Image based Measurements for Evaluation of Pelvic Organ Prolapse

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ABSTRACT

Magnetic resonance imaging (MRI) based measurements are useful in the diagnosis of pelvic organ prolapse given the inaccuracy of clinical examination. However, MRI measurements are currently performed manually and can be inconsistent, time-consuming and inaccurate. In this work, we present a scheme for automatic measurements on MRI images based on multi scale wavelet analysis. The experiments on the MRI images show that the presented scheme can automatically detect the points of reference on the pelvic bone structure to determine the reference lines needed for the assessment of pelvic organ prolapse. This may lead towards more accurate and faster pelvic organ prolapse diagnosis on dynamic MRI studies, and possible screening procedures for predicting predisposition to pelvic organ prolapse by radiologic evaluation of pelvimetry measurements.

METHODOLOGY

![Diagram of the proposed automated measurement model.](image)

**Region Segmentation**

![Figure 2: Region growing segmentation.](image)

**Point Identification Process for ROI of pubic bone**

![Figure 3: Edge maps of pubic bone.](image)

- (a) Original
- (b) After closing
- (c) After thinning

**Automatic Measurement Model**

![Figure 6: Intersecting points of ROI.](image)

- (a) Sacral promontory
- (b) Coccyx

**Figure 5: Local extreme points.**

**Figure 7: Identification of points of interest and reference lines.**

**RESULTS**

![Figure 8: Original MRI, manual measurement and automatic measurement for different images.](image)

**Table 1: Pixel-based distances between manually and automatically identified landmarks.**

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CONCLUSION

We presented a scheme based on the wavelet domain scale multiplication to automatically identify the reference points and lines for the characterization of pelvic organ prolapse (POP) using MRI. The points were identified by generating the edge map of dynamic MRI and then computing the local extremes of their first derivatives and finding corner points. Automatically identified reference points were compared with points identified manually by an expert. Experiments demonstrate that the presented automated model provides accurate, consistent, and fast measurement points on MRI. The proposed scheme sets the framework for the automated diagnosis of POP using MRI-based wavelet analysis. This will lead to the establishment of the staging criteria for POP assessment, surgical planning for POP correction, and prediction of patients predisposed to particular types of POP. In the future, we will design a technique for the automated identification of other points of interest to enable the analysis of measurements between different subjects and among groups.