FOR TIC 2.0!
FORmação em Tecnologia da Informação e da Comunicação voltada para Veículos Autônomos
(Subjects)

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PROGRAMA BRAFITEC
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1. Introduction

This document aims to show some research projects that can be developed in partnership involving french and brazilian researchers.

2. IMScience Lab

The Pontifical Catholic University of Minas Gerais - PUC Minas, founded in 1958, is one of the five largest universities in Brazil, and elected three times as the best private university in Brazil. Its activities concentrate mostly in the Belo Horizonte Campus, divided into three units - Coração Eucarístico, Barreiro and São Gabriel - and two university centres - Betim and Contagem. PUC Minas also comprises campi in four regions of the State of Minas Gerais: Arcos, Poços de Caldas, Serro and Guanhães. Altogether, PUC Minas has about 60,000 students, 2,000 faculty members and 1,800 staff members. IMScience Lab (previously VIPLAB) is a research lab hosted at PUC Minas (Belo Horizonte Campus, Brazil) and it has started its operation in 2004 . The main project areas are: digital image, video and audio processing; multimedia indexing and retrieval; multimedia content analysis. Many projects have been conducted with cooperation of other institutions and/or labs, such as UFMG/DCC/NPDI, UNICAMP/IC, INRIA/TEXMEX and ESIEE/FRANCE. And, besides the projects developed with the participation of several graduate and undergraduate students, IMScience Lab has also been involved in bilateral programs for international cooperation such as FAPEMIG-INRIA and CAPES-BRAFITEC.

2.1. Histopathological image classification

Analyzing cell images and identifying them correctly is a fundamental task in the immunohistochemical exam (see Fig. 1 for this kind of image). In this project we intend to develop methods to segment FoxP3+ Regulatory T cells (Treg) images automatically, in order to assist healthcare professionals in the task of identifying and counting potentially cancerous cells. The methods must rely on combining an object detection network, which is tailor-made for microscopy images, with a marker-based image segmentation method to produce the final segmentation, while requiring only a 50x50 training patch

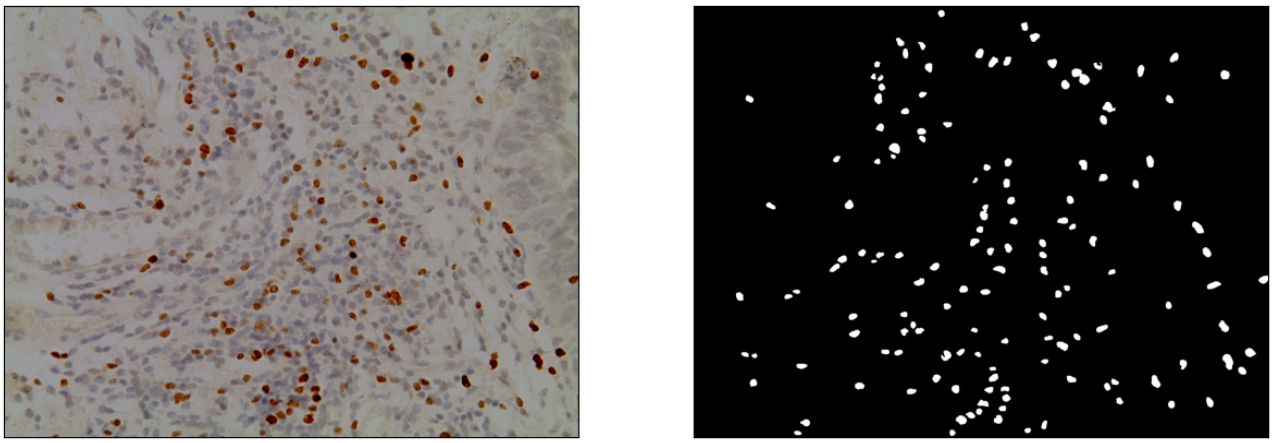

Figura 1. Ground truth example of an image obtained by immunohistochemistry. The image on the left is a component of the original FoxP3+ cells dataset. The image on the right side demonstrates the outcome after the process of obtaining a ground truth annotation.

to do so. The possible pipeline consists on predicting the location of the cells, applying morphological operations on the prediction weights to transform them into markers, and finally using the segmentation method iDISF to generate high quality segmentations.

2.2. Back- and front-end for image annotations

In order to classify data, annotations are needed. In this project, we would like to create back- and front-end tools for annotating images taking into account the expertise of the user in conjuntion with the problem to be solved. For example, in Fig. 1, we showed an original image and the annotated ground-truth for the image, however users with different degrees of expertise will identified different cells. In this sense, this tool will help the experts to study the consensus between them, and to help to identify the main difficulties for this task.

2.3. 3D object segmentation

Images obtained for volumetric medical imaging data, like computed tomography (CT), are usually showed as two-dimensional slices along the main axes of the image and display them side by side. However, this kind of visualization is so difficult to see the 3D object as in the real world. The idea of this project is to produce a tool for facilitating the visualization of 3D object for annotation, but methods for segmenting this 3D object in parts are neeed for helping the annotation. In Fig. 2, we illustrate a sketch of a potential tool to be developed.

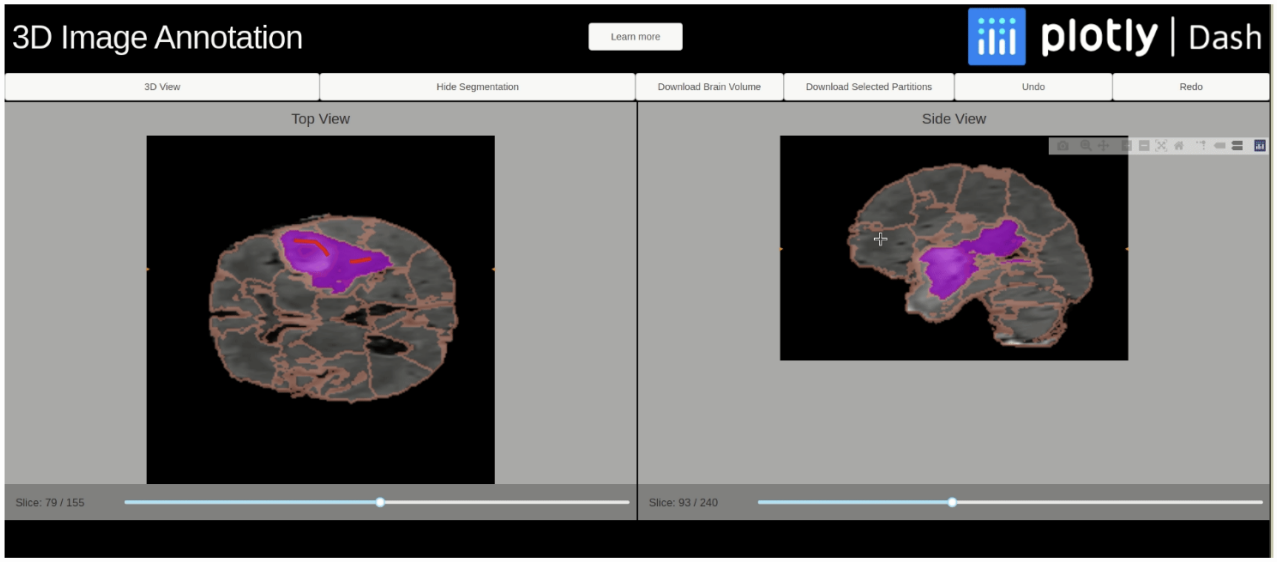

Figura 2. Sketch of a tool for 3D object segmentation and annotation.