

# Automatic Multiresolution Age-related Macular Degeneration Detection from Fundus Images

## Aim and contribution

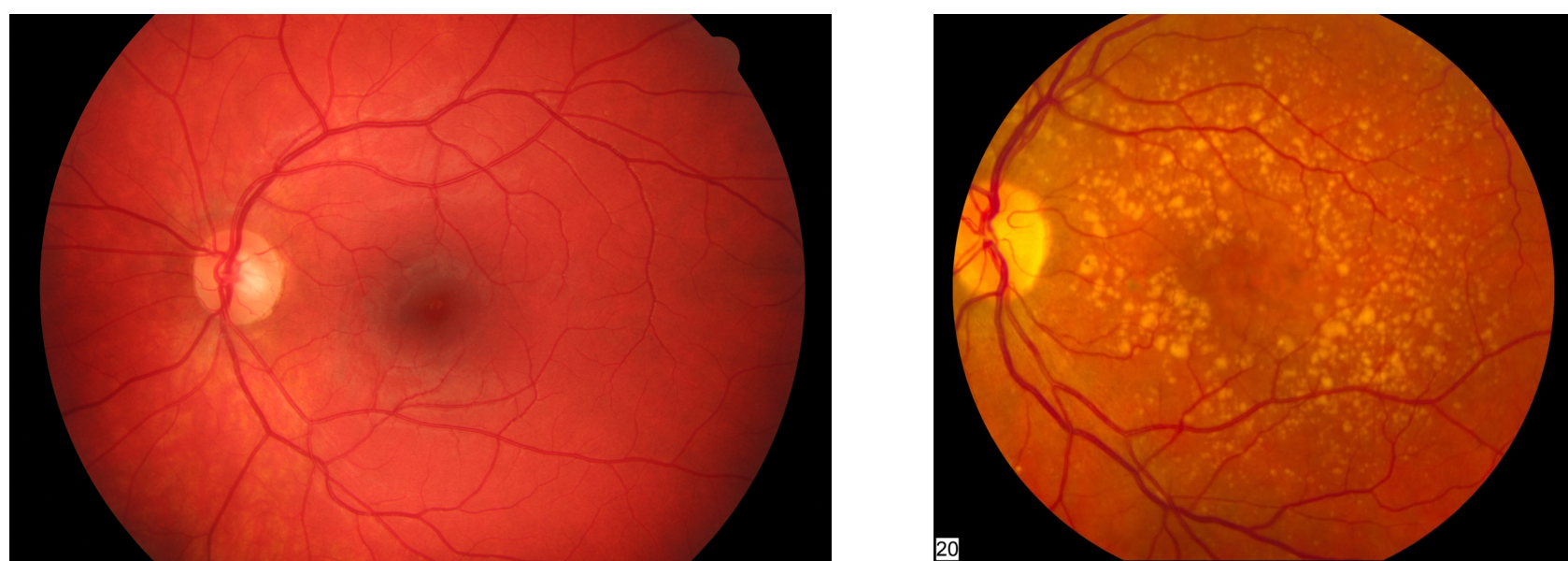
The idea of our method is to be able to detect Age-related Macular Degeneration (AMD) in its early stages without targeting any particular symptom. This, using fundus photographs since it is a low price imaging device that is widely available and commonly applied for basic eye examinations.

### Keypoints

- No specific symptoms targeting
- No preprocessing
- Robust to image quality
- Multiresolution analysis
- Measuring textural variations induced by the disease
- Selection of discriminant data

## Age-related Macular Degeneration

- Most important cause of legal blindness in developed countries
- No obvious visual changes
- Loss of central vision may occur quickly at advanced stages
- Early stages mainly characterized by drusen:



## AMD diagnosis

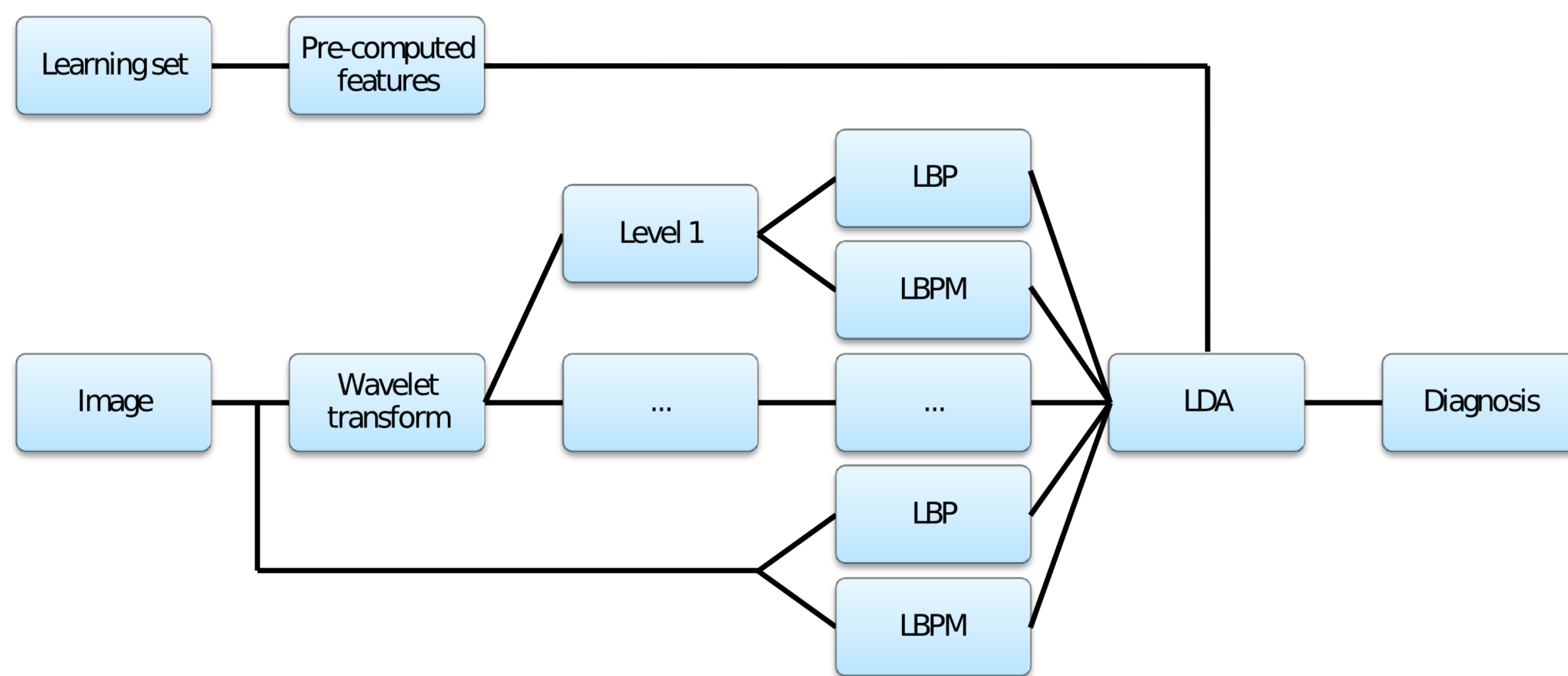
### Usually based on drusen

- No medical consensus whether it is always a clue for early AMD [1]
- Early microscopic drusen hard to detect [2]
- Drusen occur in every aged retina, not necessary afflicted by AMD [2]

### Other symptoms:

- Pigmentary changes
- Wet AMD
  - Fast ingrowth of choroidal vessels
  - Increased vessel permeability

## Proposed method

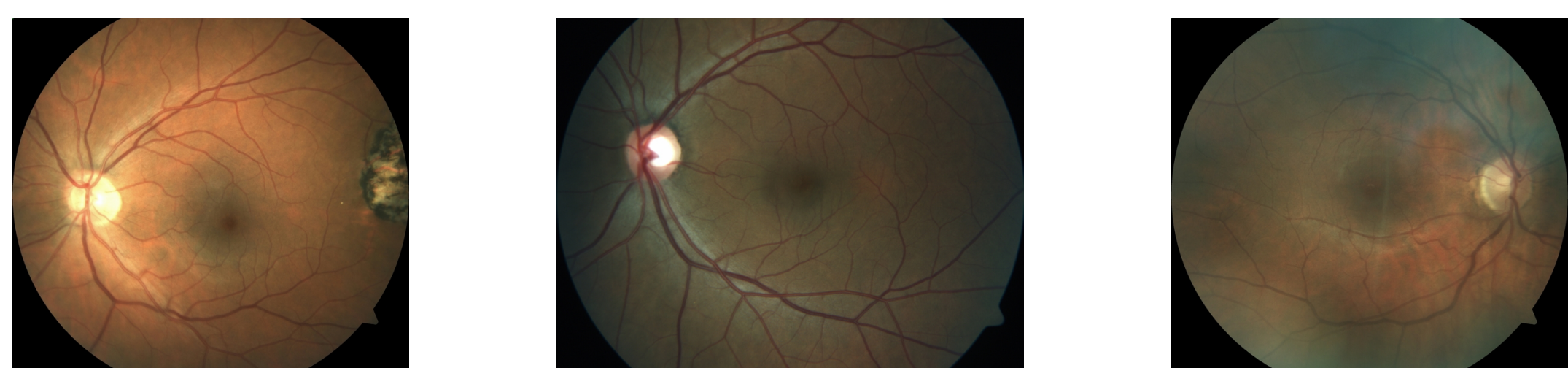


**Multiresolution analysis** We decompose our images up to four levels, giving us a set of 16 coefficient images in addition to the original image for textural features extraction. The decomposition is achieved using a wavelet filter bank with Lemarié's wavelet.

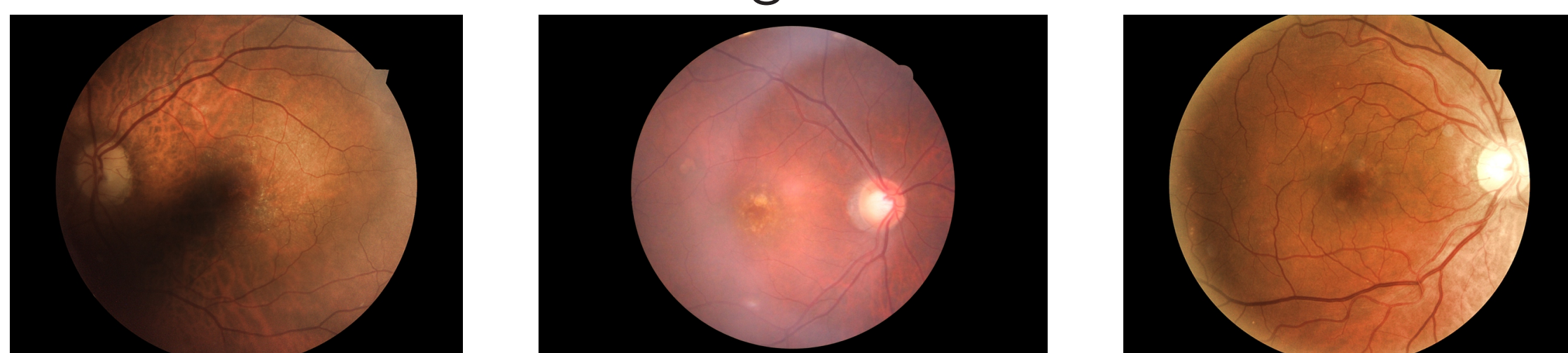
**Textural features extraction** The textural information is extracted using both the classical LBP and the magnitude (LBPM) component of the completed model of LBP [3]. Each image being described by the distributions of LBP and LBPM on every wavelet coefficient images.

**Selection of discriminant data** We apply a linear Discriminant Analysis (LDA) for feature dimension reduction and use the resulting combination of features to linearly classify our data.

## Experiments



Negative



Positive

Conducted on a private dataset composed of:

45 images { 23 negative  
22 positive to AMD

Presenting variabilities in terms of:

- Quality (illumination, blur, reflections ...)
- Camera model
- Patient ethnic group
- Patient age category

Confusion Matrix

Output Class	Target Class		
	1	2	
1	21 46.7%	1 2.2%	95.5% 4.5%
2	2 4.4%	21 46.7%	91.3% 8.7%
	91.3% 8.7%	95.5% 4.5%	93.3% 6.7%

## Conclusion

### AMD detection with:

- Multiresolution analysis
- Small texture elements
- Robust to variations
- Good preliminary results

### Future work:

- Feature selection
- Assessment of robustness to other diseases
- Extensive validation

## References

- [1] Jager, R. D., Mieler, W. F., and Miller, J. W., "Age-related macular degeneration," *New England Journal of Medicine* **358**(24), 2606–2617 (2008).
- [2] Sarks, S., Arnold, J., Killingsworth, M., and Sarks, J., "Early drusen formation in the normal and aging eye and their relation to age related maculopathy: a clinicopathological study," *British Journal of Ophthalmology* **83**(3), 358–368 (1999).
- [3] Zhenhua, G., Zhang, L., and Zhang, D., "A completed modeling of local binary pattern operator for texture classification," *IEEE Transactions on Image Processing* **19**(6), 1657–1663 (2010).