Glaucoma Cup-to-Disc Ratio Estimation

◇ 1. Introduction

Glaucoma is a leading cause of irreversible blindness worldwide. Early detection is crucial, as vision loss can be slowed but not restored. Clinically, one of the most important biomarkers for glaucoma detection is the **Cup-to-Disc Ratio (CDR)**:

- **Optic Disc (OD):** The circular region in the retina where the optic nerve exits.
- **Optic Cup (OC):** The pale depression in the center of the disc.
- **CDR = Cup Diameter ÷ Disc Diameter** (measured vertically or horizontally).

Higher CDRs (>0.6–0.7) are suspicious for glaucoma, but interpretation varies across clinicians. Automating this measurement can:

- Improve screening efficiency in **resource-constrained settings**.
- Reduce subjective variation between specialists.
- Provide a quantitative triage marker for teleophthalmology workflows.

◇ 2. Problem Statement

Develop an **AI-assisted pipeline** to estimate **Cup-to-Disc Ratio (CDR)** from retinal fundus images.

The pipeline should:

1. Detect and segment the **optic disc and optic cup**.
2. Calculate vertical and horizontal CDR.
3. classify cases as **normal vs glaucoma-suspect** based on thresholds.
4. Provide explainability (e.g., heatmaps, overlays) for clinician validation.

◇ 3. Specific Tasks

Participants are expected to complete **core tasks** and may attempt **stretch tasks** for bonus points.

Core Tasks

1. **Preprocessing**
    a. Crop region of interest around optic disc.
    b. Handle variations in image quality, illumination, and size.
2. **Segmentation**
    a. Segment **optic disc** and **optic cup** using deep learning (e.g., U-Net, Mask R-CNN).
3. **CDR Calculation**
    a. Compute vertical and horizontal CDR from segmentation masks.
4. **Evaluation**
    a. Compare estimated CDR values with ground truth (MAE, correlation).
    b. Classify eyes as normal vs glaucoma-suspect using CDR threshold (e.g., ≥0.6).
5. **User Interface (See common Specifications)**
    a. UI for uploading images and report generation

Stretch Tasks (Optional)

- **Explainability:** Overlay cup/disc segmentation masks on original images for clinician trust.

◇ 4. Provided Dataset

Participants will be given access to curated **publicly available Glaucoma dataset**:

Data Provided to Teams:

- A pre-split **training (400) and validation set (200)** of fundus images with Glaucoma cup and disc segmentation

◇ 6. Evaluation Criteria (Track-Specific)

Criterion	Weight	Notes

Classification Accuracy	**20%**	Accuracy, sensitivity/specificity, AUC.
Clinical Relevance	**20%**	Referral triage quality (urgent vs routine vs no referral).
Explainability	**15%**	Heat maps, saliency maps highlighting diseased region.
User Interface	**25%**	Usability, Intuitiveness and Informativeness of the Interface
Presentation	**20%**	Clear explanation of workflow + usability in real screening.