Medical Image Processing for Diagnostic Applications

IIH Correction – Examples and Further Applications

Online Course – Unit 26

Andreas Maier, Joachim Hornegger, Markus Kowarschik, Frank Schebesch
Pattern Recognition Lab (CS 5)

virtuelle hochschule bayern

FRIEDRICH-ALEXANDER UNIVERSITÄT ERLANGEN-NÜRNBERG
TECHNISCHE FAKULTÄT

Topics

Bias Field Estimation: Examples

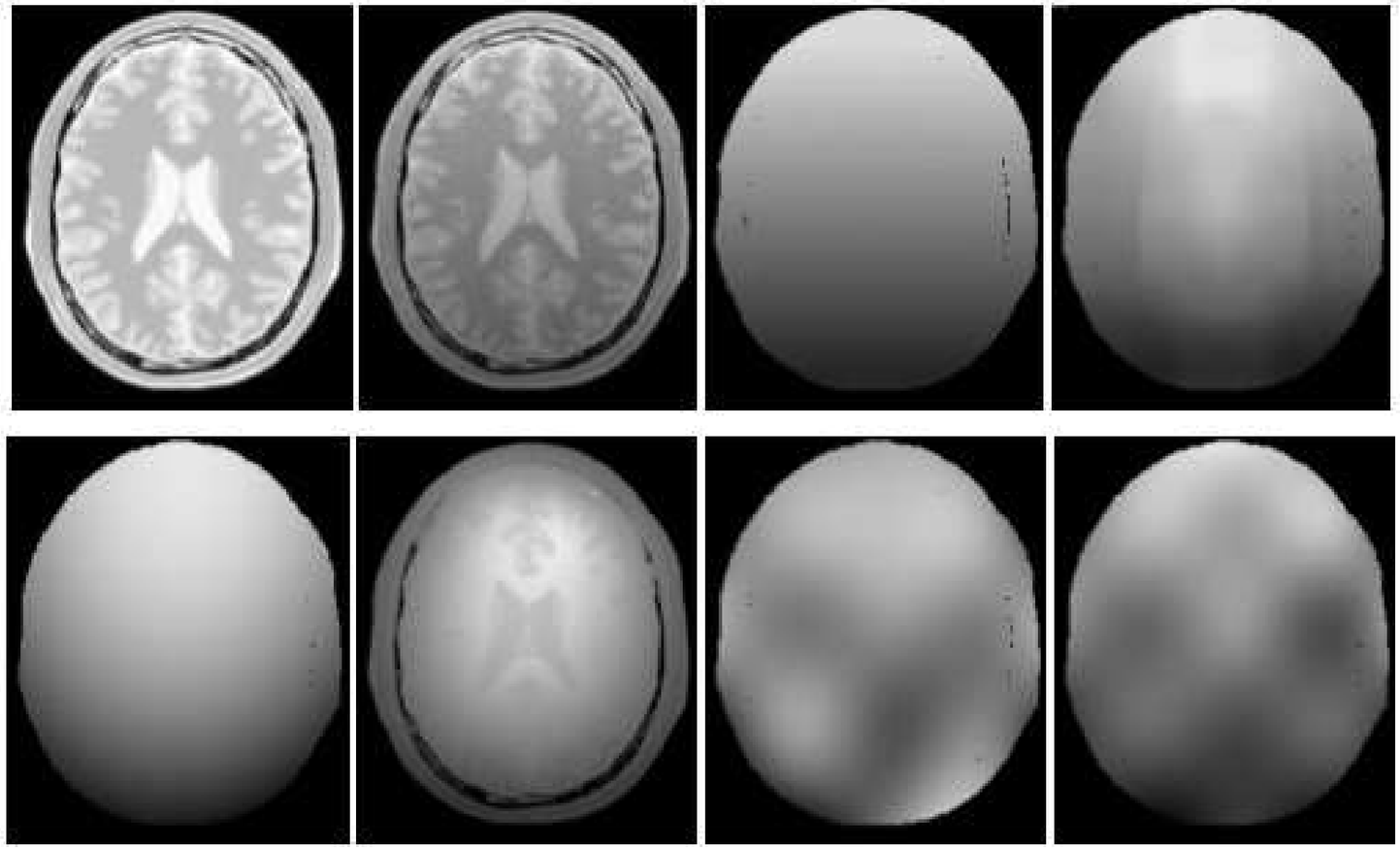

Figure 1: First row, from left to right: reference image, biased image (3% noise, 50% bias), original bias field, homomorphic unsharping mask. Second row: polynomial fit (degree 4), high pass filter, KL divergence with reference from original image, KL divergence with reference from high pass filter.

Fuzzy C-means Clustering: Image Examples

Figure 2: Comparison of segmentation results (from left to right): T1 weighted MR phantom image, fuzzy C-means algorithm without regularization, fuzzy C-means with regularization (cf. Ahmed et al.)

Topics

Further Applications of IIH

- X-ray imaging: correction of the heel effect (see further readings)
- Endoscopy/retina imaging: correction of heterogeneous illumination
- Ultrasound imaging: correction of signal decay with distance from probe and correction of shadows

Further Applications of IIH

Bias correction in retina image processing:

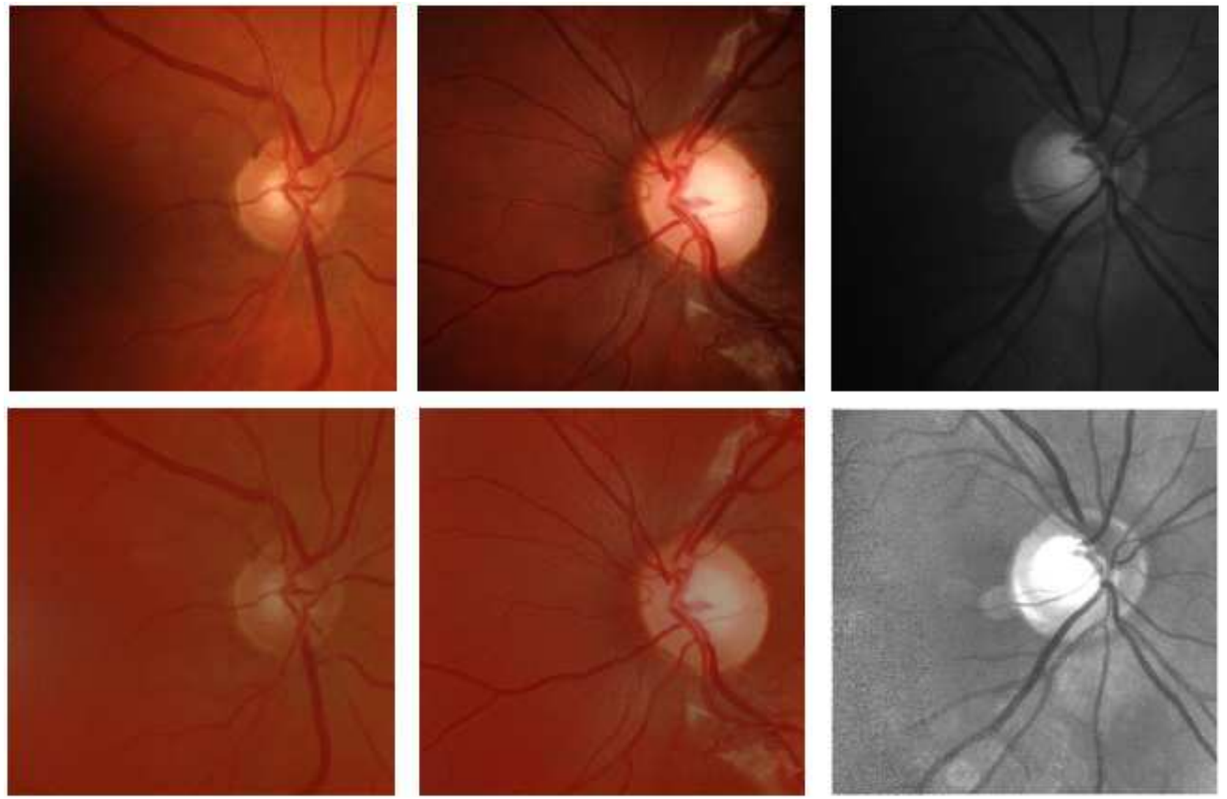

Figure 3: Retina images with heterogeneous illumination (upper row), bias corrected images (surface fitting method, degree 4 polynomials, lower row).

Further Applications of IIH

Bias correction in ultrasound imaging:

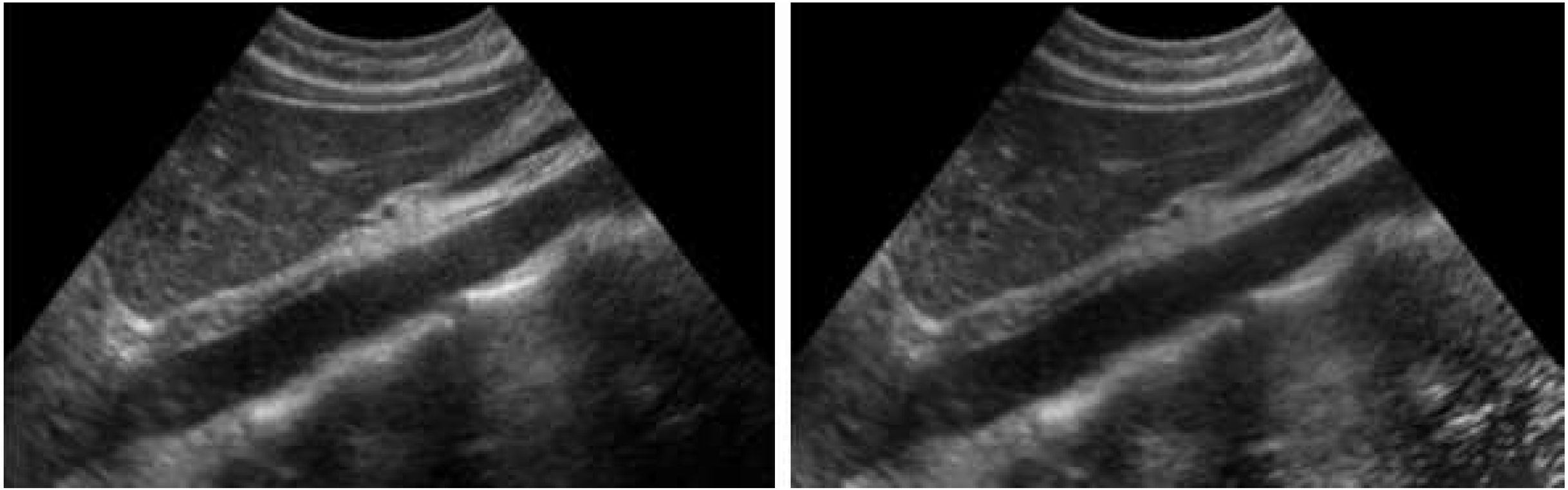

Figure 4: Ultrasound image with decreasing signal from top to bottom (left), bias corrected image (surface fitting method, degree 1 polynomial, right)

Topics

Examples

Further Applications

Summary

- Take Home Message
- Further Readings

Take Home Message

The correction methods introduced in this course extend their usefulness to other modalities than MRI as well.

Further Readings

The original paper on which the discussion in this unit is based on is:

Mohamed N. Ahmed et al. “A Modified Fuzzy C-Means Algorithm for Bias Field Estimation and Segmentation of MRI Data”. In: *IEEE Transactions on Medical Imaging* 21.3 (Mar. 2002), pp. 193–199. DOI: 10.1109/42.996338

How the heel effect can be corrected, is described in the following paper:

Gert Behiels et al. “Retrospective Heel Effect Correction in Conventional Radiography”. In: *IEEE Workshop on Mathematical Methods in Biomedical Image Analysis, 2001*. IEEE, Dec. 2001, pp. 87–94. DOI: 10.1109/MMBIA.2001.991703