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Towards Efficient Collaborative Digital Pathology: A Pioneer Initiative Of The FlexMIm Project

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Introduction/ Background

The development of digital resources for pathologists is a long process before truly validated algorithms can be used in daily practice.

Aims

In addition to developing new tools for helping Whole Slide Image (WSI) analysis by pathologists, the cooperative research project FlexMIm aims at setting up a shared platform allowing further technological improvements to be tested and evaluated online by a community of pathologists.

Methods

The FlexMIm consortium includes 27 pathology laboratories in the Paris area (coordinated by Assistance Publique-Hôpitaux de Paris), research laboratories from University Pierre et Marie Curie (UPMC Univ Paris 06) and University Paris Diderot, as well as 3 companies: TRIBVN, PERTIMM and Orange (project coordinator). Based on a cloud architecture, the project embeds a dedicated WSI database and visualisation support. Groups of partners developed dedicated algorithms. These algorithms have been tested separately, then integrated into the online platform. A large test and validation protocol, involving operational versions of these algorithms, is on-going among the 27 pathology laboratories participating to this project.

Results

One algorithm was built for blur detection in WSI in order to improve the quality of the workflow. Other quantitative algorithms were built for immunohistochemical counts such as Ki67, for mitosis detection from H&E (Hematoxylin – Eosin) stained WSI and for supporting the detection of Regions of Interest (ROI) for dysplasia screening in inflammatory bowel diseases (IBD). A series of algorithms (as gland detections in IBD) are at the proof of concept stage. Dedicated semantics and research engine are included in the platform, supporting the ROI collaborative annotations in WSI. The ontology used is generated by an operational contextual graph produced and validated for IBD diagnosis, consolidated by a semantic template linked to the annotations of IBD WSI. Another collaborative tool on the platform allows the online implementation of ontologies, with creation and edition of concepts. A full IBD diagnostic ontology is already available and a prostate cancer diagnostic ontology is underway. A major point of this platform is that all participating pathologists can finally evaluate online all the resources developed during the project. Anonymised WSI uploaded by each pathologist can be annotated by all other pathologists. These WSI can then be analysed

by all the algorithms and tools available in the platform. Pathologists can eventually fill evaluation forms that are analyzed by the project steering committee. Beside online resources, another goal of FlexMIm was to

implement tools for faster WSI communication through networks especially in low bandwidth environments. The pathologists used a test bed in order to evaluate several compression algorithms on several visualisation devices (laptop, tablets), eventually leading to a "smart transportation" algorithm that can be activated in case of non-optimal network. Within 3 years, FlexMIm partners have thus built a platform which now integrates a whole set of algorithms to foster digital pathology adoption by a large cluster of Pathology laboratories.