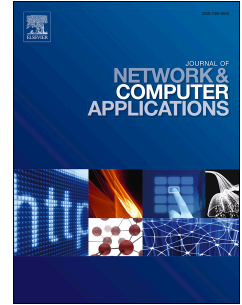


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Giuseppe Aceto, Valerio Persico, Antonio Pescapé



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The role of Information and Communication Technologies in Healthcare: Taxonomies, Perspectives, and Challenges

Giuseppe Aceto^{a,b}, Valerio Persico^{a,b}, Antonio Pescapé^{a,b}

^aUniversity of Napoli "Federico II" (Italy)

^bNM2 s.r.l. (Italy)

Abstract

Progress in *Information and Communication Technologies* (ICTs) is shaping more and more the healthcare domain. ICTs adoption provides new opportunities, as well as discloses novel and unforeseen application scenarios. As a result, the overall health sector is potentially benefited, as the quality of medical services is expected to be enhanced and healthcare costs are reduced, in spite of the increasing demand due to the aging population.

Notwithstanding the above, the scientific literature appears to be still quite scattered and fragmented, also due to the interaction of scientific communities with different background, skills, and approaches. A number of specific terms have become of widespread use (e.g., regarding ICTs-based healthcare paradigms as well as at health-related data formats), but without commonly-agreed definitions. While scientific surveys and reviews have also been proposed, none of them aims at providing a holistic view of how today ICTs are able to support healthcare. This is the more and more an issue, as the *integrated* application of most if not all the main ICTs pillars is the most agreed upon trend, according to the *Industry 4.0* paradigm about ongoing and future industrial revolution.

In this paper we aim at shedding light on how ICTs and healthcare are related, identifying the most popular ICTs-based healthcare paradigms, together with the main ICTs backing them. Studying more than 300 papers, we survey outcomes of literature analyses and results from research activities carried out in this field. We characterize the main ICTs-based healthcare paradigms stemmed out in recent years fostered by the evolution of ICTs. Dissecting the scientific literature, we also identify the technological pillars underpinning the novel applications fueled by these technological advancements. Guided by the scientific literature, we review a number of application scenarios gaining momentum thanks to the beneficial impact of ICTs. As the evolution of ICTs enables to gather huge and invaluable data from numerous and highly varied sources in easier ways, here we also focus on the shapes that this healthcare-related data may take. This survey provides an up-to-date picture of the novel healthcare applications enabled by the ICTs advancements, with a focus on their specific hottest research challenges. It helps the interested readership (from both technological and medical fields) not to lose orientation in the complex landscapes possibly generated when advanced ICTs are adopted in application scenarios dictated by the critical healthcare domain.

Keywords: Healthcare, ICTs, e-health, m-health, pervasive health, WBAN, Cloud Computing, Internet of Things, Fog, Big Data, Genomics, health monitoring, privacy, security, interoperability.

1. Introduction

Healthcare represents one of the most important social and economic challenges that every coun-

try faces: today healthcare administrators, clinicians, researchers, and other field practitioners are encountering increasing pressure generated by the growing expectations from both the public and the private sector. While the rising cost of medical care has a major impact on the quality of people's life (even higher in the case of chronic diseases), constant population growth and aging influence health-

Email addresses: giuseppe.aceto@unina.it (Giuseppe Aceto), valerio.persico@unina.it (Valerio Persico), pescape@unina.it (Antonio Pescapé)

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