Data Intelligence Institute of Paris (diiP)
call 2024 for **Masters-level Internships**

data intelligence institute of Paris

PROJECT INFORMATIONS

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MOTIVATION

Digital Pathology is on the rise. Most exams are still done visually under the analogical microscope. But new scanners have emerged (Phillips, Hammamatsu, etc.) driving revolutionary changes at the clinical level (Fig. 1).
Given the rich information present in these images, a vast field of opportunity opens up for automated image analysis. This is especially pertinent in oncology where early and accurate diagnosis is paramount and with the advent of transformer architectures, traditionally used in natural language processing tasks, there's an emerging interest in assessing its applicability for WSI image classification.

PROPOSED WORK & IMPLEMENTATION

Dataset Selection:
Public Datasets: The intern will leverage popularly available datasets. These datasets, known for their extensive collection of histopathological images, will provide a robust baseline for the study.In-house Dataset: Our proprietary datasets for both Colorectal Carcinoma (CRC), Hepatocellular Carcinoma (HCC) WSI images will be provided.

Model Architectures:
HiTrans [1] Adaptation for Slide-Level/Patient-Level Classification:
○ Model: Our modified HiTrans model, originally designed for entire neoplasm segmentation, will be incorporated for patch-level classification tasks. Its hierarchical transformer encoder structure is aptly suited to capture both local and global features in histological slides.
○ Slide-Level Aggregation: Slide-level or patient-level representation extracted by HiTrans will be processed through aggregation approaches. Techniques such as max pooling, average pooling, or more sophisticated methods like attention-based pooling might be considered to distill relevant features and information for slide-level classification tasks.

Evaluation & Interpretation:
Comprehensive evaluation metrics including Accuracy, Precision, Recall, F1-Score, and AUC-ROC will be employed. Techniques such as Grad-CAM and SHAP will be used to understand the focus regions of both CNN and Transformer architectures, offering insights into how models make decisions [2].

Learning Experience:
- Selection and application of public datasets for benchmarking.
- Implementation and customization of complex architectures (CNN & Transformer).
- Practical evaluation strategies and model interpretability methods.

The proposed work ensures a comprehensive approach towards comparing Transformer architectures in the context of WSI images. Integrating in-house datasets with public datasets allows for robust and generalizable conclusions, while the exploration of both architectures promises valuable insights into the nuances of each.

REFERENCES

[1] Janowczyk, A., & Madabhushi, A. (2016). Deep learning for digital pathology image analysis: A comprehensive tutorial with selected use cases. Journal of pathology informatics, 7.
[2] Lundberg, S. M., & Lee, S. I. (2017). A unified approach to interpreting model predictions. In Advances in neural information processing systems (pp. 4765-4774).

Link : **https://helios2.mi.parisdescartes.fr/~lomn/Data/DIIP/DIIPInternshipLomenie.pdf**