11.MULTILINGUAL HANDWRITTEN TEXT RECOGNITION USING VISION TRANSFORMERS AND FEDERATED LEARNING FOR AI-POWERED HERITAGE TOURISM

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Handwritten Text Recognition (HTR) plays a crucial role in digitizing historical records, ensuring their preservation and accessibility. Traditional HTR methods, including Hidden Markov Models (HMMs) and CNN-RNN architectures, have improved text recognition but struggle with multilingual adaptability, paragraph-level accuracy, and real-time deployment. Existing Transformer-based models, such as TrOCR, enhance recognition using self-attention mechanisms but require extensive labeled data and high computational resources. To address these challenges, this research proposes an advanced HTR framework integrating Self-Supervised Learning (SSL), Vision Transformers (ViTs), and Federated Learning (FL). SSL enables training on large-scale unlabeled data, reducing annotation dependency. ViTs improve paragraph-level recognition by capturing long-range dependencies, while FL facilitates multilingual adaptation without compromising data privacy. Additionally, this system enhances AI-powered heritage tourism, enabling interactive and multilingual exploration of historical sites through voice-assisted guidance and contextual storytelling. The proposed model significantly improves recognition accuracy, efficiency, and scalability, making it a robust solution for large-scale historical document digitization and AI-driven cultural heritage applications.

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