

Artificial Intelligence for Polysomnographic Analysis: Clinical Validation, Technical Architecture and Real-World Implementation of Somnolyzer

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Abstract

Health data form the foundation of modern medicine, yet their clinical value is determined by how effectively they are managed throughout the entire data lifecycle. From the collection of biomedical and physiological data to their transformation into actionable clinical insights, each stage introduces challenges related to data quality, standardization, interoperability, security, and interpretability. This presentation examines the health data lifecycle through the lens of advanced, AI-assisted analytics, using sleep monitoring as a representative use case. Key stages of the health data lifecycle are discussed, including multi-sensor data acquisition, data interoperability, preprocessing and artifact removal, extraction of clinically relevant features, AI-based automated analysis supported by clinically validated models, and the integration of results into clinical decision support systems. Particular emphasis is placed on clinical validation, algorithmic transparency, and data trustworthiness as prerequisites for the responsible use of artificial intelligence in healthcare. In addition, the presentation highlights the role of data governance, regulatory compliance, and real-world data in the development and deployment of health data analytics solutions. Emerging scenarios such as home-based monitoring and the analysis of incomplete or limited-sensor datasets are also addressed, underscoring the need for robust and adaptable data lifecycle frameworks. The conclusion emphasizes that a holistic, end-to-end approach to managing health data is essential for delivering safe, scalable, and patient-centered clinical decision support.

Keywords: Clinical Decision Support Systems; Data Quality and Standardization; Patient-Centered Digital Health.

