SS2-2 Hybrid Cloud System for Efficient Storage, Processing, and Collaborative Annotation of Whole Slide Images in Digital Pathology

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= Abstract =

Integrating digital pathology into routine diagnostic procedures necessitates the practical storage and processing of whole slide images (WSIs) data. We aimed to create a cloud-based platform capable of supporting collaborative image annotation, multiple-user interactions, and the management of substantial imaging datasets. Our dataset comprised mrxs, svs, ndpi, and tiff file formats, all scanned at a 40x magnification level. We adopted the Cytomine platform to include annotation tools, clinical data, and pathology report management features. We assessed a system that utilizes cloud and on-premise servers to determine its accessibility, cost efficiency, and image display speed. Using pyvips Python, we converted the original WSI formats into tiff files, ensuring the pixel count remained consistent with the native WSIs. Our compression process with a Q-factor of 50 reduced the file size by an average of 69% without significantly degrading visual quality, thus facilitating data annotation. Within our hybrid cloud server setup, the original WSIs were conserved on an on-premise server, while the compressed tiff files were transferred to the object storage of a public cloud server. The files were relocated to Network-Attached Storage (NAS) for annotation or on-demand viewing. The tiff WSIs stored in the NAS could be directly annotated, making them accessible from any device with an internet connection. We incorporated XML ingestion/export capabilities to support local annotation. The hybrid cloud system we developed is cost-effective, environmentally friendly, and offers rapid, memory-efficient processing of extensive WSIs. It supports annotation, visualization, and machine learning capabilities. Its flexibility, scalability, and user-friendly design make it a powerful resource for collaborative annotation, accommodating multiple users and various annotation types. It also simplifies the management and analysis of large imaging datasets. The system's ability to facilitate collaborative annotation across different platforms and its capacity to ingest and export annotations in XML adds further advantages for users.