Swarm Learning for precision medicine in infectious diseases and pandemic preparedness

Initiative: Pioniervorhaben Exploration

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The increased availability of large-scale medical and high-resolution (single-cell) multi-omics data increases the value and the need for machine learning and artificial intelligence (ML/AI) applications paving the path towards data-driven precision medicine. Yet, critical questions and challenges remain unanswered, such as how to effectively use single-cell patient data in clinical research across sites, ensuring data protection and privacy, assessing the generalizability and reliability of ML/AI applications, implementing these technologies in real-world clinical settings, monitoring model and data drifts, involving the public and patient groups, and addressing the social and ethical implications of medical AI. To address these vital aspects within the context of infectious diseases and pandemic preparedness, an interdisciplinary team of experts spanning fields from data and information sciences to immunology, virology, clinical infectious diseases, and ethics will collaborate. Leveraging high-resolution single-cell omics data and AI applications across multiple medical centers within Germany as well as with international partners across the world, the team will use the Swarm Learning (SL) principle, which is the first in its kind to combine AI and blockchain technology. SL guarantees highest standards in data protection and privacy by exchanging the concept of data sharing with insight sharing in multi-center studies, allowing ML/AI generalization across institutions, and testing of real-world application of AI under clinical conditions, while continuous learning approaches enable model- and data-drift detection in real time. Taken together, this consortium is expected to create a blueprint for the development of SL-enabled, AI-based diagnostic and prognostic tools by leveraging the combined power of high-dimensional clinical, immunological and single-cell multi-omics data from multiple clinical sites and cohorts, exemplified for infectious diseases, yet, expandable to any other medical field.

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Es werden die Institutionen genannt, an denen das Vorhaben durchgeführt wurde, und nicht die aktuelle Adresse.

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