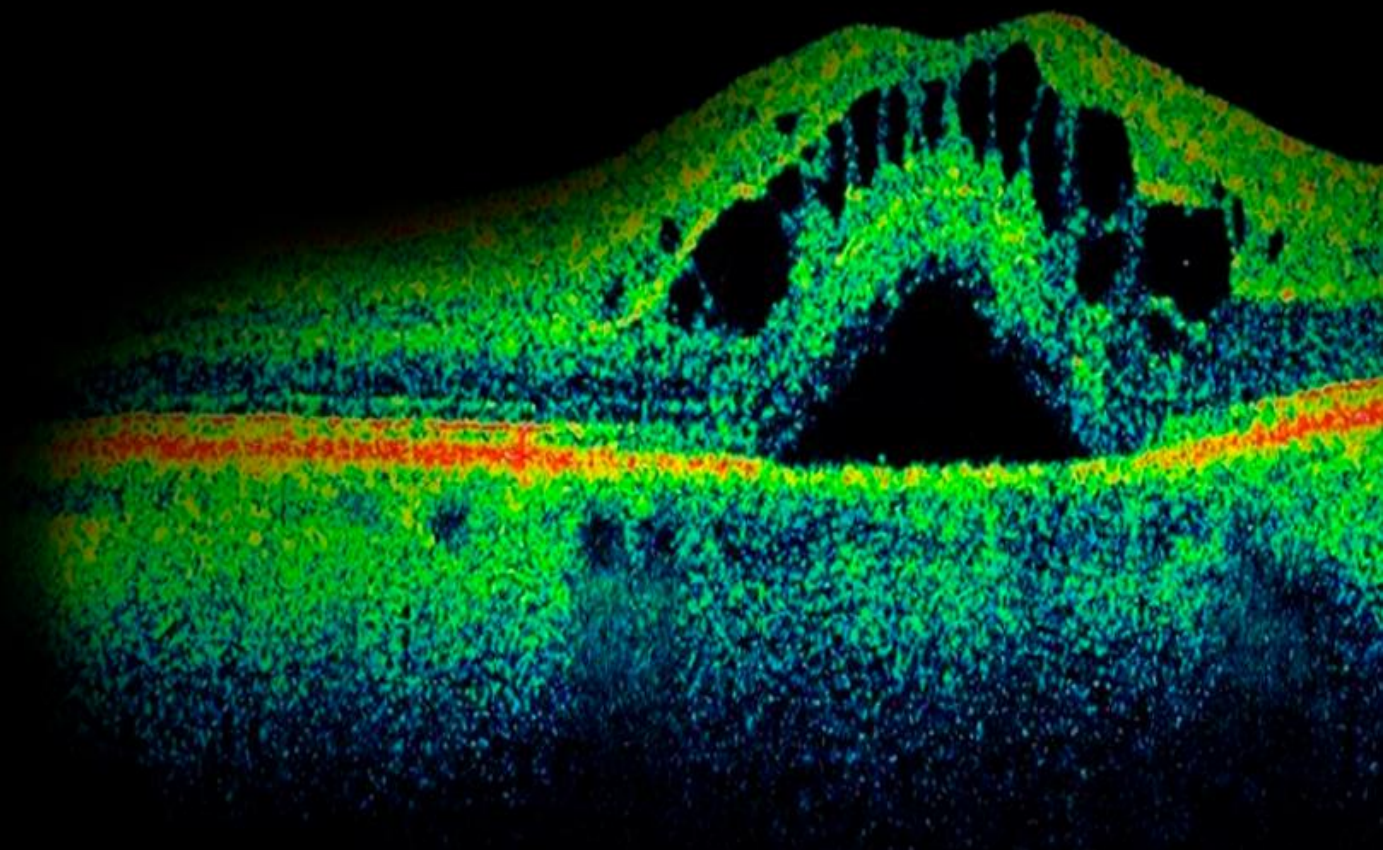


DEEP LEARNING METHOD FOR THE RECONSTRUCTION OF OPTICAL COHERENCE TOMOGRAPHY IMAGES WITH LATERAL SUBSAMPLING

Diego A. Pulgarín, José H. Ortiz, Sebastián Ruiz-Lopera,
Néstor Uribe-Patarroyo, Sofia Obando-Vásquez, Juan José
Cadavid-Muñoz, Carlos trujillo and René Restrepo



APPLIED OPTICS
research group

UNIVERSIDAD
EAFIT[®]



Agenda



APPLIED OPTICS
research group

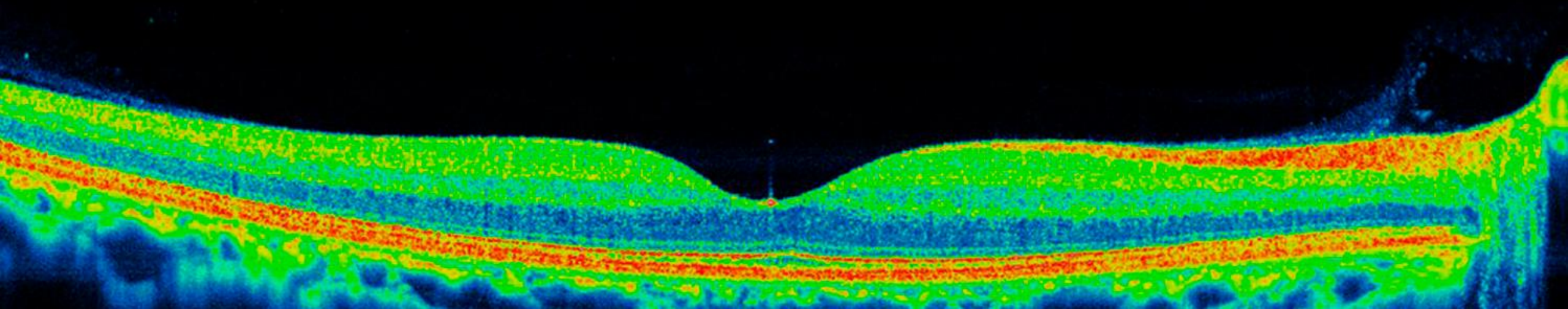
UNIVERSIDAD
EAFIT[®]

01 What is OCT?

03 Reducing
acquisition time

02 System
acquisition

04 Proposed method
and results



Optical Coherence Tomography (OCT)

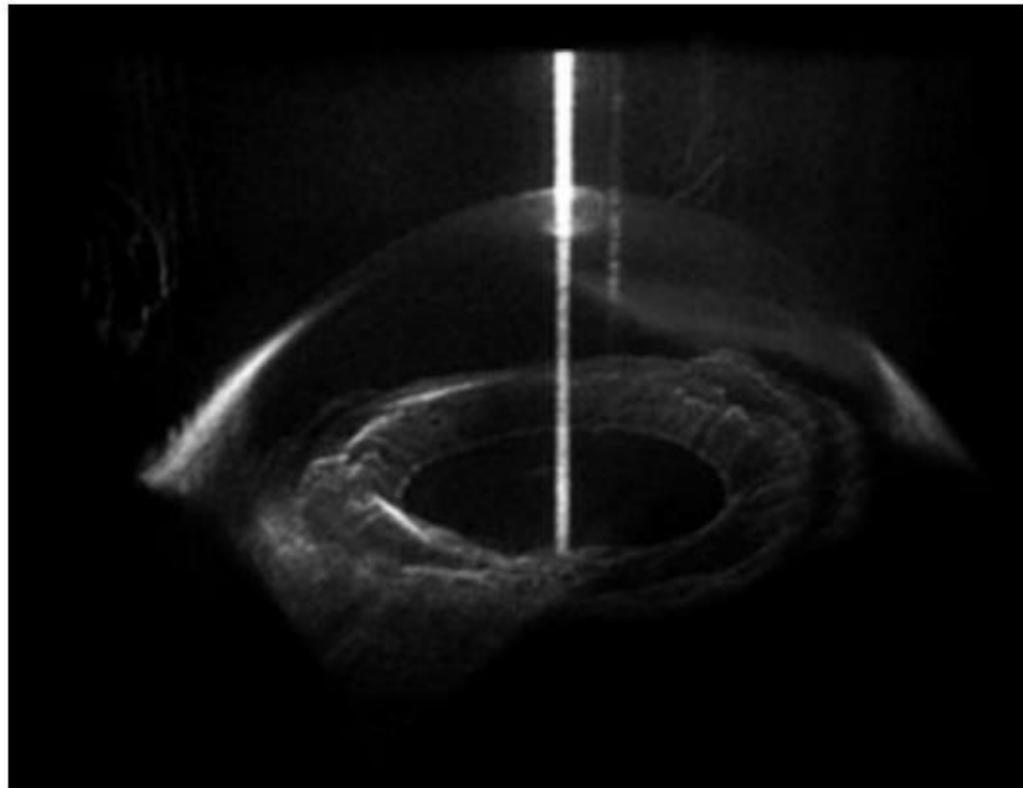
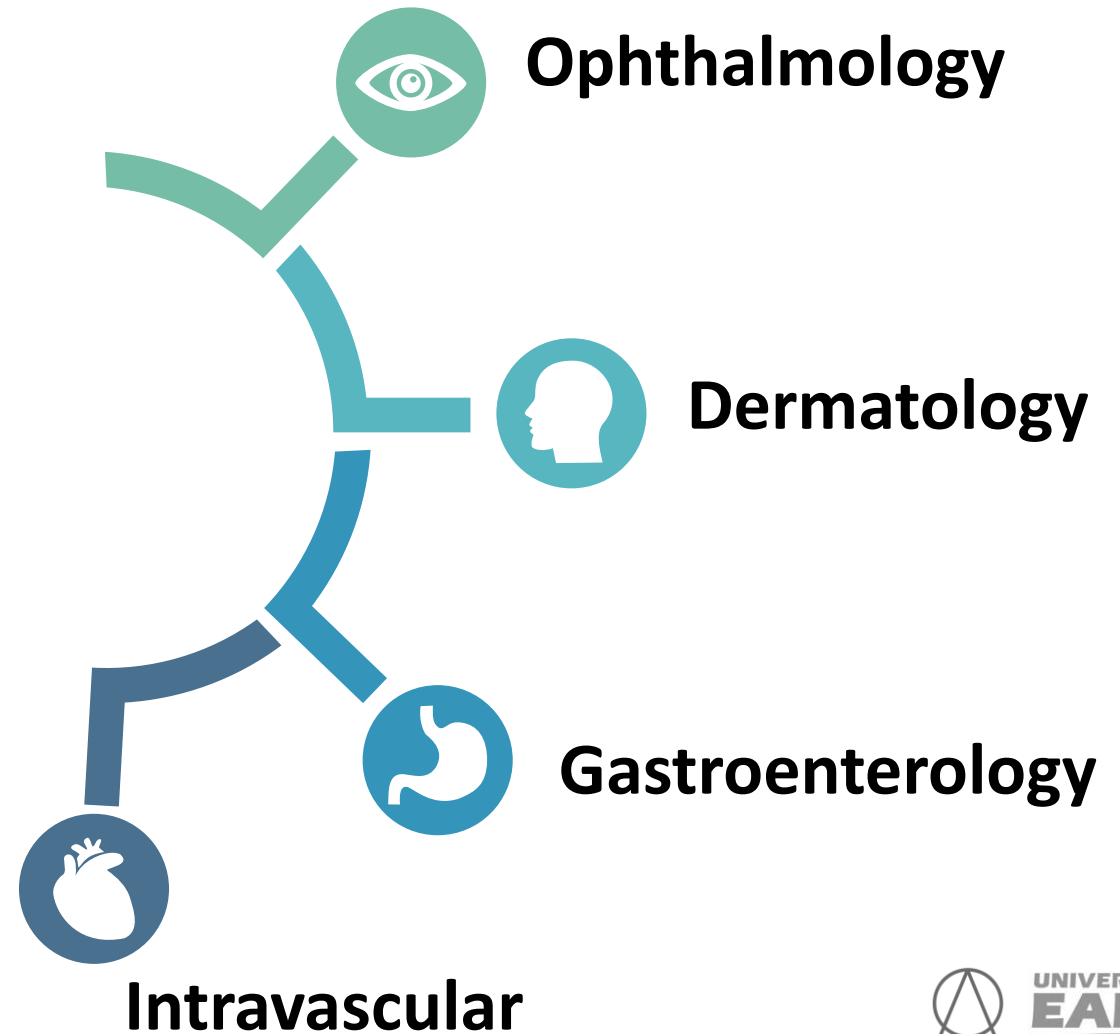
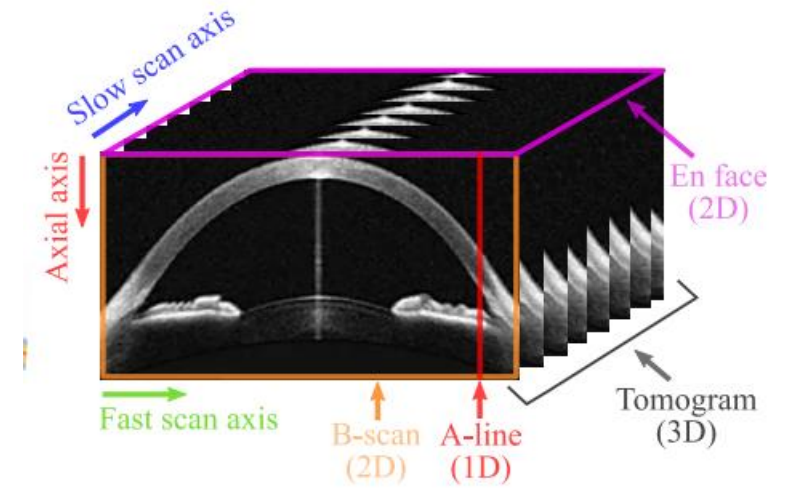
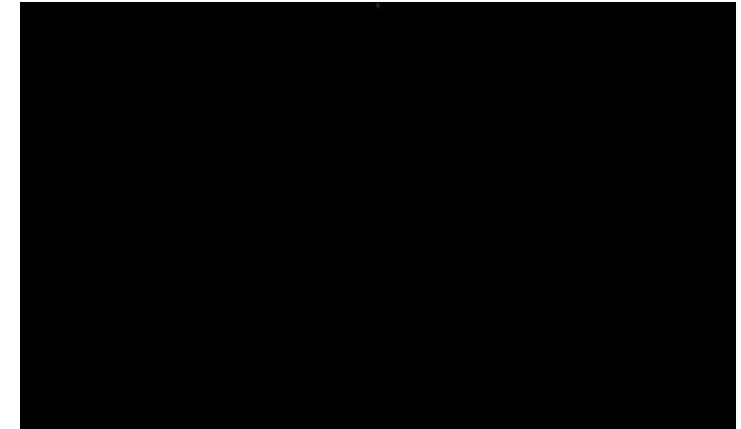
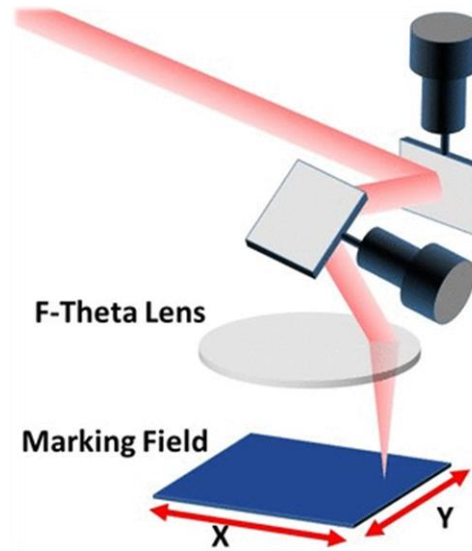
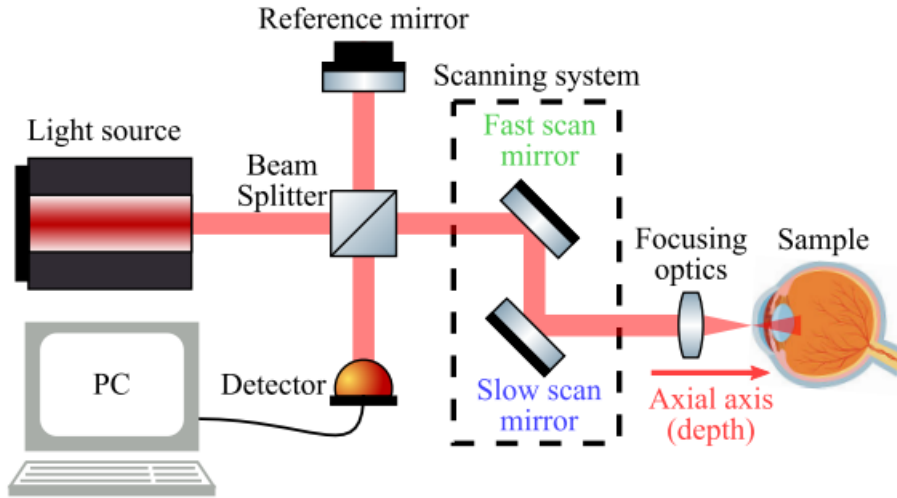


Figura tomada de: Complex Conjugate Removal in SS Optical Coherence Tomography



OCT acquisition system

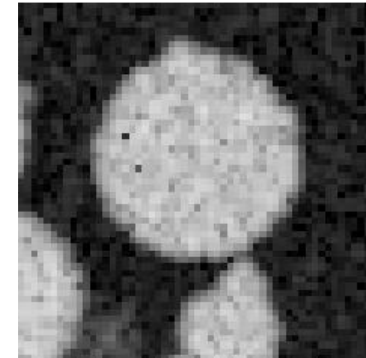
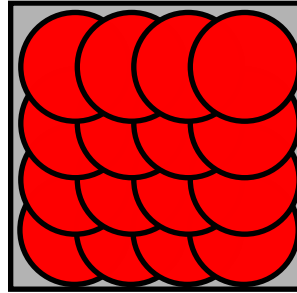
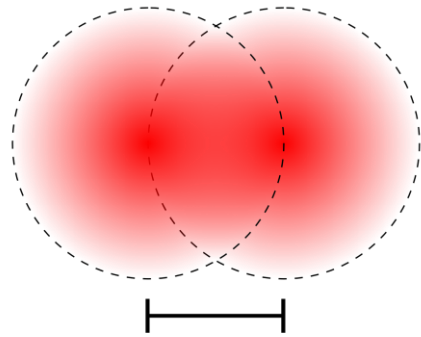
How is the acquisition?



Lateral Resolution

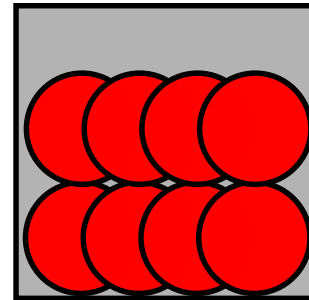
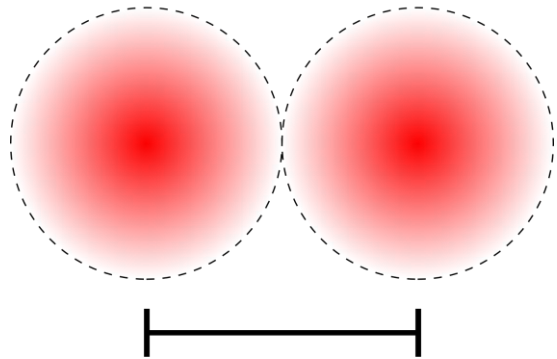
Nyquist sampling:

$$d = \frac{\Delta x}{2}$$



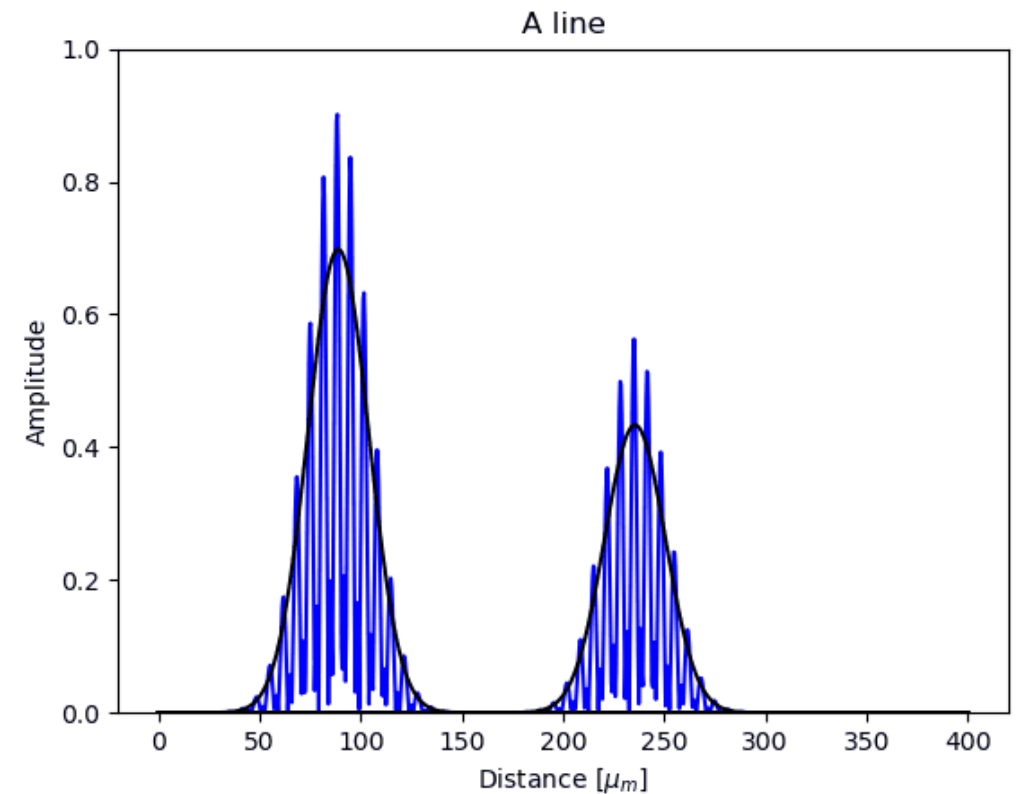
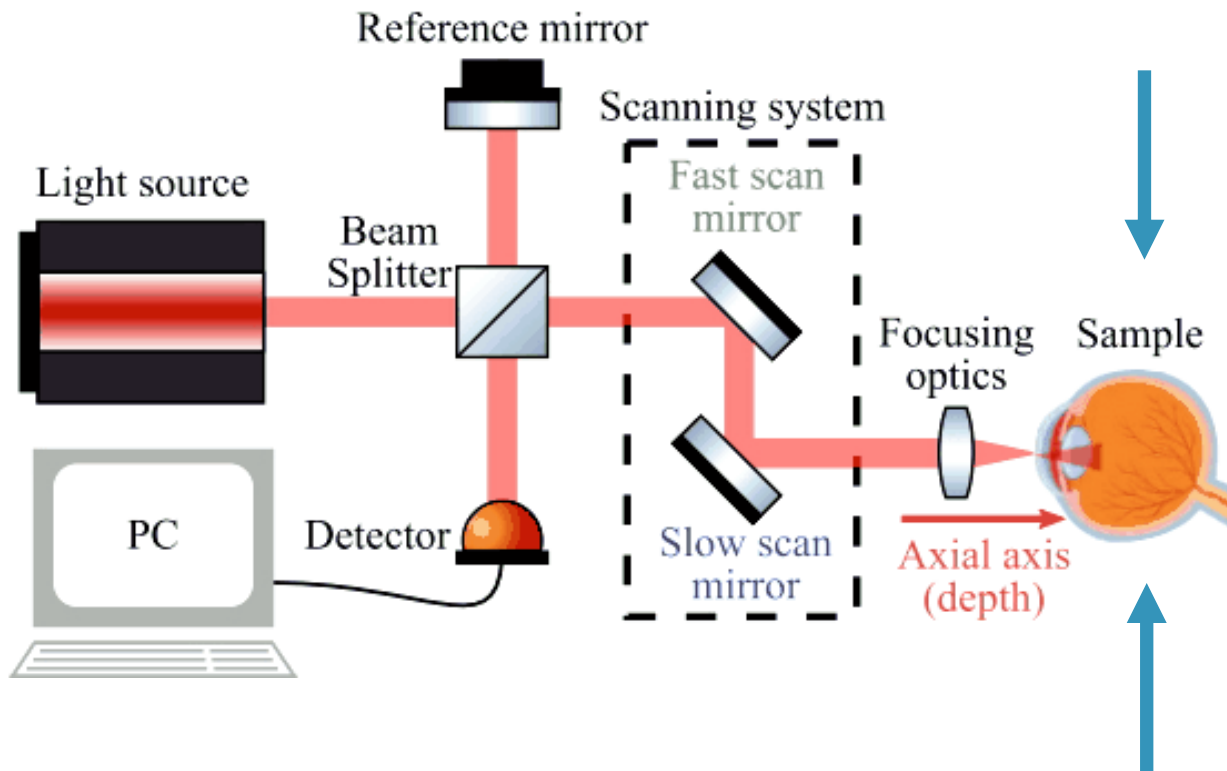
subsampling:

$$d = \Delta x$$

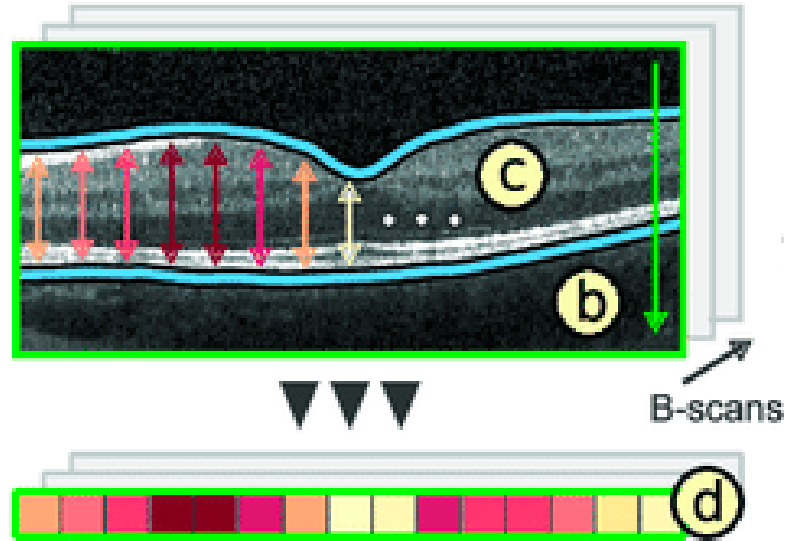


$$\Delta x = 2w_0 = \frac{2\lambda_c}{\pi NA},$$

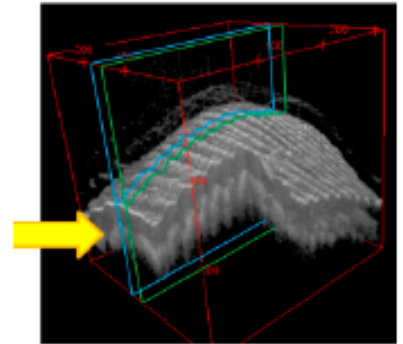
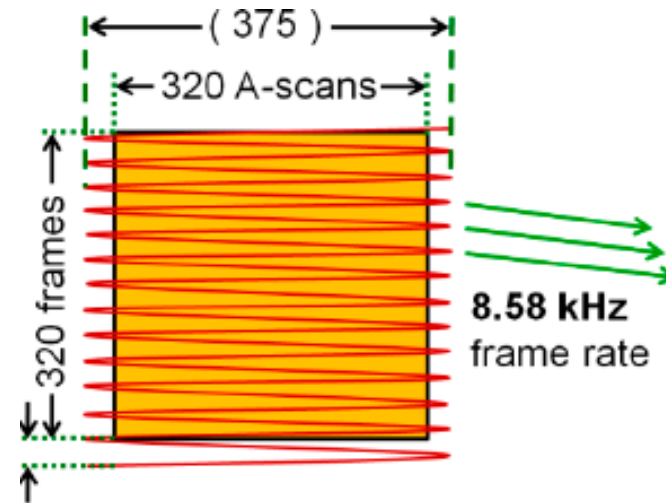
Importance of reducing acquisition time



What does it depend on?



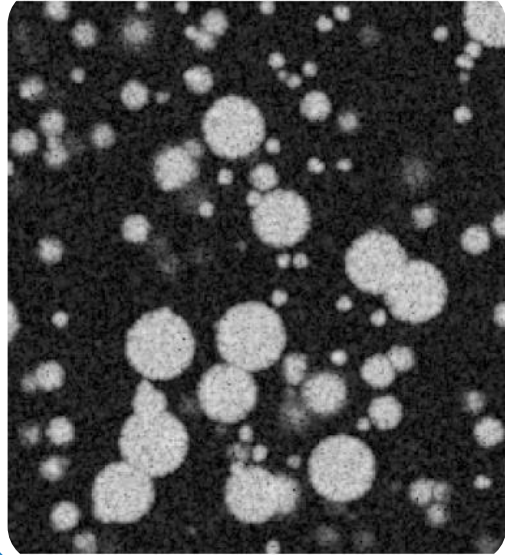
Acquisition rate



Numbers of lines

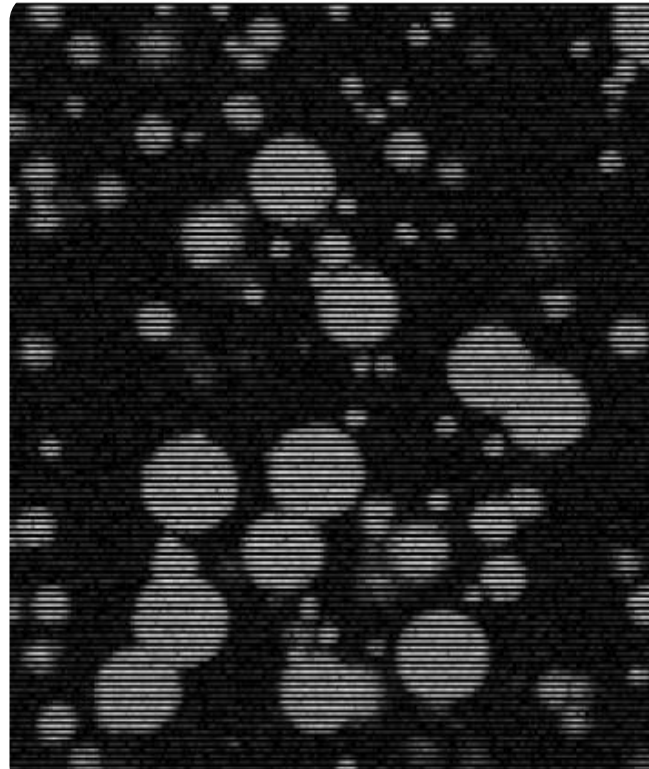
Röhlig, Martin & Prakasam, Ruby & Stüwe, Jörg & Schmidt, Christoph & Stachs, Oliver & Schumann, H.. (2019). Enhanced Grid-Based Visual Analysis of Retinal Layer Thickness with Optical Coherence Tomography. Information. 10. 266. 10.3390/info10090266.

Sampled correctly



Acquisition time T

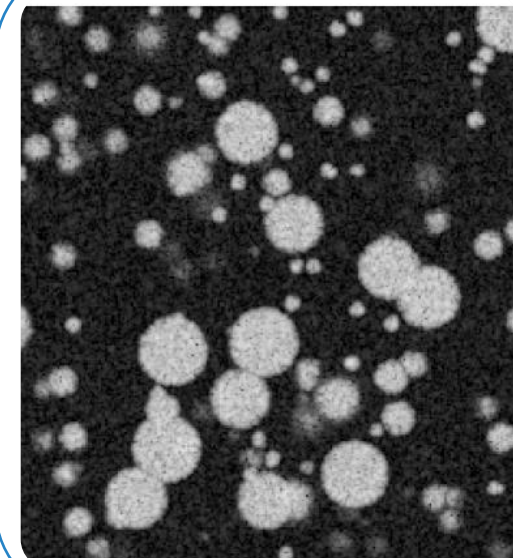
Sub-Sampled



Acquisition time T/2

Problem Statement

Sampled correctly

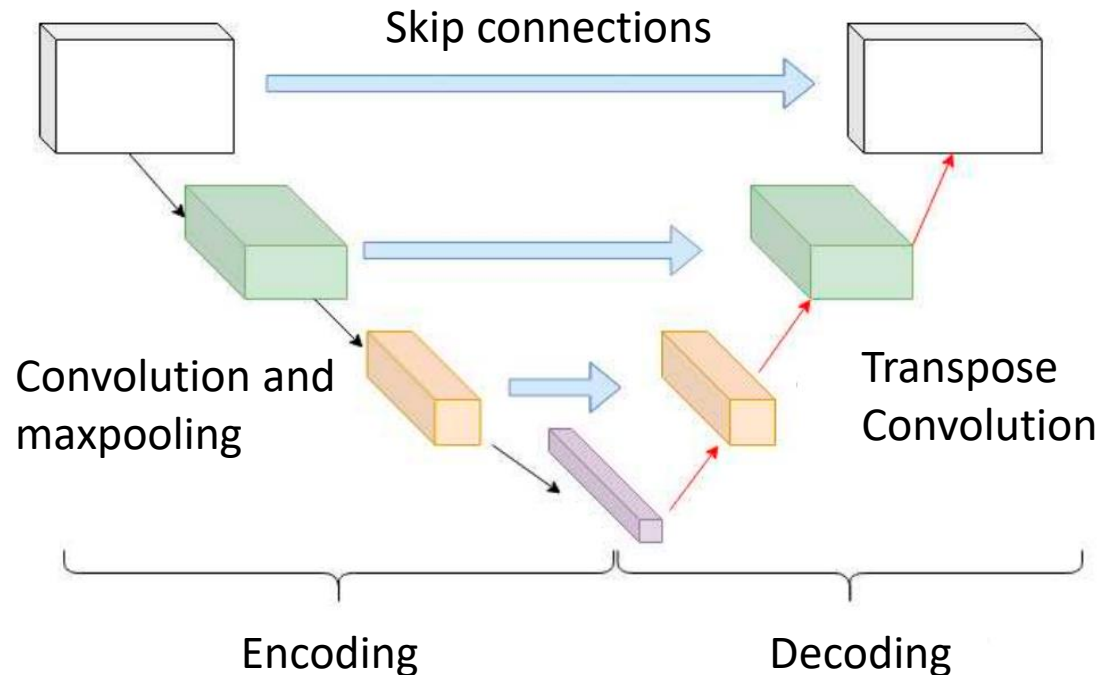


Acquisition time T/2

Deep Learning

Convolutional networks

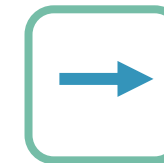
Convolutional Neural Networks (CNNs) are a sub-classification of the DL that is used for the treatment of 2D information, due to which use not only the information of the individual pixels, but also the relationship spatial between them from the use of convolutional layers.



U – Net architecture



- Convolutional layers
- Dropout Layers
- Maxpooling layers



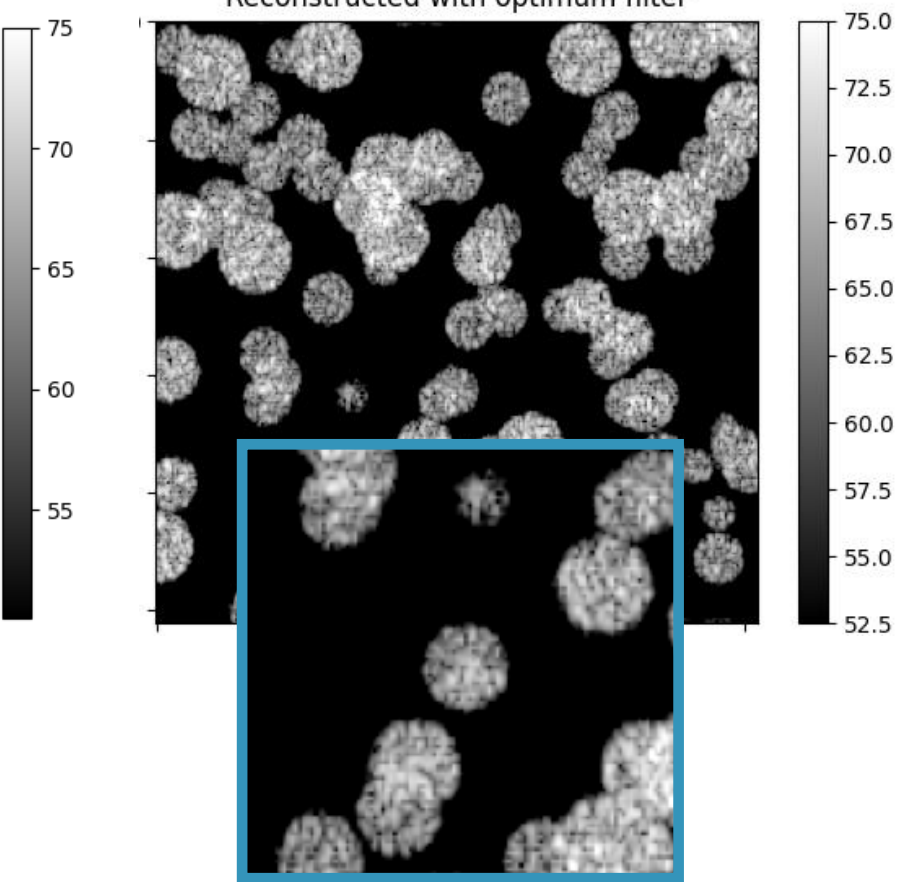
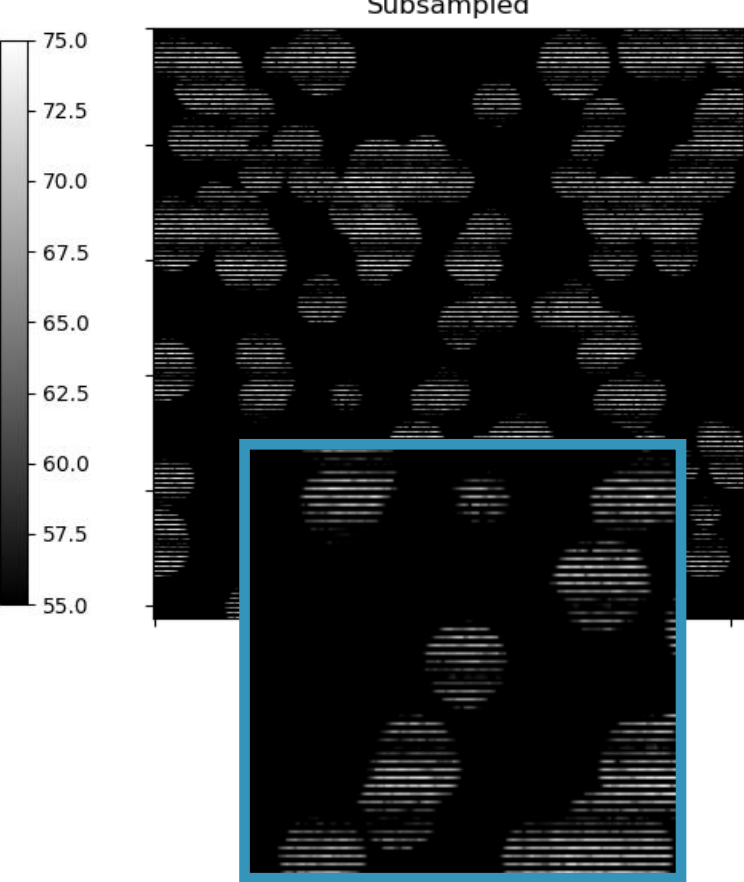
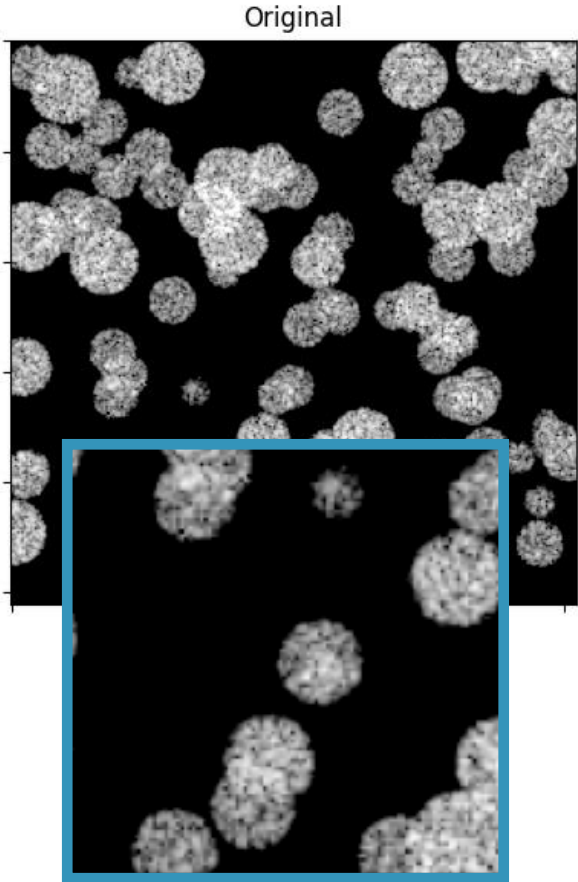
Skip connection



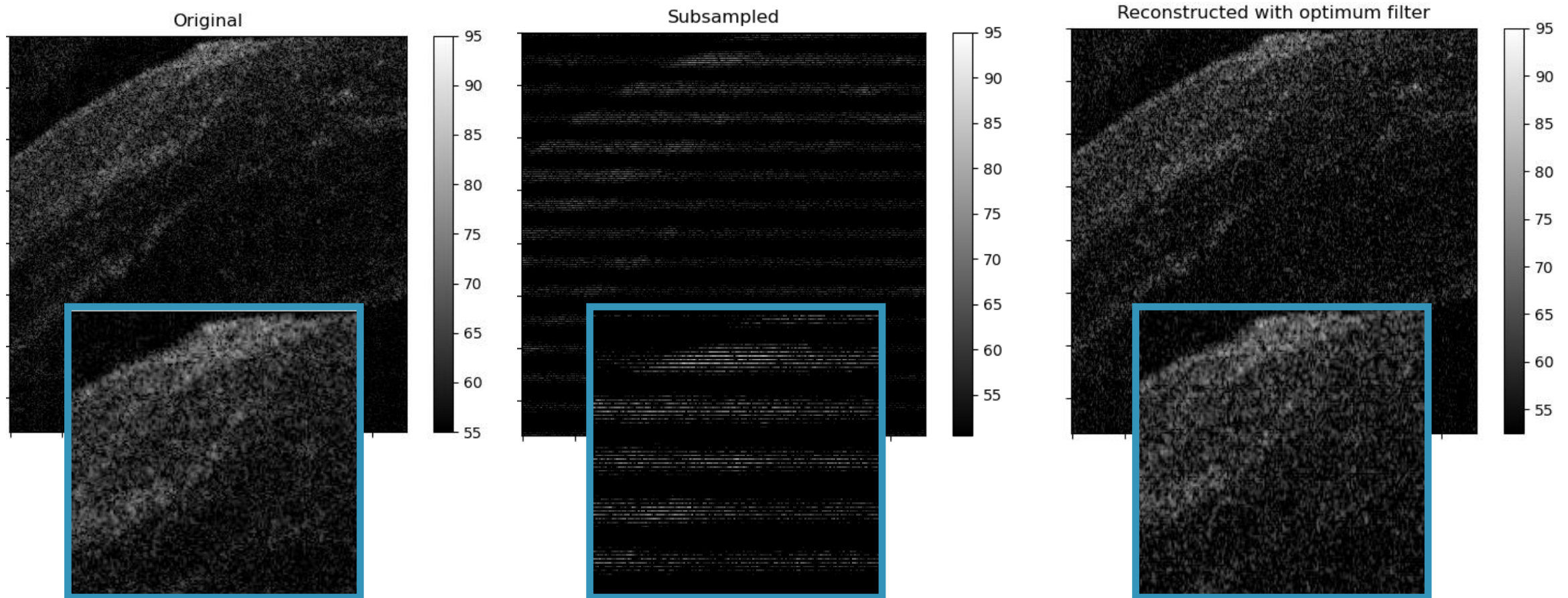
- Convolutional transpose layers
- Dropout layers
- Upsampling layers

<https://medium.com/@arvindwaskarthik/pedestrian-segmentation-a-study-of-influence-of-parameters-and-datasets-with-unet-716162bac05f>

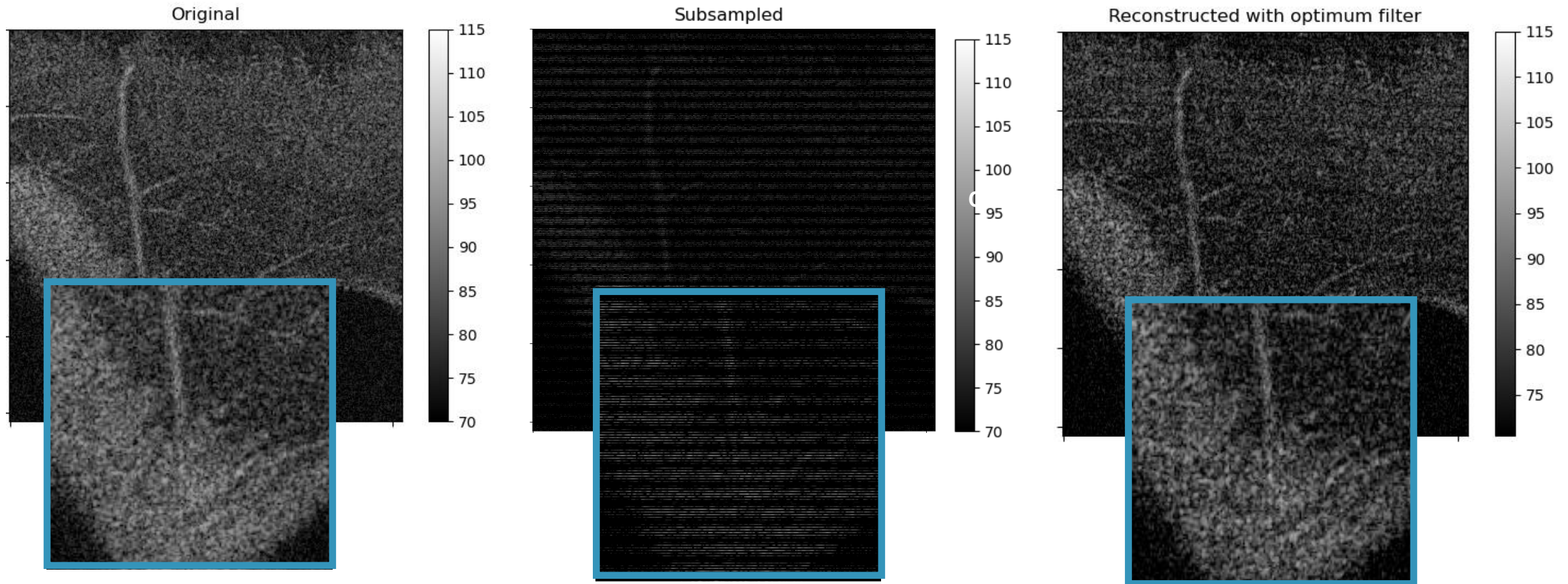
Synthetic Data



Experimental Data-cornea of a swine

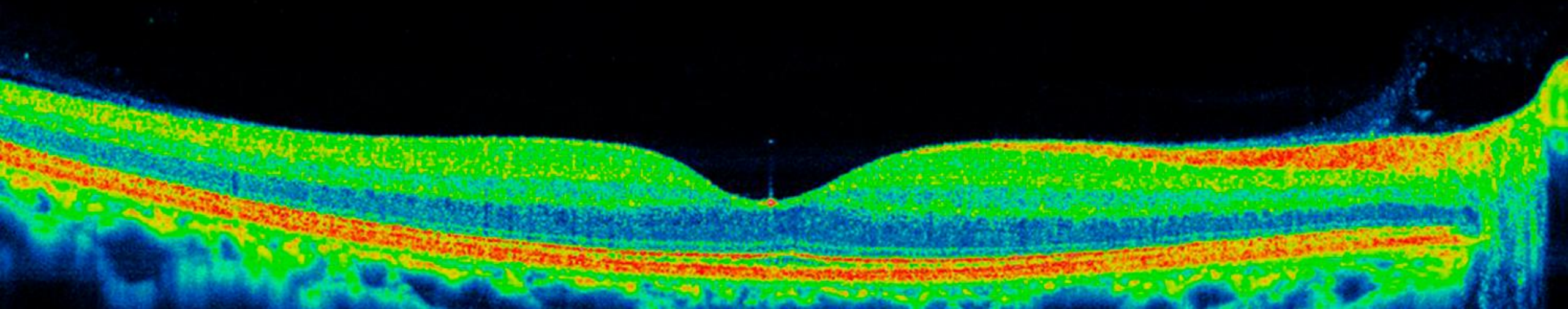


Experimental Data-retinal fovea



Conclusion and future work

- The proposed method reduces the acquisition time by using fewer lines than necessary
- In future work we want acquire a sub sampled tomogram for probe an test the reduction time.
- We want explore some diferents arquitectures to choose the better network





THANK YOU