

MMIR: an open-source software for the registration of multimodal histological images

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FIGURE 1

MMIR software architecture, with three main components: a project manager, an algorithm manager, and an image visualization system, which allows the images to overlap and the comparison of multiple registration algorithms.

Multimodal histology image registration involves aligning two or more images from different microscopy modalities into a common coordinate system. This combination of information can enhance the understanding of tissue specimens, aiding in more accurate diagnoses and improved research insights. However, it presents challenges due to the inherent differences in characteristics and the need for tailored optimization algorithms for each modality. To address these challenges, we developed an open-source cloud-based system called MMIR. The software architecture includes a project manager, an algorithm manager, and an image visualization system. The project manager handles project management tasks, while the algorithm manager ensures the integration and execution of registered algorithms. The image visualization system efficiently displays high-resolution images using a

pyramidal organization without overloading the users' memory. MMIR supports multiple annotation formats and offers flexibility in loading annotations using different methods.

The tool was designed to simplify image registration tasks with a user-friendly approach. It helps manage multiple algorithms, provides responsive web interfaces, supports multi-resolution images, and enables batch image registration. Additionally, its modular architecture allows for the integration of custom algorithms, ensuring alignment with specific requirements for each modality combination. In addition to image registration, the software facilitates the conversion of segmented annotations from one modality to another.

MMIR provides precise alignment and integration of multimodal data enabling more accurate and comprehensive tissue analysis.

