Epithelial Cell Detection in Endomicroscopy Images of the Vocal Folds

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Introduction

- Voice hoarseness can be caused by several reasons including laryngitis, larynx cancer, and structural changes in the vocal folds like nodules and polyps.
- Recently, it was shown that changes in the vocal fold mucus affect the acoustic properties of the voice signal [1].
- The purpose of our research is to investigate the mucus of the vocal folds in vivo using a micro endoscope. An essential step towards this goal is the detection of epithelial cells in the mucus layer.

Methods

1. The epithelial cell image is band-passed filtered. The filter is designed to remove the tiny details which may hinder the detection. At the same time, it emphasizes the regular structure and the repetitive pattern of the epithelial cells.
2. Minima are located using a minima-search.
3. Watershed is applied in order to delineate the cell borders.

Figure 1 illustrates these steps.

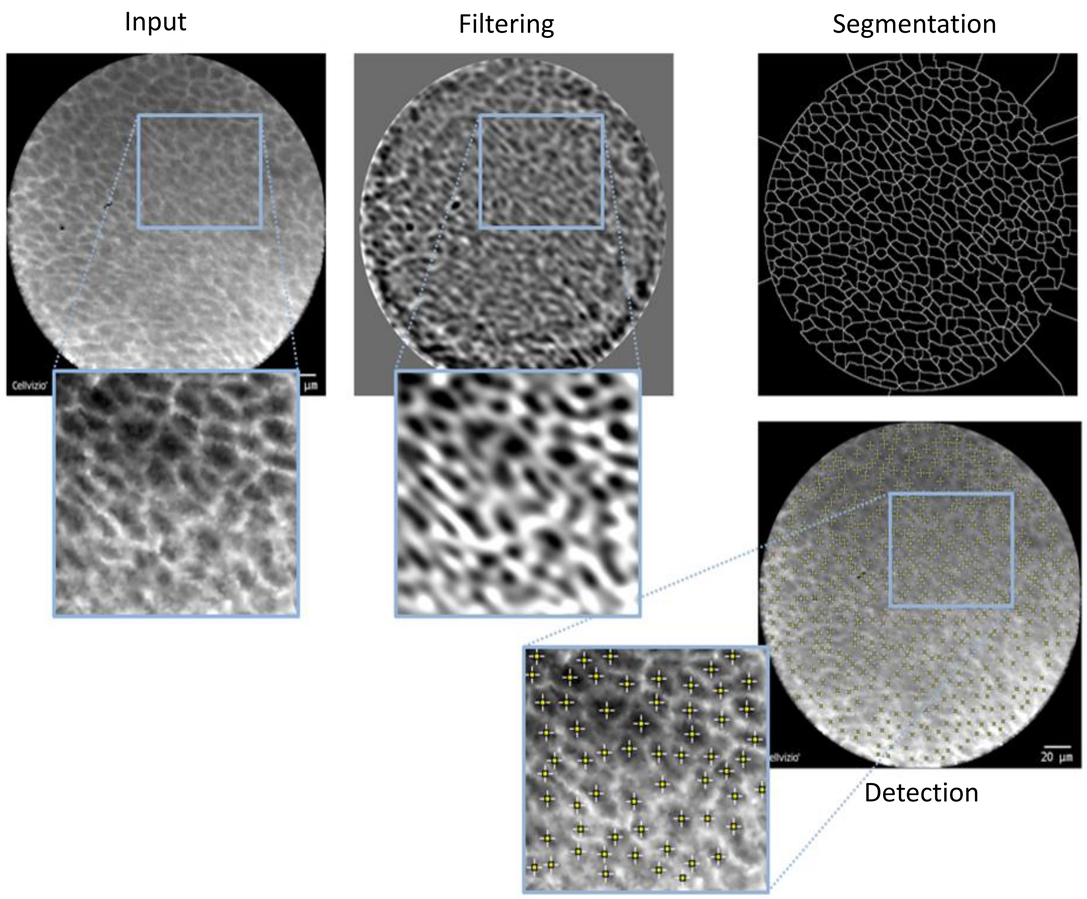

Figure 1: Cell detection and segmentation pipeline

Results and Discussion

- The method was shown to yield detection results of high accuracy on an evaluation set of nine images.
- In [2], it was shown that the repetitive pattern of the corneal endothelium manifests itself as a ring in Fourier domain. The radius of this ring can then be used to estimate cell density.
- We noticed in preliminary experiments (data not shown), that this ring is not clearly present in our data. Nevertheless, the results show that it is possible to find a frequency band which makes cell detection using basic image processing methods feasible.
- Due to the fact that cells cover the whole scene, sophisticated features for cell/background separation [3, 4] are not needed.

Conclusions & Outlook

- Compared to endothelial corneal images [2], the repetitive pattern of the endomicroscopy images of the vocal folds exhibit less apparent frequency-domain ring.
- Nevertheless, band-pass filtering with basic image processing yield high detection results.
- Further work will tackle the problem of automatic pass-band determination.

References

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