

# Managing Distributed Machine Learning Lifecycle for Healthcare Data in the Cloud

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## ABSTRACT

The main objective of this paper is to highlight the research directions and explain the main roles of current Artificial Intelligence (AI)/Machine Learning (ML) frameworks and available cloud infrastructures in building end-to-end ML lifecycle management for healthcare systems and sensitive biomedical data. We identify and explore the versatility of many genuine techniques from distributed computing and current state-of-the-art ML research, such as building *cognition-inspired learning pipelines* and *federated learning (FL) ecosystem*. Additionally, we outline the advantages and highlight the main obstacles of our methodology utilizing contemporary distributed secure ML techniques, such as FL, and tools designed for managing data throughout its lifecycle. For a robust system design, we present key architectural decisions essential for optimal healthcare data management, focusing on security, privacy and interoperability. Finally, we discuss ongoing efforts and future research directions to overcome existing challenges and improve the effectiveness of AI/ML applications in the healthcare domain.

**INDEX TERMS** Machine Learning, Healthcare, Biomedicine, Data Management, Federated Learning, Cloud, Coded Computation, Distributed Systems

## I. INTRODUCTION

TRADITIONAL healthcare, as a mission-critical domain, is in flux for various reasons: Cost and capacity concerns, ageing populations, personalized treatments, and technological advancements that enable speedy pattern analysis. Data analytics and Artificial Intelligence (AI)/Machine Learning (ML) techniques are paving the way for many use cases in medicine that are quite critical today. At the same time, healthcare and biomedical applications are constantly generating increasingly large and diverse datasets. Information can include a variety of data types, spanning from genetic information to Electronic Health Records (EHRs), which can cover details like patient medical records, important physiological measurements, results from labora-

tory tests, inherited disorders, behavioural tendencies, and more. This information can also be gathered from wearable gadgets utilizing headgear (AR and VR technologies) or networks of body sensors, largely constituting time-series biomedical data. The range of modern biomedical applications is already huge and growing each day. AI in healthcare is shown to help transform medical techniques into better disease treatment and prevention, therapy recommendations, and health management that considers various factors such as a patient's genetic, environmental, and usual lifecycle behaviors. In the present era, AI/ML methods are employed for diverse purposes: Foreseeing illnesses in high-risk patients requiring additional support [1], aiding individuals with motor impairments [2], uncovering potential drug combinations

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*Solutions for Networked Databases* Dimitris N. Chorafas, Heinrich Steinmann, 2014-05-10 Solutions for Networked Databases How to Move from Heterogeneous Structures to Federated Concepts reviews developments in standards and ad hoc solutions aimed at providing cross database connectivity for networked databases The emphasis is on how to move from heterogeneous structures to federated concepts The advent of the multidatabase is discussed along with schemata dictionaries and protocols Applications with federated databases are also considered Comprised of 18 chapters this book begins with an introduction to database and knowledge bank concepts reliability and availability characteristics and the synergy necessary to create and sustain federated databases Centralized and distributed databases are then compared and the different ways of managing distributed databases are outlined Subsequent chapters focus on the importance of treating the networked database as a corporate resource the use of schemata to solve cross database problems the Information Resource Dictionary System and application programming interface and remote data access A solution to heterogeneous distributed databases the Data Access Integrated Services DAIS is described This monograph is written for specialists in computers and communications

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**Client/server Programming with OS/2 2.0** Robert Orfali, Dan Harkey, 1992 This updated edition features extensive revisions to explain OS/2 2.0 and its new functions The authors also introduce new database features and incorporate them into RSQL New SAA features System View and the Distributed Computing Environment DCE are fully described Code developed with OS/2 2.0's Workframe environment and the new 32 bit C Set 2 compiler enables users to make improvements in tasking APIs and PM calls Other new sections in the edition address

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