francisco.javier.burgos@upc.edu

Deep Learning for Eye Fundus Diagnosis based on Multispectral Imaging

Francisco J. Burgos-Fernández[1,2], Buntheng Ly[2], Fernando Díaz-Doutón[1], Meritxell Vilaseca[1], Jaume Pujol[1] and Maxime Sermesant[2,3]

[1]Centre for Sensors, Instruments and Systems Development (CD6), Universitat Politècnica de Catalunya (UPC)
[2]Inria Centre de Recherche Sophia Antipolis Mediterranee; [3]Electrophysiology and Heart Modelling Institute (IHU, Liryc)

PURPOSE: Apply deep learning techniques to the classification of multispectral images from healthy and diseased eyes fundus.

METHODS

Subjects

68 healthy & 68 diseased eyes (only eye fundus diseases)

89 patients = 63% ♀ and 37% ♂

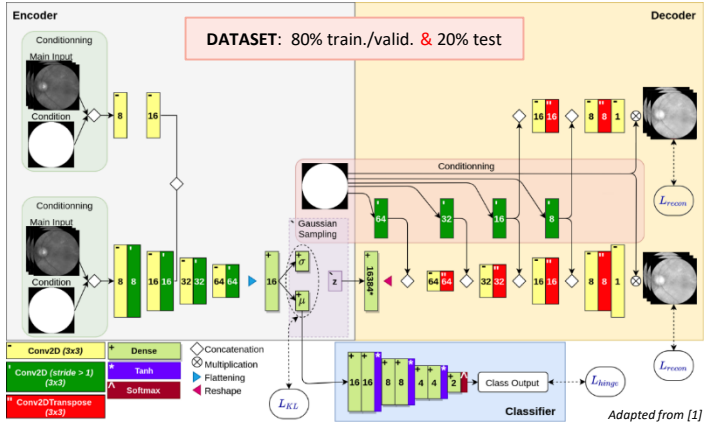
Age = 54.5 ± 16.0 years [19, 95] years

Sphere ± 15D & Cylinder ≤ 2D

Conditional Variational Autoencoder (CVAE)

Spectral cube size 386x386x3
Spectral range 1025 – 1213 nm

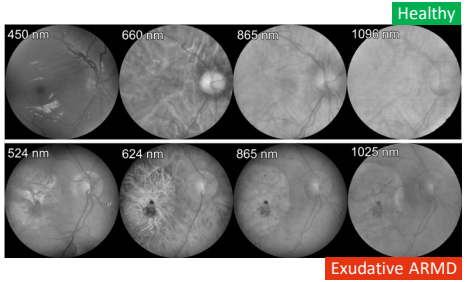
Spectral cube size 1757x1757x12
Spectral range 416 – 955 nm

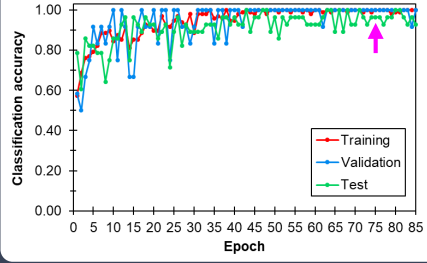


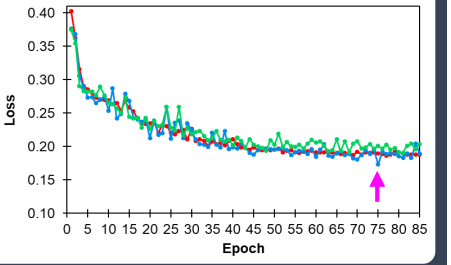
Adapted from [1]

RESULTS

Classification accuracy	0.96
Loss	0.20
Sensitivity (%)	92.86
Specificity (%)	100.00







CONCLUSIONS: The automatic classification of eye fundus through the proposed CVAE produced an excellent outcome, highlighting the power of an encoder-decoder network and the significant information retrieved from multispectral images in the visible and near-infrared beyond 900 nm, a relatively unexplored range. Future work will focus on differentiating among pathologies.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Marie Skłodowska-Curie grant agreement No. 801342 (Tecniospring INDUSTRY) and the Government of Catalonia's Agency for Business Competitiveness (ACCIÓ).

ACCIÓ Generalitat de Catalunya Government of Catalonia

Tecniospring INDUSTRY

REFERENCES: [1] B. Ly, S. Finsterbach, M. Nuñez-García, H. Cochet, and M. Sermesant; Proceedings of Functional Imaging and Modeling of the Heart, 461 (2021).