

# In-vivo evaluation of corneal collagen fibrils pattern to detect keratoconus

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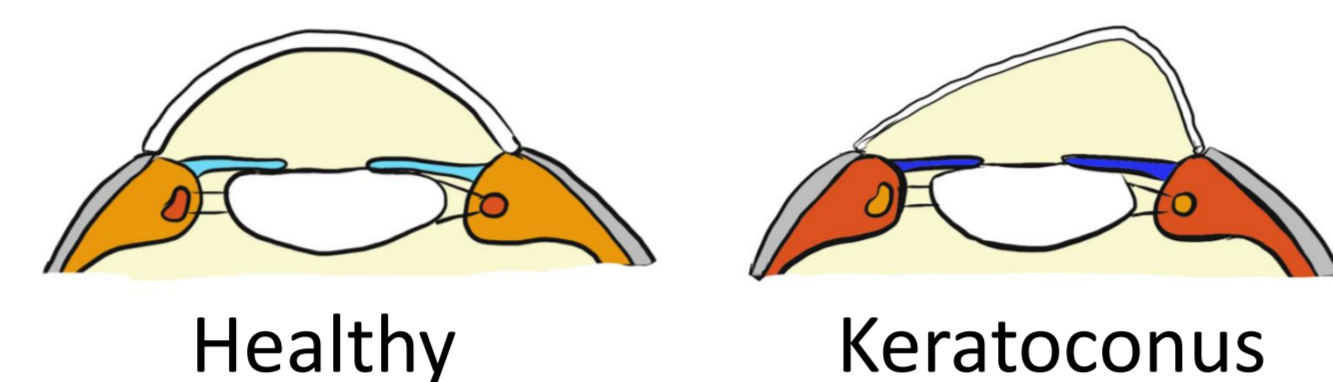


## Purpose and Aims

To investigate a method for discriminating changes in the pattern of corneal collagen fibrils to detect keratoconus

### Aims:

- Improve visualisation of response to polarised light
- Quantification of cross feature
- Distinguish healthy eyes from keratoconic



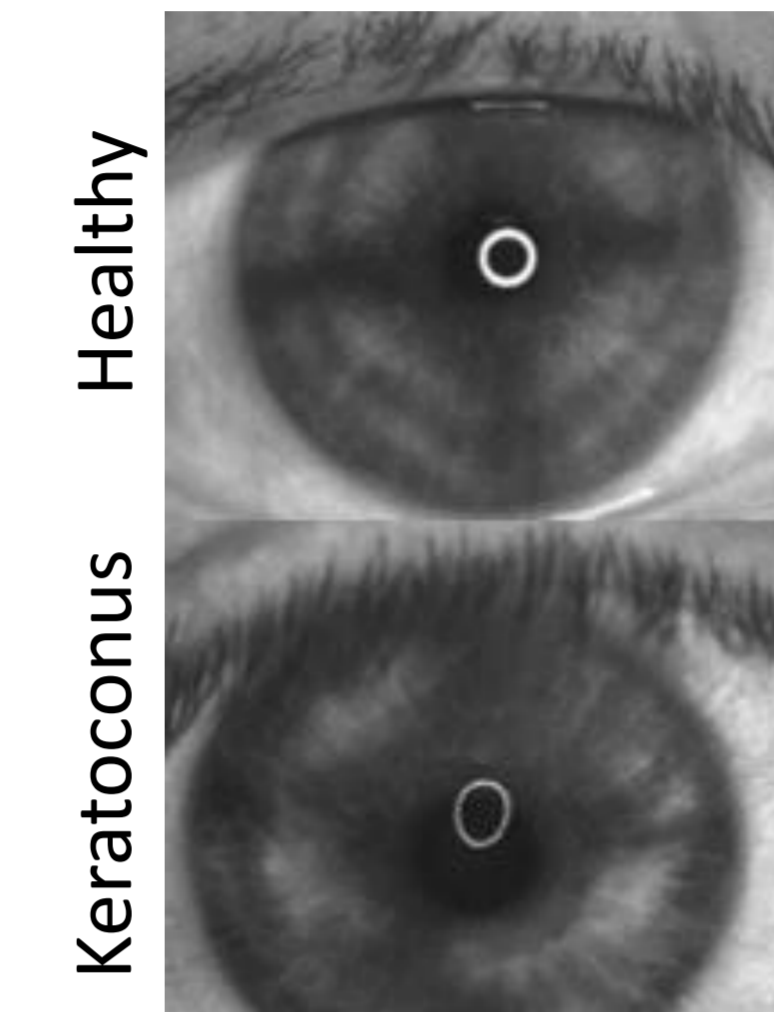
## Methods



### Patient-side:

- 3 repeated scans per patient with:
  - Pentacam<sup>†</sup>
  - Lumaxis<sup>‡</sup>
- Obtain keratometry calculation
- Determine diagnosis

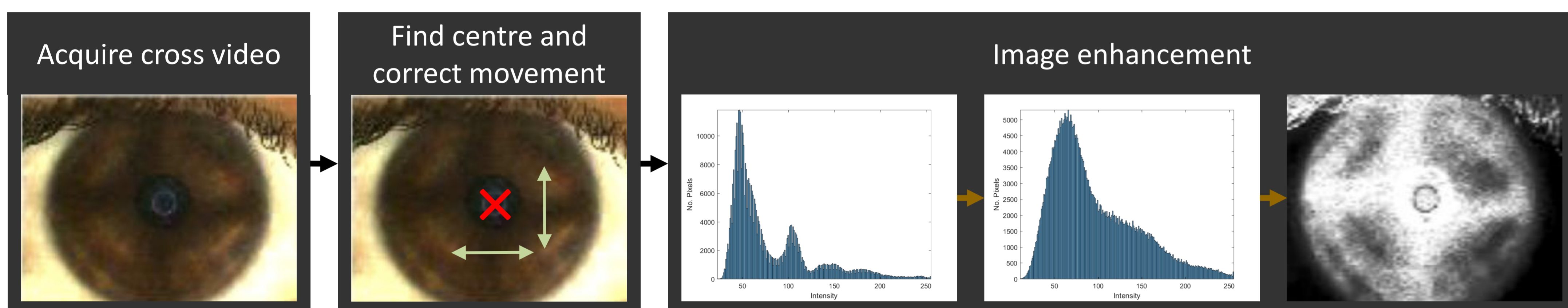
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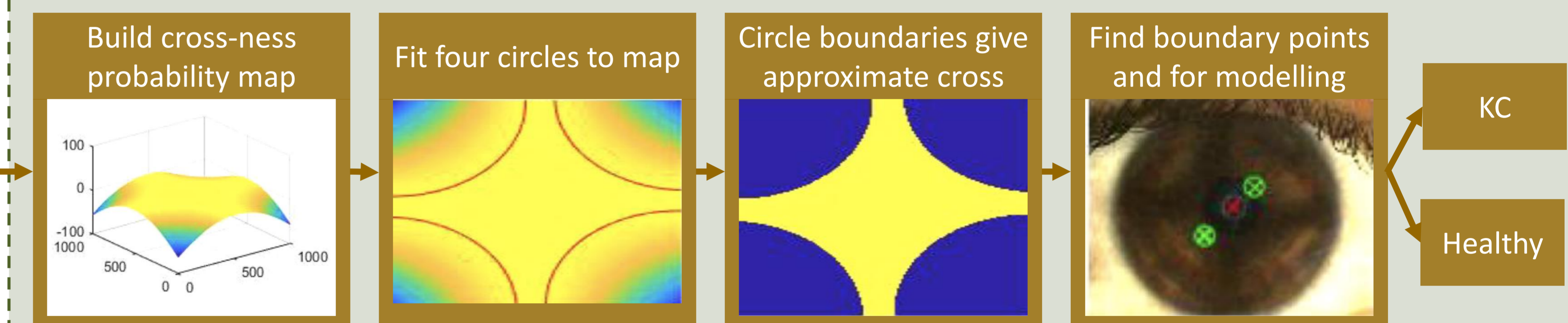
### Computer-side:

- Build annotated dataset of Lumaxis images with diagnosis
- Develop algorithm for visualising the cross effect
- Develop methodology for quantifying the properties of the cross
- Develop an approach to link this to Healthy-Keratoconus distinction
- Develop with Matlab and test on dataset

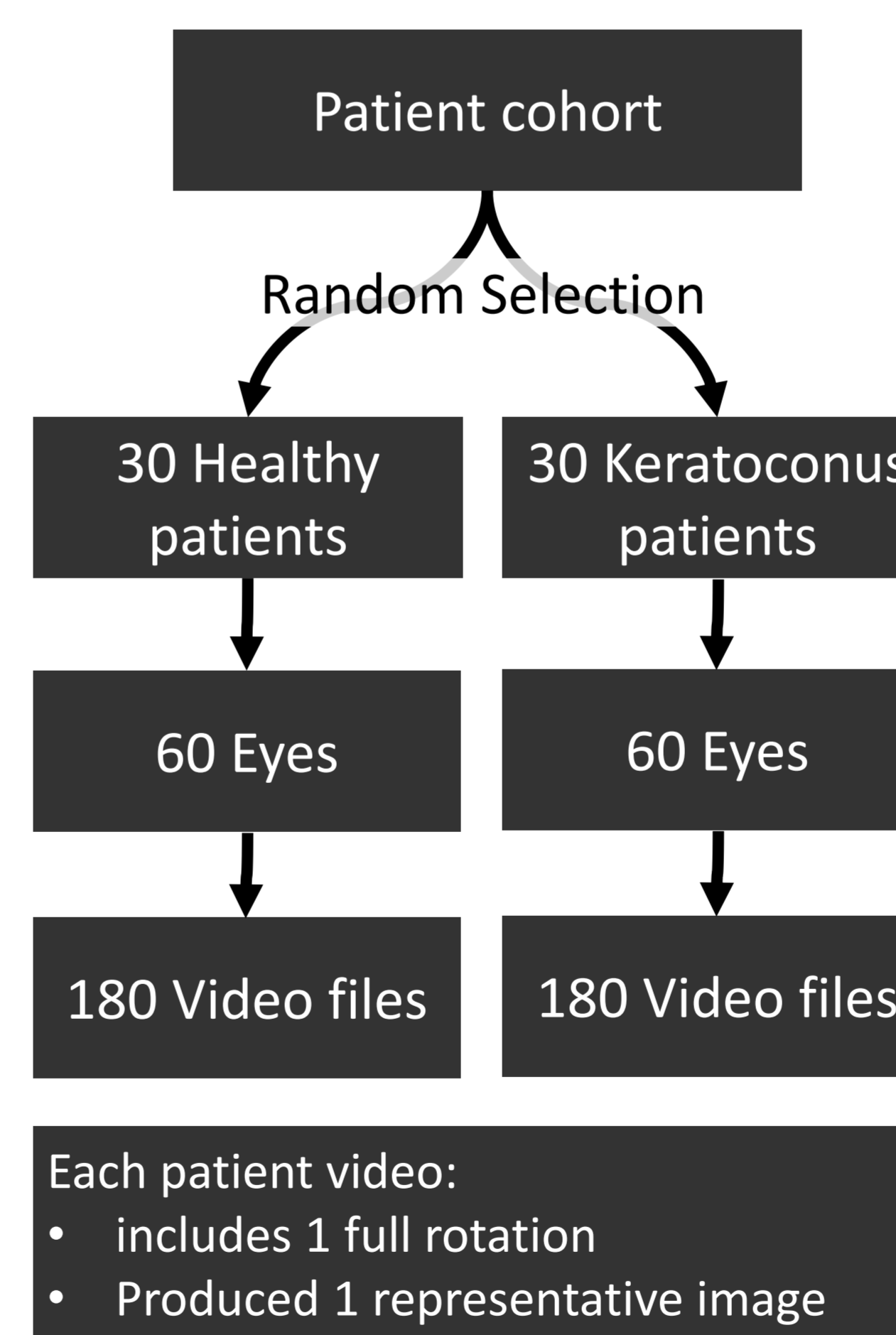
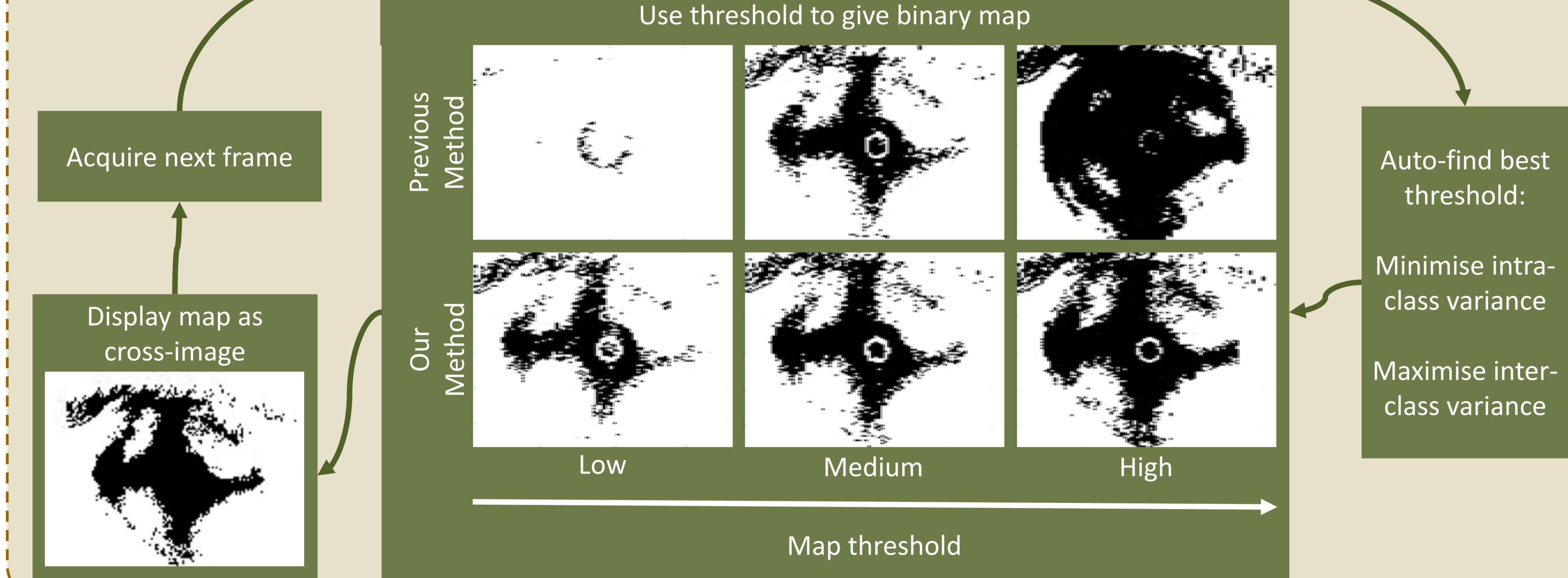
## Results



### Distinguish Keratoconus from Healthy



### Visualisation



	Healthy	Keratoconus
Mean Patient Age (yrs)	38.0 ± 13.2	39.2 ± 12.9
Max Keratometry (D)	59.4 ± 11.2	45.3 ± 0.8
Cross Parameter	0.41 ± 0.028	0.24 ± 0.055

Given the cross parameter, we can look for a suitable threshold to distinguish keratoconic eyes from healthy.

Cross parameter lies between 0 and 1  
Optimal threshold for accuracy: 0.35

Accuracy: 0.97  
Area Under ROC: 0.9769  
Sensitivity/ Specificity: 1.00/0.96

## Discussion

- We have demonstrated robustness in visualisation, improving on legacy work
- We have distinguished automatically between healthy and keratoconic eyes to high accuracy
- It remains to develop a large, annotated dataset for model refinement and validation

## Conclusion

The interferometric analysis of diffractive and polarizing effects related to the birefringent properties provide new morphological information at corneal fibrils level. A different corneal pattern of corneal collagen fibrils can be recognised in keratoconus patients compared to healthy patients.

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