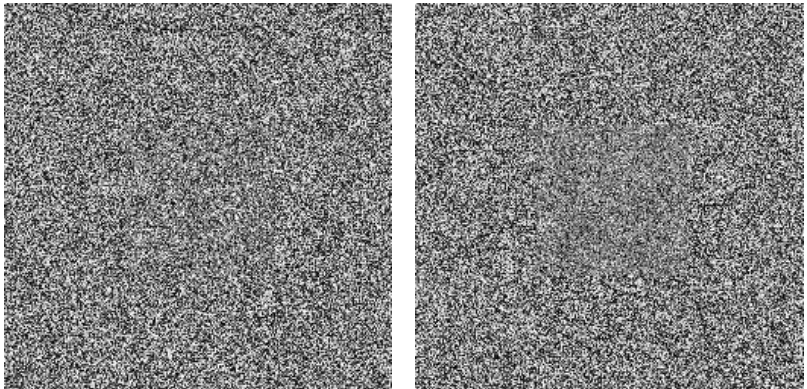


Figure 6: Result of interpolation after 1000 (left) and 5000 iterations (right)



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## Application to Endoscopy

- Endoscopy: wet surfaces lead to specular reflections
- Segmentation of highlighted areas
- Apply defect interpolation

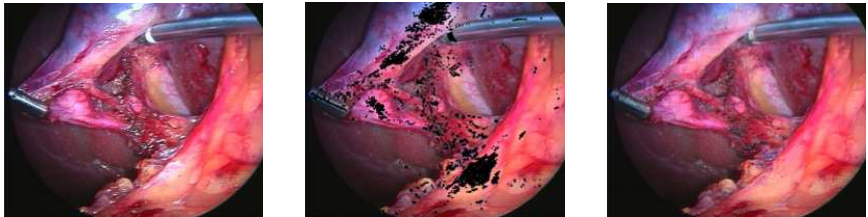


Figure 7: Endoscopy image with reflections, segmentation result, and result of interpolation (image courtesy of Xie Weiguo)

## Application to Ophthalmology

### Color images in Ophthalmology

- In Ophthalmology the early diagnosis of diseases is done on the basis of retina images.
- For the diagnosis of Glaucoma disease, sometimes vessel structures are less important and misleading.



Figure 8: Color image of retina showing also the papilla, veins and arteries

## Application to Ophthalmology

### Eliminate vessel structures:

- Perform a segmentation of vessels, i. e., identify all image points that belong to a vessel.
- Consider pixels of vessels as defects.
- Run a defect pixel interpolation algorithm on images with defects.

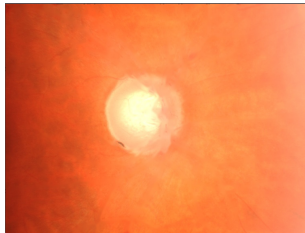


Figure 9: Segmented image (left) and image after defect pixel interpolation (right)

## Application to CT Angiography

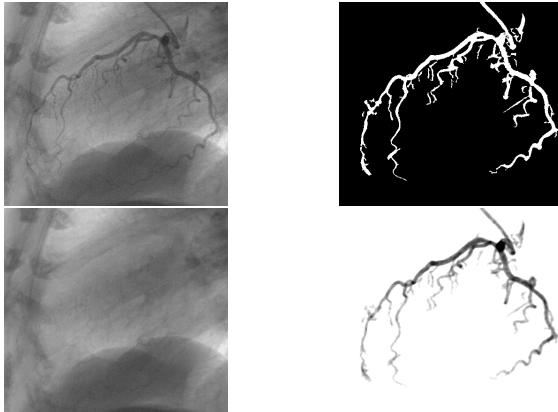


Figure 10: CT image showing heart scan (top left), segmentation (top right), inpainting (bottom left) and DSA (bottom right) (Mathias Unberath, Pattern Recognition Lab, FAU)

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## Take Home Messages

- You have seen results of defect pixel interpolation.
- The methods from defect pixel interpolation are applied to many other problems in medical image processing.

## Further Readings

- The method presented for defect pixel interpolation in the frequency domain was published by Til Aach and Volker Metzler in 2001:  
Til Aach and Volker Metzler. “Defect Interpolation in Digital Radiography: How Object-Oriented Transform Coding Helps”. In: *Proc. SPIE 4322, Medical Imaging 2001: Image Processing*. Vol. 4322. San Diego, CA: SPIE, Feb. 2001, pp. 824–835. DOI: 10.1117/12.431161
- A recent article about defect pixel interpolation with respect to image quality issues can be found here:  
Jan Kuttig et al. “Effects of Defect Pixel Correction Algorithms for X-ray Detectors on Image Quality in Planar Projection and Volumetric CT Data Sets”. In: *Measurement Science and Technology* 26.9 (Aug. 2015), 095406 (14pp). DOI: 10.1088/0957-0233/26/9/095406