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Data Article

Dataset of fundus images for the diagnosis of ocular toxoplasmosis

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ABSTRACT

Toxoplasmosis chorioretinitis is commonly diagnosed by an ophthalmologist through the evaluation of the fundus images of a patient. Early detection of these lesions may help to prevent blindness. In this article we present a data set of fundus images labeled into three categories: healthy eye, inactive and active chorioretinitis. The dataset was developed by three ophthalmologists with expertise in toxoplasmosis detection using fundus images. The dataset will be of great use to researchers working on ophthalmic image analysis using artificial intelligence techniques for the automatic detection of toxoplasmosis chorioretinitis.

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Specifications Table

Subject	Ophthalmology.
Specific subject area	Toxoplasmosis chorioretinitis.
Type of data	Image. Excel file.
How data were acquired	The fundus images were captured with the VISUCAM 500 camera from ZEISS [2] and the Pictor Plus-Portable Ophthalmic Camera [3]. The retinographies are centered on the macula.
Data format	Raw. 1. JPG (.jpg), Fundus images whose dimensions are 2124 × 2056 (VISUCAM 500 camera from ZEISS) and 1536 × 1152 (Pictor Plus-Portable Ophthalmic Camera). 2. dataset_labels (.csv).
Parameters for data collection	Field angle: 45°. Capture Mode: Color Image.
Description of data collection	Fundus images. The fundus images provided correspond to patients with suspected congenital toxoplasmosis infection. These are classified as healthy and non healthy. The non healthy ones are further classified into (i) inactive, (ii) active and (iii) active/inactive. Manually segmented images corresponding to images with active and/or inactive lesions are also provided.
Data source location	• 291 color fundus images were acquired at the Department of Ophthalmology of the Hospital de Clínicas, Facultad de Ciencias Médicas, Universidad Nacional de Asunción, San Lorenzo 2160, Paraguay with the VISUCAM 500 camera from ZEISS. • 121 color fundus images were acquired at the Niños de Acosta Ñú General Pediatric Hospital with the Pictor Plus-Portable Ophthalmic Camera.
Data accessibility	**Repository name:** Ocular Toxoplasmosis Fundus Images Dataset **Data identification number:** https://doi.org/10.5281/zenodo.4439566 **Direct URL to data:** https://zenodo.org/record/5156953#.YbqGF2jMKUk
Related research article	R. Parra, V. Ojeda, J. L. Vázquez Noguera, M. García Torres, J. C. Mello Román, C. Villalba, J. Facon, F. Divina, O. Cardozo, V. E. Castillo, and I. Castro Matto, **Automatic Diagnosis of Ocular Toxoplasmosis from Fundus Images with Residual Neural Networks**, Public Health and Informatics, May 2021 [4].

Value of the Data

- The data set is especially useful for research and training of new professionals involved in the study of pathologies associated with vision.
- Computer vision researchers can benefit from this dataset to train machine learning models that classify or detect active or inactive ocular toxoplasmosis in patients.
- The data set can be used for the study of retinal anatomy and its physiological variations by comparing different normal images.

1. Data Description

Data collected at baseline included fundus images which were captured at 2 hospital centers:

1. Hospital de Clínicas Medical Center: The clinical procedure used for the acquisition of color fundus images is described in Castillo-Benítez et al. [1]. The period of time consumed to collect the fundus images was from 2018 to 2020. The dataset consists of 291 fundus images with a size of 2124 × 2056 pixels in JPG format.

	A	B	C
1	Image name	Label	Source
2	1.jpg	healthy	Hospital de Clínicas Medical Center
167	IM0159RE.JPG	inactive	Hospital General Pediátrico Acosta Ñu Medical Center
173	(747).jpg	active/inactive	Hospital de Clínicas Medical Center
276	17117.jpg	active/inactive	Hospital de Clínicas Medical Center
277	IM0053RE.JPG	healthy	Hospital General Pediátrico Acosta Ñu Medical Center
278	IM0062RE.JPG	healthy	Hospital General Pediátrico Acosta Ñu Medical Center

Fig. 1. Example of toxoplasmosis labels in the CSV file.

Table 1
Classification of the images in the database.

Classification	Number of images
healthy	131
inactive	188
active	36
active/inactive	57

2. Niños de Acosta Ñú General Pediatric Hospital: Images were acquired in children under 18 years of age according to the protocol described in Section 2.1.2. The images were captured in the year 2021. The dataset consists of 121 fundus images with a size of 1536×1152 pixels in JPG format.

The images correspond to patients with suspected congenital toxoplasmosis infection. The fundus images are classified according to the following categories: Healthy and Non Healthy. Non Healthy in turn, can be classified into: i) Inactive only, ii) Active only and iii) Active/Inactive. In addition, manual segmentation of the images with active and/or inactive lesions is provided.

Fig. 1 shows information available in the CSV file with the following column description:

A. The “Image name” attribute is the number of the anonymized and renamed patient image.
B. The “Label” attribute shows the classification of the disease.
C. The “Source” attribute shows the center where the image was captured.

Table 1 shows the classification of the database and the number of fundus images owned by each category.

Fig. 2 shows fundus images of healthy, toxoplamosis inactive, active, and active/inactive lesions.

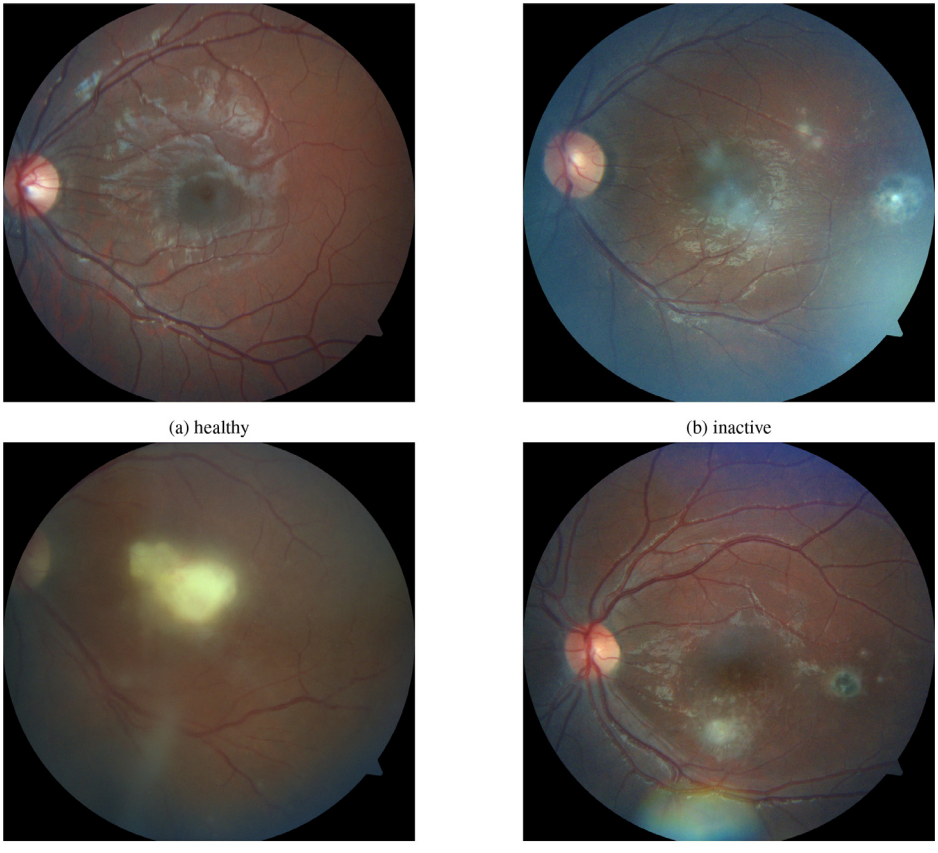


Fig. 2. Example of fundus images from the database.

2. Experimental Design, Materials and Methods

This section presents the image acquisition procedure and the image segmentation procedure for active and inactive toxoplasmosis lesions.

2.1. Image acquisition procedure

The images were captured from two medical centers, with different equipment and image acquisition procedures. This helps to have a larger heterogeneous number of images that could be useful for computer vision researchers to develop algorithms for classification and segmentation of this disease.

2.1.1. Hospital de clínicas medical center

The acquisition of the 291 fundus images from the Hospital de Clínicas, of patients older than 18 years, was performed following the procedure described in Castillo-Benítez et al. [1]. The mentioned procedure is described as follows:

1. Patients are surveyed and data are recorded in a patient file.
2. Mydriatic eye drops should be applied. A drop of Photorretin is applied in each eye twice at 15 min intervals.
3. The examination is performed in a dark room with the Visucam 500 camera after 30 min and when pupil dilation is complete. The patient should be seated in front of the equipment and correctly support the forehead and chin.
4. An image of the retina of each eye is captured using a Zeiss camera, model Visucam 500. This is followed by a fundoscopic examination with an indirect ophthalmoscope and a 20D magnifier. Staging of diabetic retinopathy is established in the patient's file. In the analysis of the retinographies obtained, out-of-focus images, with artifacts or with low image quality due to media opacity (presence of corneal scars, cataracts or vitreous opacities such as hemovitreous or vitritis) are discarded. Retinographies of patients with other concomitant retinal pathology are not included.

2.1.2. Niños de acosta ñú general pediatric hospital

For the acquisition of fundus images, the procedure performed on patients who attended the ophthalmology service of the Niños de Acosta Ñú General Pediatric Hospital was as follows:

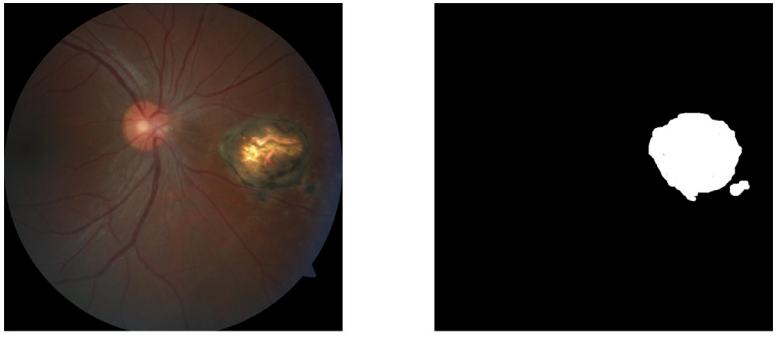
1. The parents or the legal guardians of patients under 18 years of age were interviewed and their data recorded in a pre-coded sheet after having accepted the informed consent.
2. Application of mydriatic eye drops: A drop of Fotoretin (Phenylephrine 5% and tropicamide 0.5% Laboratorio Poen, Argentina) was applied every 15 min in each eye, 3 times. After 30 min and after having verified the complete pupillary dilation, the examination was carried out in a dark room with the Pictor Plus-Portable Ophthalmic Camera. The patient was lying on a hospital gurney and the Pictor Plus-Portable Ophthalmic Camera was supported on the patient's forehead by the operating ophthalmologist (who was the same in all cases) to capture the image. The equipment has a sensor that enables the correct acquisition of the image for the operator.
3. A retinal image of each eye was captured using a Pictor Plus-Portable Ophthalmic Camera.
4. Finally, a fundoscopic examination was performed with an indirect ophthalmoscope and a 20D magnifying glass, for the evaluation and classification of the lesions according to their activity or not, and then they were recorded in the clinical history.

2.2. Image segmentation procedure with active and inactive toxoplasmosis lesions

The segmentation procedure of active and inactive toxoplasmosis lesions was performed by a specialist ophthalmologist using the Label Studio tool[1]. First, the images were loaded and labeled. Then, an ideally segmentation was performed, followed by extraction of the masks of the segmented images. The ideal segmentation consists of marking the segments or pixels of the image containing the lesion and indicating the type of lesion. The masks obtained are stored in the mask folder of the dataset.

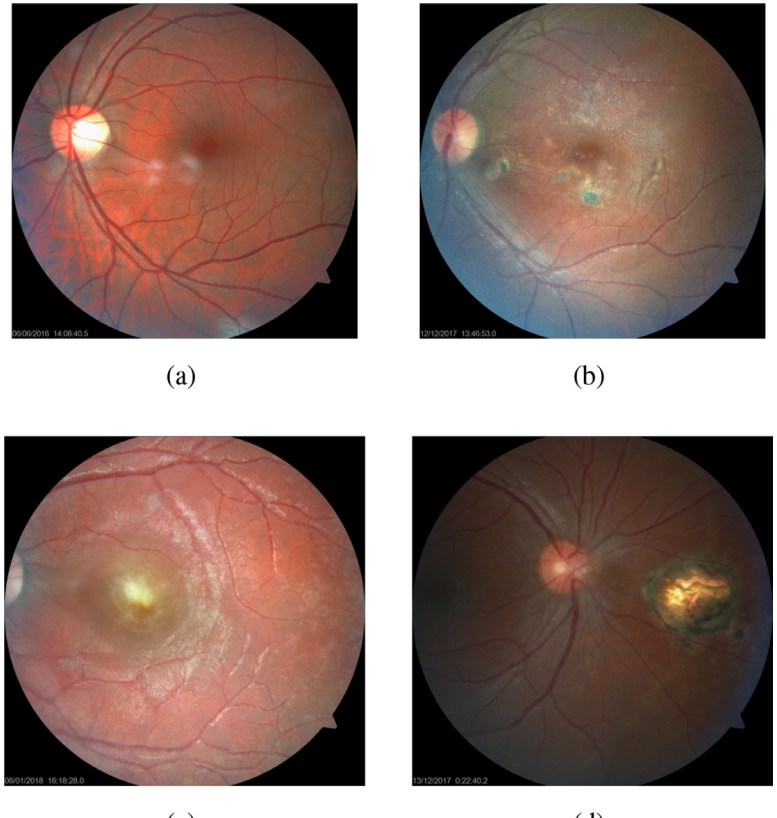
Fig. 3 shows the ideal segmentation made by the ophthalmologist of an inactive lesion. Fig. 4 shows the fundus images available in the dataset.

[1] https://labelstud.io/



(a) 82.jpg (b) Mask

Fig. 3. Example of segmentation of the image 82.jpg with inactive lesion.



(a) (b)

(c) (d)

Fig. 4. A sample of healthy (a), unhealthy with inactive lesions or scars (b), unhealthy with active lesion (c) and unhealthy with both active and inactive lesions (d) retinal fundus images from the dataset.

After the segmentation step, the images were labeled according to the following set of rules:

- Images with no OT lesions (healthy)
- Images with at least one active lesion (active)
- Images with inactive lesions only (inactive)

Ethical Statement

The research committee of the Hospital General Pediatrico Niños de Acosta Ñú approved the protocol with approval number 00197 and IRB 00006311. The researchers ensured that the patients were properly informed about the aim of this investigation. The data of each patient and their disease states are of the utmost confidentiality. Therefore, their data remain anonymous.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability

Ocular Toxoplasmosis Fundus Images Dataset (Original data) (zenodo).

CRediT Author Statement

Olivia Cardozo: Data curation, Investigation, Visualization; **Verena Ojeda:** Data curation, Investigation, Visualization; **Rodrigo Parra:** Data curation, Investigation, Visualization; **Julio César Mello-Román:** Data curation, Investigation, Resources, Visualization, Writing – original draft, Writing – review & editing; **José Luis Vázquez Noguera:** Conceptualization, Funding acquisition, Project administration, Validation, Resources, Writing – review & editing; **Miguel García-Torres:** Conceptualization, Funding acquisition, Project administration, Validation, Writing – review & editing; **Federico Divina:** Investigation, Visualization; **Sebastian A. Grillo:** Validation, Writing – review & editing; **Cynthia Villalba:** Validation, Writing – review & editing; **Jacques Facon:** Validation, Writing – review & editing; **Veronica Elisa Castillo Benítez:** Data curation; **Ingrid Castro Matto:** Data curation; **Diego Aquino-Brítez:** Writing – review & editing.

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