Kardio Diagnostix Implementation of a Continuous Medical Data Lifecycle

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Abstract

Kardio Diagnostix was founded with the goal of reducing the burden on health systems while increasing the quality of care. We have developed a a novel deep learning architecture integrating a physics-informed Harmonic-Percussive-Residual (HPR) signal decomposition with a stacked Long Short-Term Memory (LSTM) network to screen heart murmurs found in 3.2 million children yearly in North America alone. Our platform has the potential to reduce the number of unnecessary referrals of innocent murmurs to pediatric cardiologists in North America from 1.6 million to 75,000, reducing the cost of care by US$3.8 billion annually. Besides cost reduction, we will increase the detection of abnormal murmurs by 75%. Our product has a potential to access an annual US$1.5 billion market for the care of children with murmurs in North America. We tested our product with heart murmurs for 300 patients in Nova Scotia. The data was collected he data was obtained by the cardiologists or delegated research assistant for the patients who arrived at their clinic during the study period. We are expanding our data collection to other regions starting with a clinic in Toronto. We describe a comprehensive, data science-driven methodology for developing and deploying any intelligent medical diagnostics application. This strategy centers on a cyclical process that ensures the diagnostic model is accurate, integrated, compliant, and continuously improving within a clinical environment. The foundational stage involves establishing a secure, scalable architecture for handling sensitive medical data, including implementing a real-time data ingestion and feedback integration engine and designing data pipelines for EMR data synchronization. Next, the diagnostic model must be validated at scale using diverse, real-world clinical data to ensure accuracy. Concurrently, co-design sessions and field trials help develop production-ready UI/UX that aligns with clinical workflows. Crucial for long-term use is the MLOps automation phase, which involves setting up CI/CD pipelines, real-time monitoring, and auto-retraining mechanisms to establish a continuous learning loop. Finally, to ensure deployment readiness, the system must integrate robust features for secure data handling, access controls, and audit logging to meet compliance standards (e.g., HIPAA/PIPEDA). Implementing Explainable AI (XAI) dashboards provides necessary transparency for clinicians, supporting the final deployment.

Keywords: Pediatric Heart Murmur Screening; Deep-Learning AI Platform; Healthcare Cost Reduction; MLOps Automation; Clinical Workflow Integration; Explainable AI.