DETECTING GLAUCOMA IN RETINAL IMAGES

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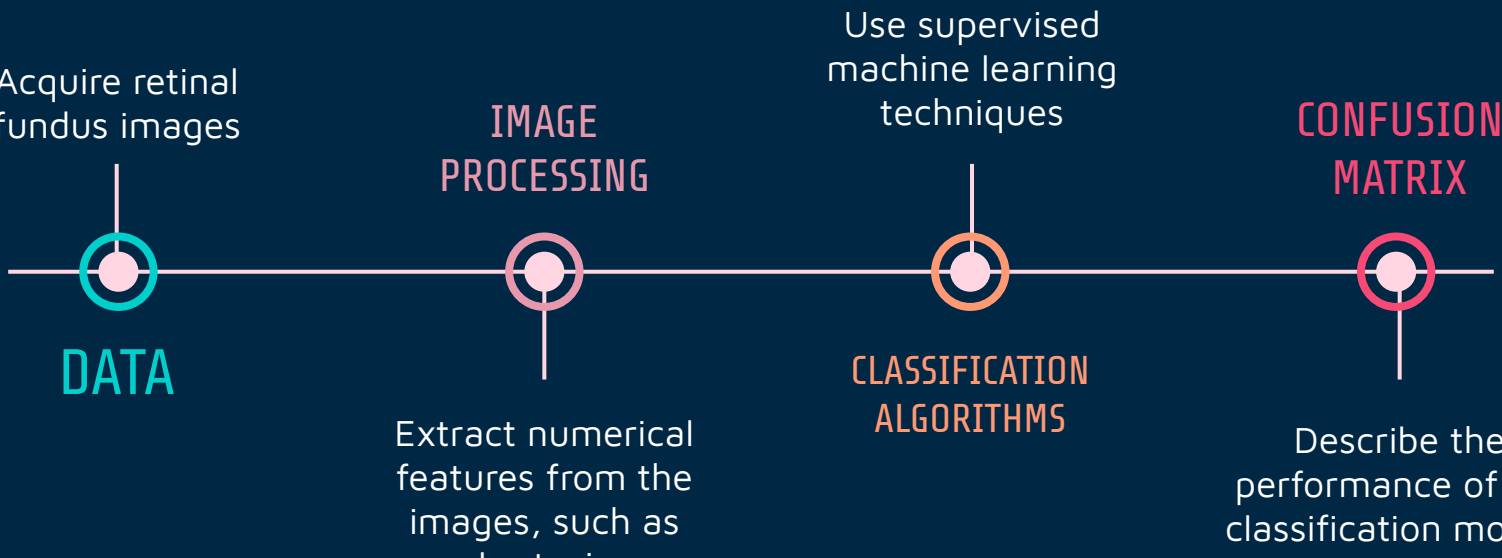
OBJECTIVE

Detect Glaucoma

- Eye disease that can cause permanent vision loss
- Roughly three million Americans have glaucoma as reported by the CDC
- Early treatment can stop damage and protect vision

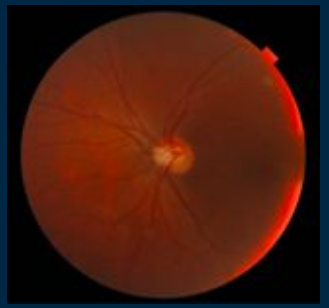
METHOD


Acquire retinal fundus images
DATA
IMAGE PROCESSING
Extract numerical features from the images, such as kurtosis
Use supervised machine learning techniques
CLASSIFICATION ALGORITHMS
CONFUSION MATRIX
Describe the performance of the classification models

DATA

Retinal Fundus Images

- 4000 images
- Obtained through fundus photography
- Less intrusive examination required to acquire retinal fundus images, as opposed others that require slit lamp microscope examinations



Normal

Glaucoma

Figure 1. Sample normal and glaucoma fundus images.

IMAGE PROCESSING

Identify elements in the retinal fundus images

- Optic Disc
- Optic Cup

Extract numerical features from the elements

- Optic Cup to Disc Ratio (CDR)
- ISNT Quadrant Ratio
  - Inferior
  - Superior
  - Nasal
  - Temporal

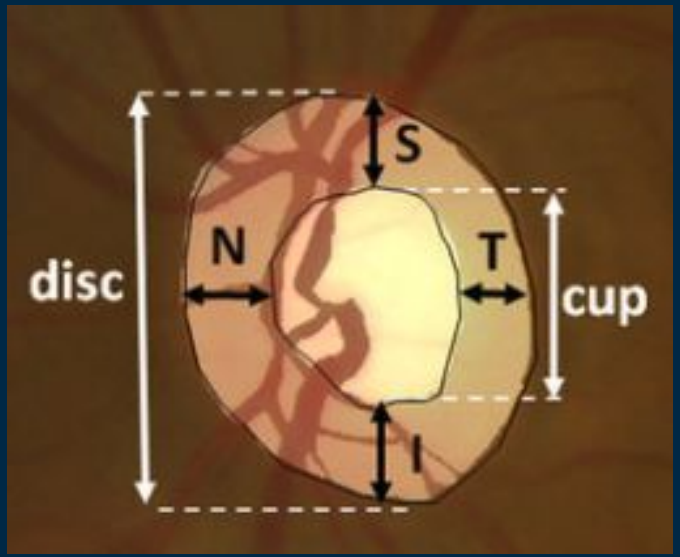
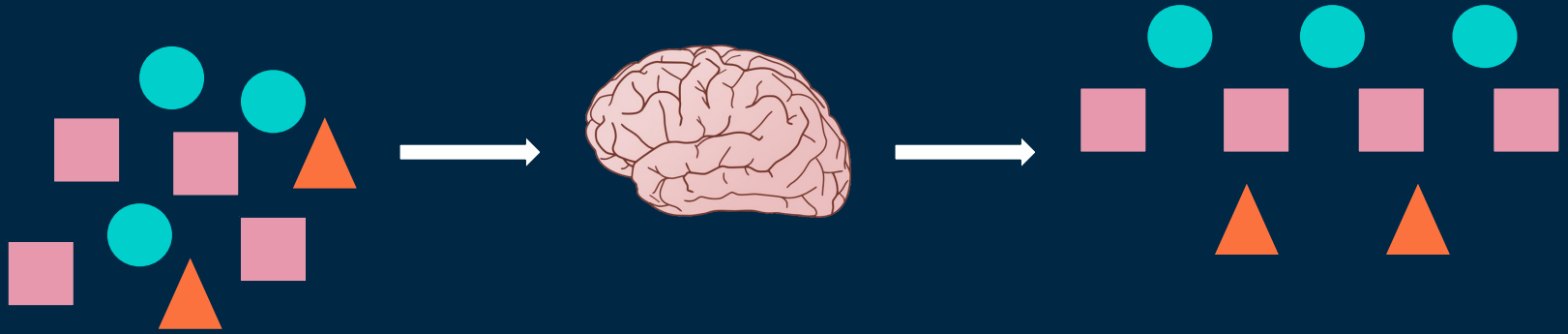


Fig. 2 Anatomy of the Optic Disc

CLASSIFICATION ALGORITHMS

- Machine learning is concerned with algorithms that learn from data
- Supervised learning → type of machine learning system → labels
- Classification algorithms → supervised learning
  - Analyze sets of training data and assign the data to preset categories
  - Binary classification
    - Glaucoma
    - Normal



CLASSIFICATION ALGORITHMS

- Logistic Regression
- Random Forest
- K-Nearest Neighbors
- Support Vector Machine

Ensemble learning → combine several machine learning models

- Decreases variance (bagging)
- Decreases bias (boosting)
- Improves predictions (stacking)

CONFUSION MATRIX

- Used to describe the performance of a classification algorithm on a set of test data for which the values are unknown
- Shows the predicted value on the y axis
- Shows the true condition on the x axis
- Sensitivity rate of 64.1%
- Specificity rate of 77.1%
- Accuracy rate of 72.3%

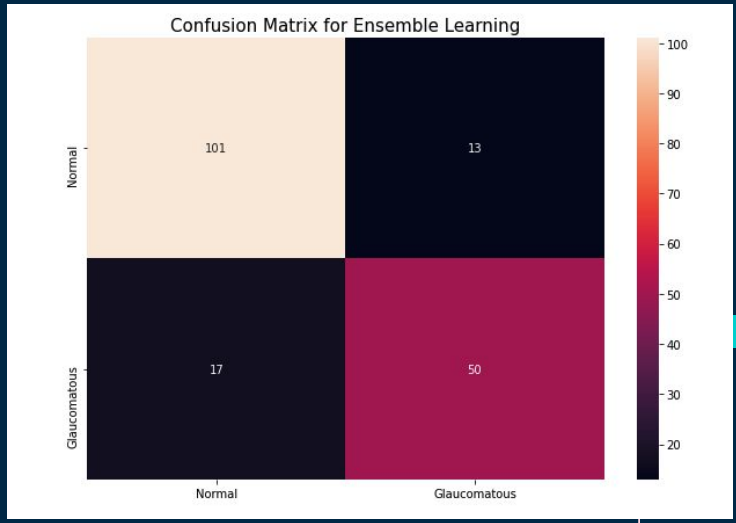


Figure 3. Confusion Matrix

THANK YOU!

I would be happy to take any questions via email (khushmeetchandi@gmail.com)