COMP9517 Project

2019, T3

Danni Ovens

Project Description

- Apply computer vision and machine learning techniques assist medical image analysis
- Medical domain: Ophthalmology / optometry
  - Examining the eyes for any abnormalities or defects
  - Diagnosis and treatment of eye diseases

Course Marks

- Project = 45% of total course marks
  - Individual component: 15%
  - Group component: 30%
- Deliverables:
  - Individual
    - 3 page report (and source code), Nov 22nd, Friday week 10
  - Group:
    - 15 minute demonstration, Nov 19th, Tuesday week 10
    - 10 page report (and source code), Nov 22nd, Friday week 10
- Reports: 2 Column IEEE Format

Domain Description

- Retinal image: image of the back of the eye
- Key features:
  - Optic disc
  - Fovea
  - Vasculature

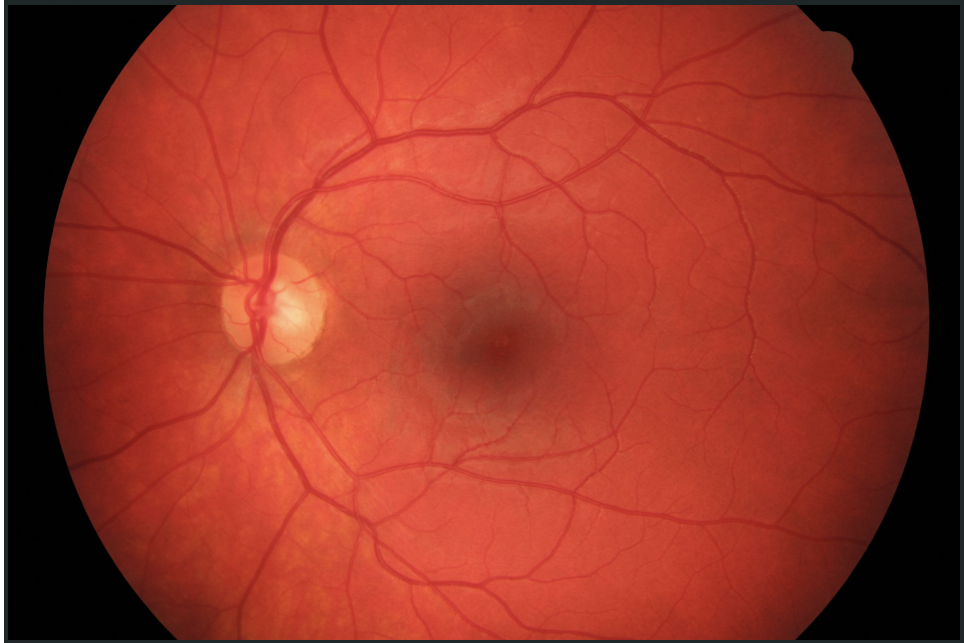

Figure 1: Healthy eye
High-Resolution Fundus (HRF) Image Database

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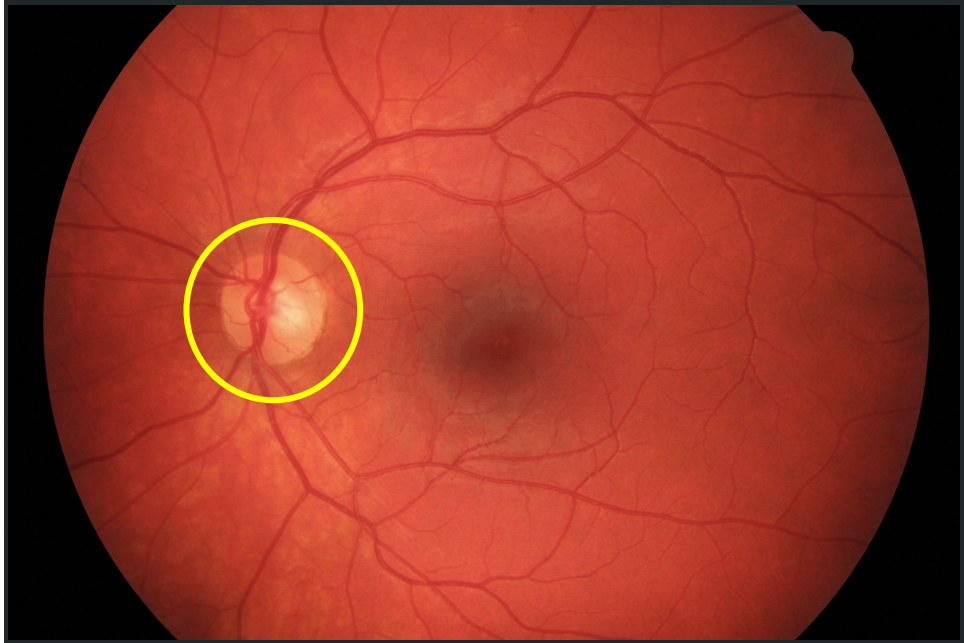

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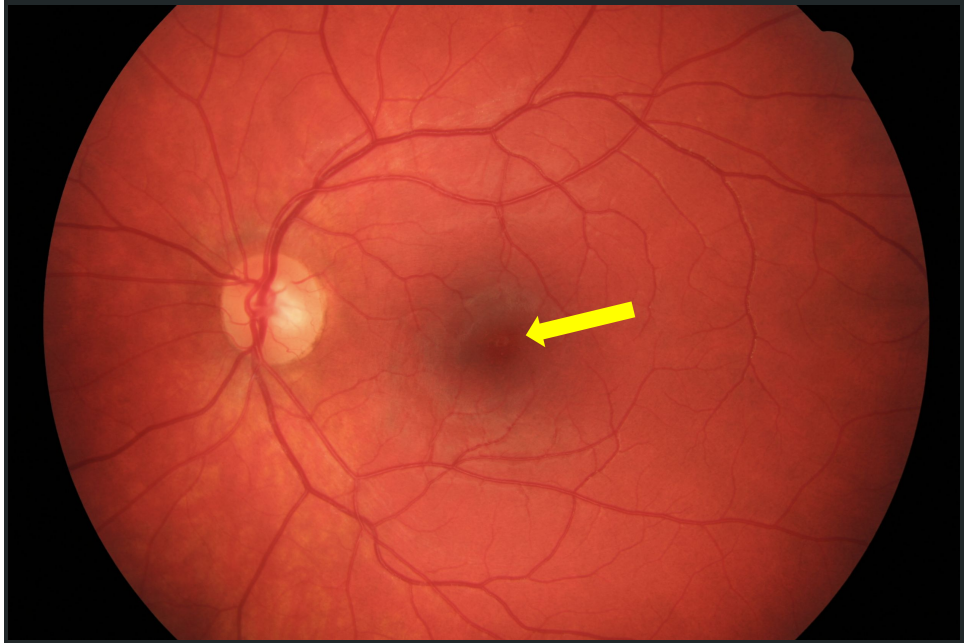

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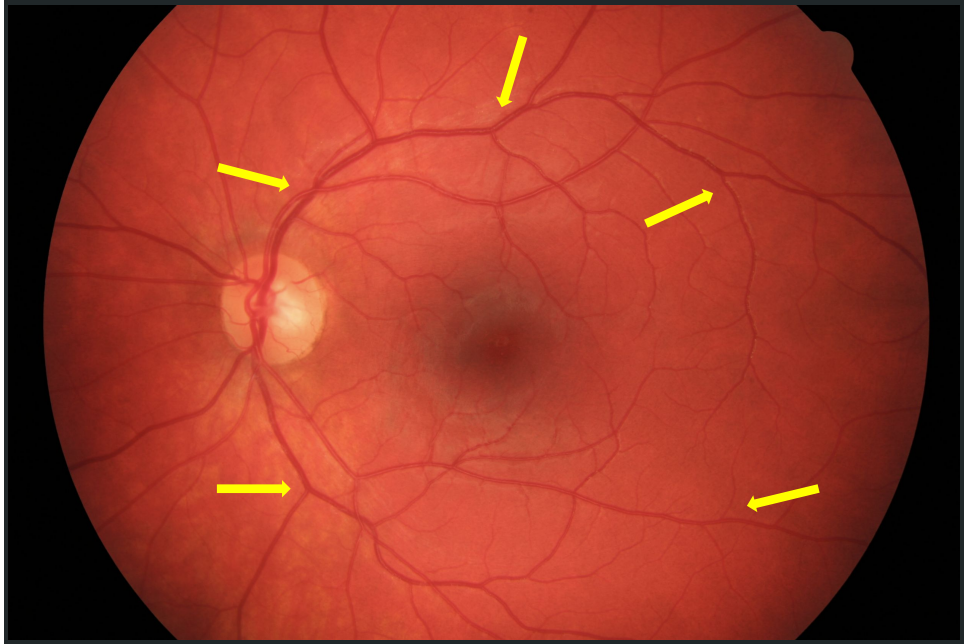

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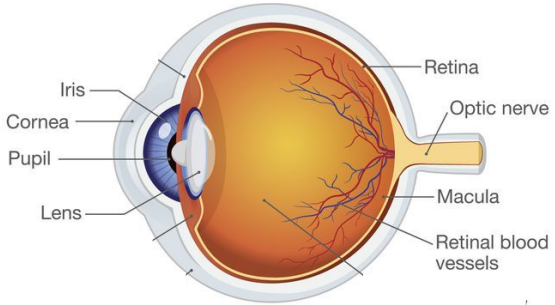
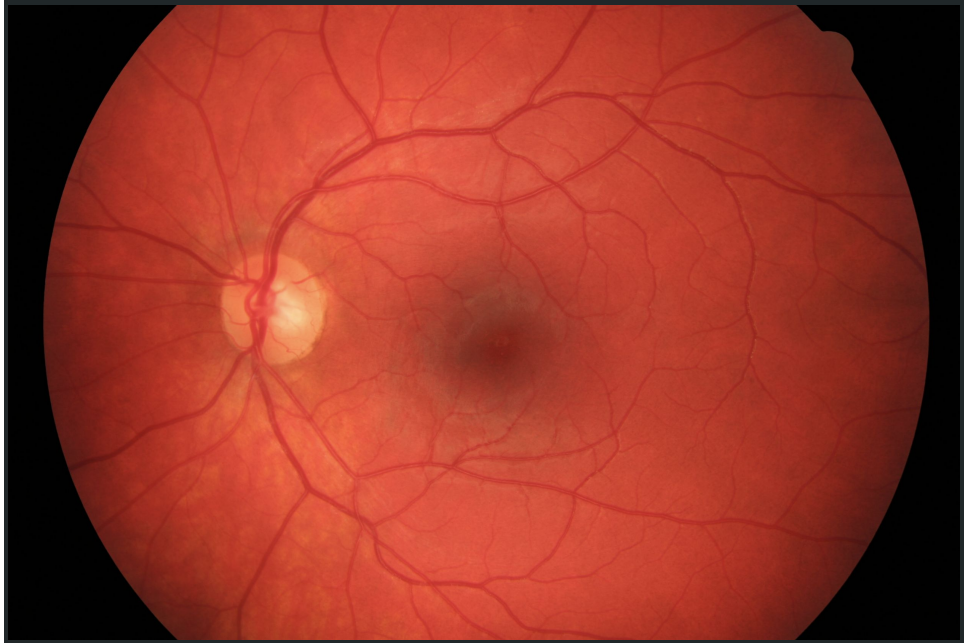


Eye anatomy (cross sectional)
Modified image from Helmenstine, A.M., 2019



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High-Resolution Fundus (HRF) Image Database

Individual Component

- Task: Segment the optic disc
- Data: Indian Diabetic Retinopathy Image Dataset (IDRiD)
  - 54 images
  - Corresponding ground-truth segmentation
- Methods: traditional segmentation algorithms based on image processing
- Evaluation: statistical **or** subjective
- Deliverable: report and code.
  - To be completed individually and evaluated for each student separately

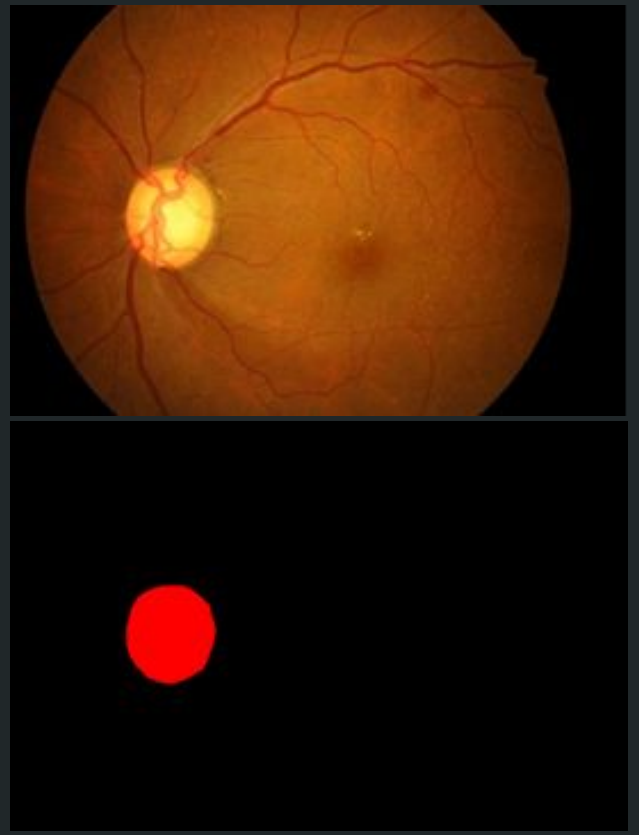


Figure 2: Example retinal image from the IDRiD database (top) and the ground-truth optic disc segmentation (bottom)

Group Component

- **TWO** tasks

- Task 1: Segment retinal lesions of abnormal conditions associated with diabetic retinopathy
  - Microaneurysms
  - Haemorrhages
  - Hard Exudates
  - Soft Exudates
- Task 2: Segment blood vessels in retinal images

Group Component - Task 1

- Task: Segment abnormal lesions associated with Diabetic Retinopathy (DR)
  - DR is a condition where damage occurs to the retina due to diabetes.
  - One of the leading causes of blindness
- Data: IDRiD
  - 54 training images
  - 27 test images
  - Corresponding ground-truth segmentation for each lesion type (wherever present)
- Methods: any segmentation and/or classification technique(s)
- Evaluation: based on ground truth

Figure 3: DR afflicted retinal image and segmentations from IDRiD

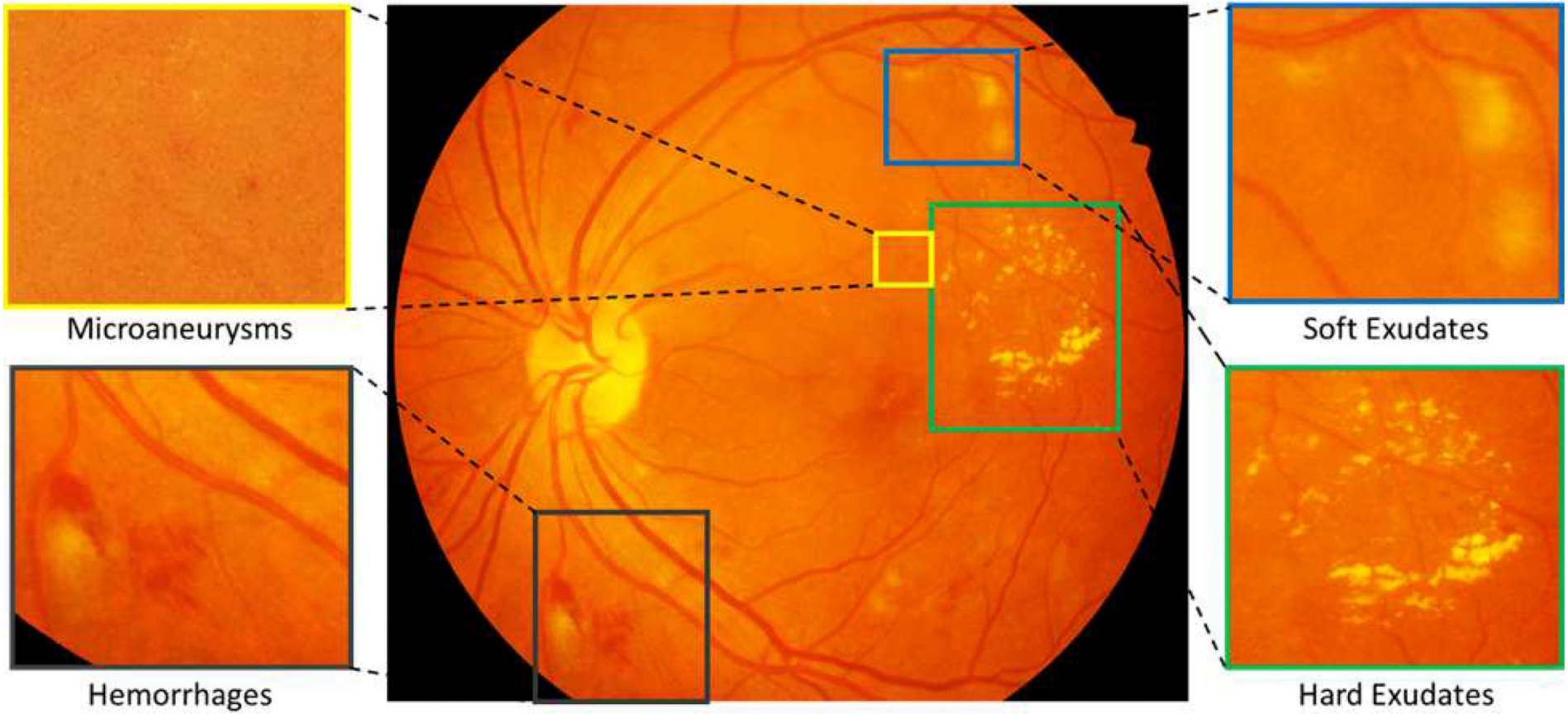


Figure 4: Retinal lesions associated with diabetic retinopathy. (Porwal et al, 2018)

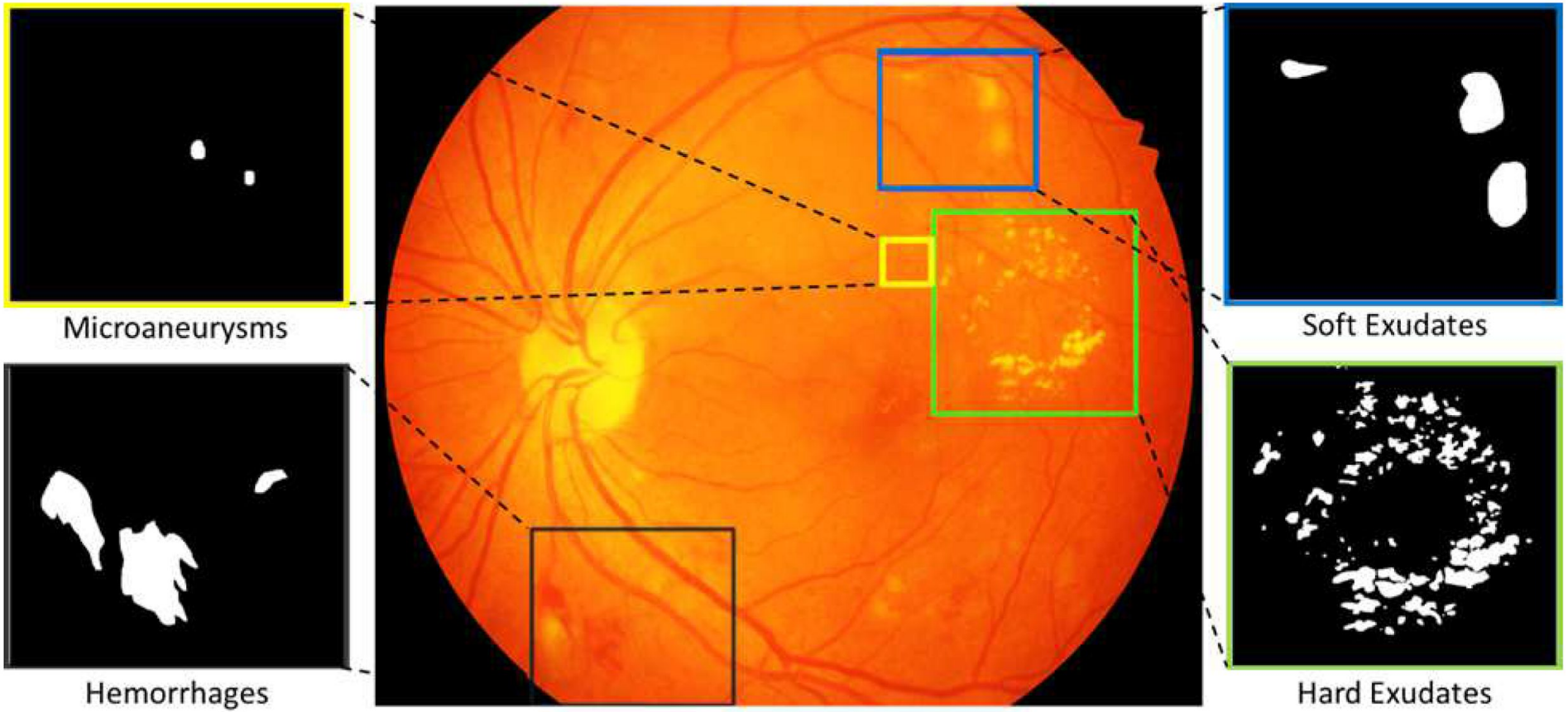


Figure 5: Sample segmentation (enlarged) of retinal lesions associated with diabetic retinopathy. (Porwal et al, 2018)

Group Component - Task 2

- Task: Segment retinal blood vessels
- Data: **DRIVE** database
  - 40 images
  - Corresponding ground-truth segmentation
  - Background masks
- Methods: any segmentation and/or classification technique(s)
- Evaluation: based on ground truth

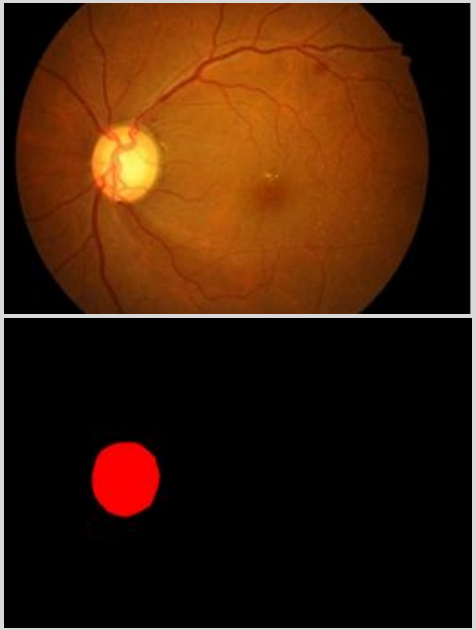
Figure 6: Example retinal image from the DRIVE database (left) and the ground-truth blood vessel segmentation (right)

Supplementary Material

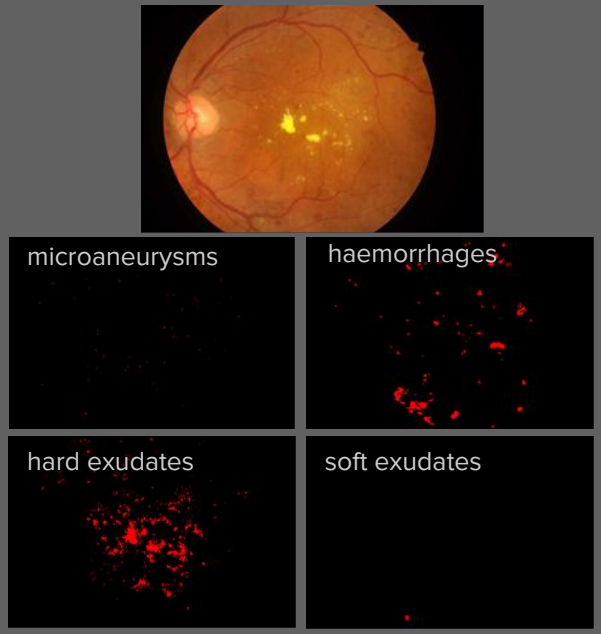
- Four papers for each task have been listed at the bottom of the project spec
- Access the papers through the UNSW library database
- Use these papers as a starting point for your project
  - Provides a range of existing methods
  - Benchmark for evaluation techniques

Summary

Individual



Group (task 1)



Group (task 2)

References

- Budai, Attila; Bock, Rüdiger; Maier, Andreas; Hornegger, Joachim; Michelson, Georg. Robust Vessel Segmentation in Fundus Images. International Journal of Biomedical Imaging, vol. 2013, 2013
- Helmenstine, A.M., 2019. Structure and Function of the Human Eye. Available at: https://www.thoughtco.com/how-the-human-eye-works-4155646 .
- Hoover, A. "STARE database." Available at: http://www. ces. clemson. edu/~ ahoover/stare (1975)
- Indian Diabetic Retinopathy Image Dataset (IDRiD) Available at: https://idrid.grand-challenge.org/
- Porwal, P.; Pachade, S.; Kamble, R.; Kokare, M.; Deshmukh, G.; Sahasrabuddhe, V.; Meriaudeau, F. Indian Diabetic Retinopathy Image Dataset (IDRiD): A Database for Diabetic Retinopathy Screening Research. Data 2018, 3, 25.