Phase contrast image analysis for cell counting of epithelial monolayers

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Keratinocytes in the oral mucosa

- Hard palate and gums
  - Protects underlying tissues
  - Continuity breaches lead to problems
- Want to characterise cell behaviour
  - Causes of disease
  - Response to treatments

http://upload.wikimedia.org/wikipedia/commons/1/11/Oral_mucosa.png
1. Background and motivation

Cell counting

• Haemocytometer
  • Simple ✓
  • Destructive ✗
  • High operator error ✗

Cell counting

- Phase contrast microscope images
  - Non-destructive and stain-free ✓
  - Potential to offer more information than just cell number ✓
  - Phase contrast microscopy delivers challenges to image analysis …
Cell segmentation

1. Morphological filters
   - Original image
   - Small mean filter
   - Large mean filter

2. Subtract small from large

3. Make binary!
Counting cells from binary image

• Ideally, number of binary regions = number of cells

• Low density images suffer from incorrectly segmented “noise” regions

• These will cause erroneous cell counts
1. Calculate morphological and greyscale properties of binary regions
2. Reduce features using principal component analysis
3. Label regions using k-means clustering (k=2)
4. Discard errors – remaining cells = cell count!
Generation of growth curves

- Image at multiple time points to generate growth curves
Thank you

Any questions?