Classification of SD-OCT Volumes with LBP: Application to DME Detection

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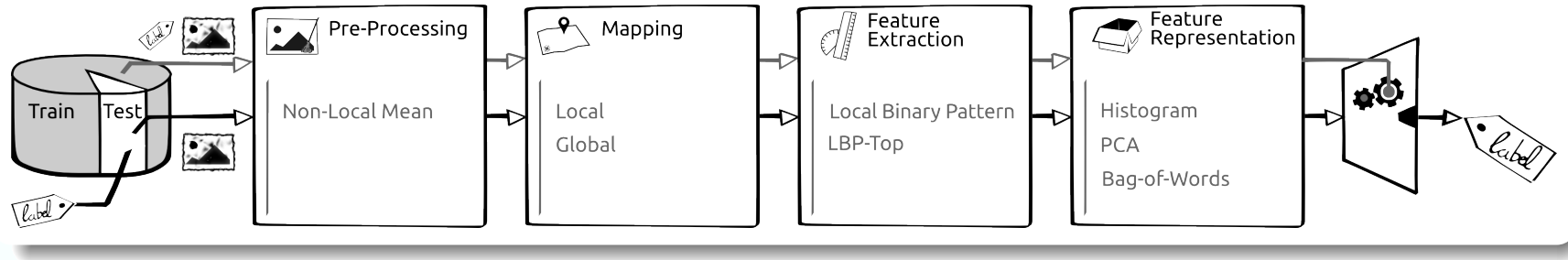
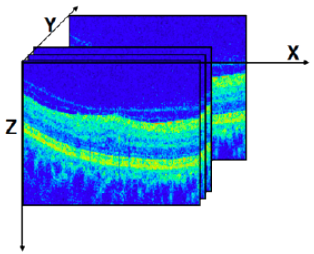
DME detection
Framework

Overview



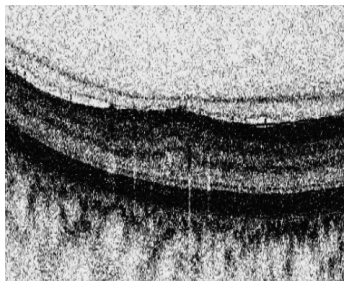
DME detection
Image pre-processing

Reference system

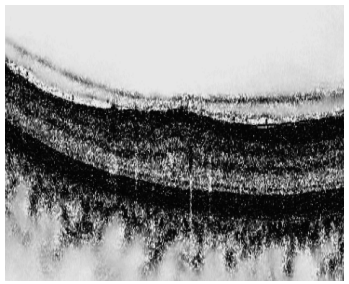


- OCT images corrupted with speckle noise
- Denoising for each B-scan ($x - z$ slice)
- **Non-Local Means** [1]

Qualitative results



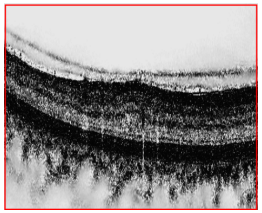
Raw image



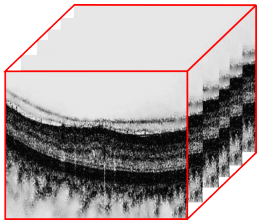
NLM denoising

DME Detection
Mapping

Global mapping

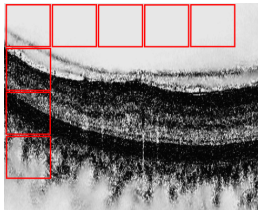


2D

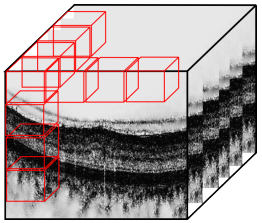


3D

Local mapping



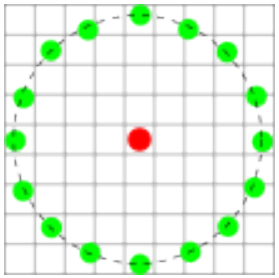
2D



3D

DME Detection
Local Binary Pattern

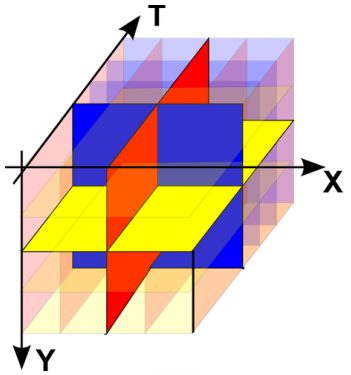
LBP



$$LBP_{P,R} = \sum_{p=0}^{P-1} s(g_p - g_c)2^p \ , \ s(\cdot) = \begin{cases} 1 & \text{if } (g_p - g_c) \geq 0 \\ 0 & \text{otherwise} \end{cases} ,$$

- Select uniform and rotation invariant

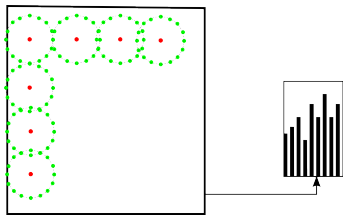
LBP-Three Orthogonal Plane (TOP)



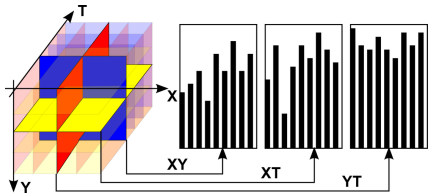
DME Detection
Feature representation

Low-level representation

$\rightarrow$ Compute the histogram of the LBP codes



LBP histogram



LBP-TOP histogram

Global *versus* local mapping

- 1 LBP histogram per *B-scan* later concatenated
- 1 LBP-TOP histogram per *volume*
- 1 LBP histogram per *window* later concatenated
- 1 LBP-TOP histogram per *sub-volume* later concatenated

DME Detection
Feature representation

High-level representation

- Principal Component Analysis (PCA)
- Bag of Words (BoW)

PCA

- Reduce the number of feature dimensions by finding a space where the data variance is maximized

BoW

- Reduce the complexity of the feature space by clustering samples together
- A codebook is learnt through k-means
- Each sample is affected to a specific cluster/word (i.e., hard-voting)
- Histogram by calculating the frequency of occurrences of each word

Experiments
Datasets

SERI dataset

- 32 SD-OCT images with 16 DME cases and 16 healthy cases
- Each volume has 128 B-scans with a resolution of 512×1024 pixels

Duke dataset

- 30 SD-OCT images with 15 DME cases and 15 healthy cases
- Volumes were denoised and cropped with different sizes