The Erlanger Glaucoma Matrix - a Visualization Approach Towards Optimal Glaucomatous Optic Nerve Head Image Presentation

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Purpose

The glaucoma classification of a single image is difficult even for experts. We present a method to **improve diagnostic findings** by two-dimensional visualization approach of retina images.

Materials

Color fundus photos from the Erlangen Glaucoma Registry (EGR), acquired with a Kowa non-myd camera, 22,5° field-of-view. N=240 pre-diagnosed reference images (patients' age 55 ±11), glaucoma stages from 0 to 10 diagnosed by an expert, papilla sizes from 1.0 to 3.4 mm^2 (measured semi-automated).

Methods

We present a new matrix visualization technique for digital optic nerve head image assessment:

- Contains pre-diagnosed reference images
- Images ordered in a matrix for glaucoma diagnostics
  - Rows (from bottom to top): glaucoma stage
    samples range from healthy (stage 0) to advanced glaucoma cases (stage 10)
  - Columns (from left to right): papilla size
    samples ordered by the size of the optic nerve head
- Generalization for other criteria possible
  - Image parameter (e.g. quality)
  - Patients' parameters (age, risk factor)
- Arbitrary image modalities (e.g. HRT) and image numbers can be incorporated

Results

Visualization provides

- Intuitive way for neighborhood comparisons of optic nerve head images
- Evaluate new image in context of given pre-diagnosed reference samples
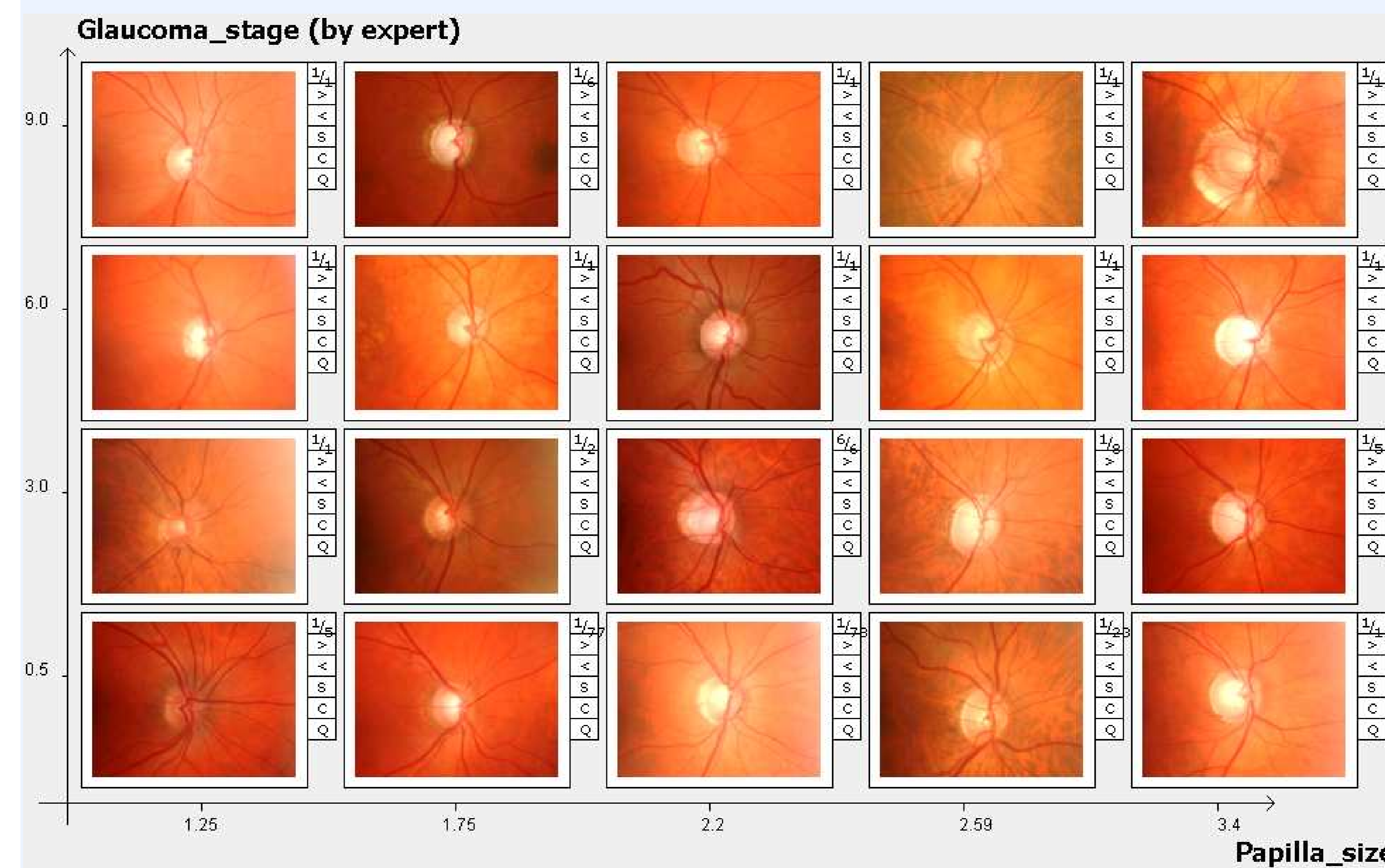
Visualization

Figure 1: The Erlanger Glaucoma Matrix - Reference fundus images ordered along two axis
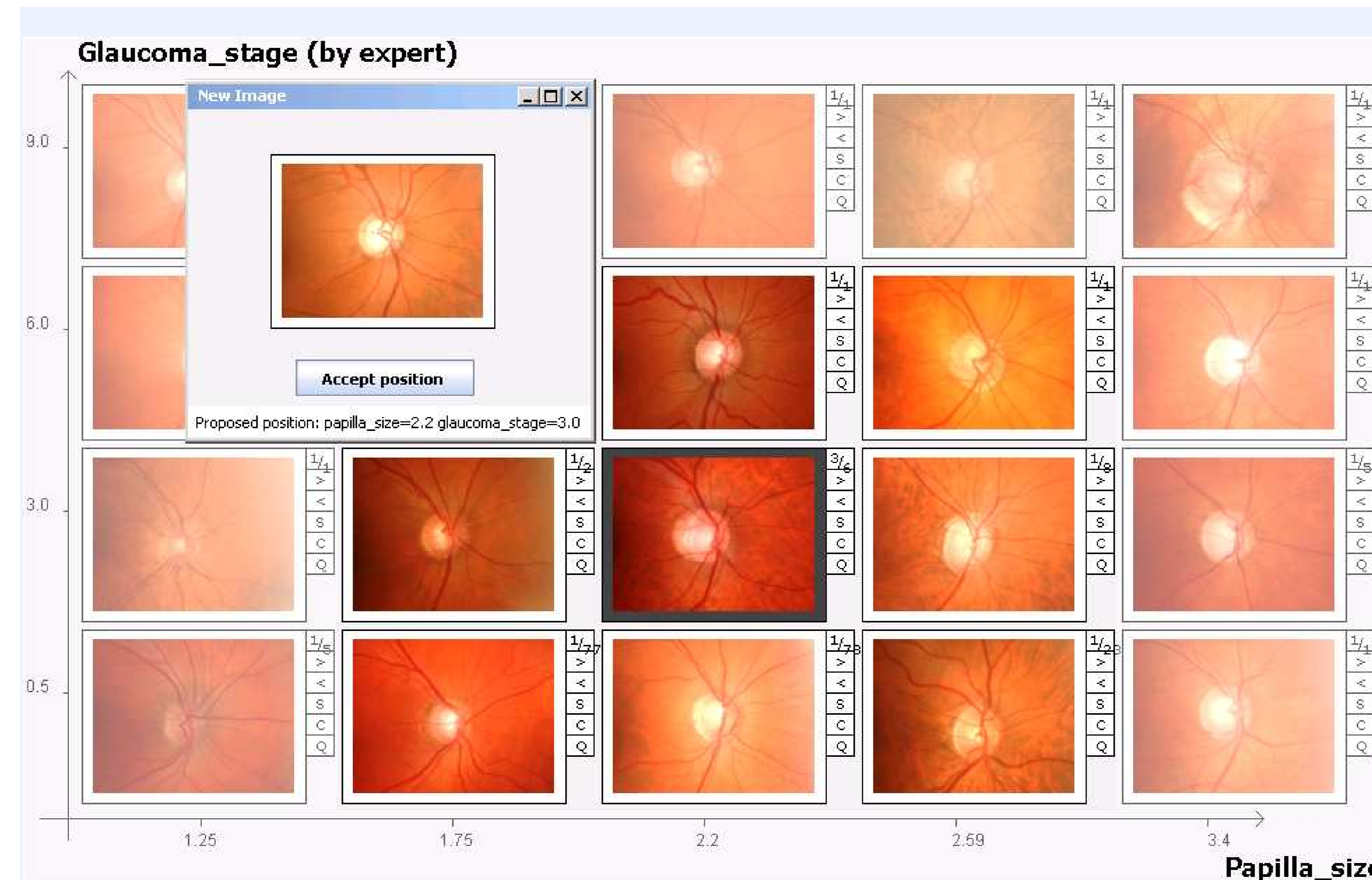

Figure 2: Compare new image with reference images

Conclusion

- **Novel visualization of a single image within the context of reference images**
  - Support diagnosis even in problematic cases, such as macropapillas
  - Trustworthiness of physicians' diagnosis can be improved
- **Visualizes computer calculated risk estimations** by presenting the result within context of given gold-standard images (see poster: 1863/D772)
- **Explains relationship to similar pre-diagnosed cases** (in contrast to pure classification systems)
- Disease-dependent changes can be observed separately from other variations, e.g.
  - Observe glaucoma appearance independent from papilla size variations
  - Study the appearance of the disease in different age groups
- Important tool for learning and training medical glaucoma detection

Support

Commercial Relationship

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