

# Extracting medically relevant features of the human retina

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UNIL BSc course: **Solving Biological Problems that require Math 2018**

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The Retina is the only part of the cardiovascular system that can be observed noninvasively



# Retinal images features are implicated in disease

## Diseases:

- Macular degeneration
- Diabetic retinopathy
- Glaucoma
- Hypertension
- Atherosclerosis

## Features:

- vessels size
- vessels tortuosity
- vessels branching coefficients
- size and color of the optic disk
- overall color of the fundus
- discontinuity of the fundus

# We use computers to extract such features

The image displays a software interface for retinal vessel analysis. The main window, titled "320791\_D", shows a retinal fundus image with a network of vessels overlaid and numbered. The right sidebar, titled "ARIA v1 - 09-12-11", contains a list of vessel segments with their coordinates and diameters, and a "Profile plot" showing a cross-section of the vessels.

**320791**  
**320791 320791** **17.06.2014**

**ARIA v1 - 09-12-11**

**File Processors Copy Vessels Retina Display**

**File**  
320791\_D  
(1.3791 seconds)

**Calibration**  
1 px per pixel   
 Pixels  Calibrated

**View**  
  
 Centre  Diameters  
 Edges  Selected  
 Labels  Optic disc

**Vessel segment**  
1

No. diameters	223
Mean diameter	6.6277 px
Std. dev. diameters	1.3023 px
Min. diameter	3.6049 px
Max. diameter	9.6811 px
Segment length	228.8684 px
Diameter / length	0.0290
Tortuosity	1.0554

**Profile plot**

# Aim of the Project

The aim of this project is to **implement a computer program** to manipulate retinal images with the objective of **extracting numerical values** that could be used to **assess the state of health of an individual.**

# Tools

- **Computational Tools:** Students will be asked to write a MATLAB program to manipulate 2D retinal images. The task will be simplified by the use of a MATLAB library called “Image processing Toolbox”.
- **Mathematical tools:** Students will be asked to use simple statistics (comparison of probability distributions) to assess whether the features they have extracted carry information.
- **Biological or Medical aspects:** the state of our retinal provides information about diseases such as hypertension, atherosclerosis, macular degeneration, retinopathy, glaucoma of the eye.

Thank you

Questions?