2020 IEEE 17th International Symposium on Biomedical Imaging (ISBI)
April 3-7, 2020, Iowa City, Iowa, USA

DEEPIMAGEJ: BRIDGING DEEP LEARNING TO IMAGEJ

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ABSTRACT

DeepImageJ[1] is a user-friendly plugin that enables the generic used in FIJI/ImageJ of pre-trained deep learning (DL) models provided by their developers. The plugin acts as a software layer between TensorFlow and FIJI/ImageJ, runs on a standard CPU-based computer and can be used without any DL expertise. Beyond its direct use, we expect DeepImageJ to contribute to the spread and assessment of DL models in life-sciences applications and bioimage informatics.

***Index Terms*—** Deep Learning, segmentation, FIJI/ImageJ.

1. MOTIVATION

Machine Learning (ML), and in particular, Deep Neural Networks (DNN), have become an inflection point in many areas of scientific research. In the case of biomedical image analysis, these new techniques provide significant improvements in most of the tasks such as denoising, super-resolution, segmentation, detection, tracking, response prediction or computer-aided diagnosis.

Nonetheless, the use of DNN models requires previous programming knowledge and expertise, which makes them unapproachable to the general public. Therefore, the spread of this technology to the scientific community is strongly limited. We present DeepImageJ [1], a user-friendly plugin of FIJI/ImageJ, as an alternative solution to target this imminent necessity.

2. DESIGN AND CURRENT DEVELOPMENT

DeepImageJ is designed as a standard ImageJ plugin with the technicalities hidden behind a user-friendly interface. It has the potential to make available many of the powerful algorithms for image processing that are continuously being developed and published, enhancing research. While the plugin is thought to import TensorFlow and Keras models, currently there exist Python routines to convert other Python-based models such as Pythorch, into a format compatible to DeepImageJ.

[1]EGM and CGLH contributed equally to this work.

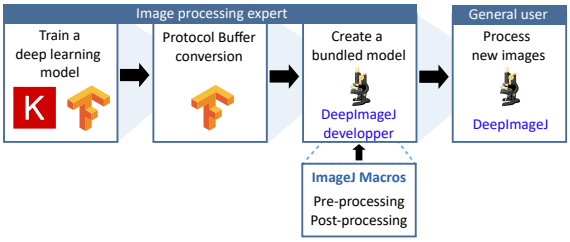

Fig. 1. Proposed pipeline for image analysis using deep-learning models and DeepImageJ plugin.

The plugin is built at two different levels: (1) a model importer tool that gather from developers all critical information to get a correct image processing, and (2) a user-oriented tool that run a selected model on an image batch. This design facilitates the use of DNN models by end-users. Furthermore, the plugin can be called in a standard ImageJ macro which permits its inclusion in image analysis workflows. Figure1 shows a generic workflow for image analysis using DNN models and DeepImageJ plugin. As part of this project, we have also made available a web page [2] that serves as a model repository that can benefit both image processing users and developers.

3. ACKNOWLEDGEMENTS

This work is partially supported by the grants TEC2015-73064-EXP, TEC2016-78052-R, a 2017 Leonardo Grant for Researchers and Cultural Creators, BBVA Foundation, the COST network NEUBIAS and NVIDIA Corporation with the donation of a Titan X (Pascal) GPU card. This work is part of the EPFL initiative 'imaging@EPFL'.

4. REFERENCES

[1] E. Gómez-de Mariscal, C. García-López-de Haro, L. Donati, M. Unser, A. Muñoz-Barrutia, and D. Sage, "Deepimagej: A user-friendly plugin to run deep learning models in ImageJ," *bioRxiv*, 2019.

[2]https://deepimagej.github.io/deepimagej/