E-HEALTH

Perspectives on AI use in medicine: views of the Italian Society of Artificial Intelligence in Medicine

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Summary

The first annual meeting of the Italian Society for Artificial Intelligence in Medicine (Società Italiana Intelligenza Artificiale in Medicina, SIIAM) on December 7, 2023, marked a significant milestone in integrating artificial intelligence (AI) into Italy's healthcare framework. This paper reports on the collaborative workshop conducted during this event, highlighting the collective efforts of 51 professionals from diverse fields including medicine, engineering, data science, and law. The interdisciplinary background of the participants played a crucial role in generating ideas for innovative AI solutions tailored to healthcare challenges. Central to the discussions were several AI applications aimed at improving patient care and streamlining healthcare processes. Notably, the use of Large Language Models (LLMs) in remote monitoring of chronic patients emerged as an area of focus. These models promise enhanced patient monitor-

ing through detailed symptom checking and anomaly detection, thereby facilitating timely medical interventions. Another significant proposal involved employing LLMs to improve empathy in medical communication, addressing the challenges posed by cultural diversity and high-stress levels among healthcare professionals. Additionally, the development of Machine Learning algorithms for standardizing treatment in pediatric emergency departments was discussed, along with the need for educational initiatives to enhance AI adoption in rural healthcare settings. The workshop also explored using LLMs for efficient data extraction and analysis in scientific literature, interpreting healthcare norms, and streamlining hospital discharge records. This paper provides a comprehensive overview of the ideas and solutions proposed at the workshop, reflecting the participants' forward-thinking vision and the potential of AI to revolutionize healthcare.

Introduction

The Italian Society for Artificial Intelligence in Medicine (Società Italiana Intelligenza Artificiale in Medicina - SIIAM) conducted its First Annual Meeting on December 7, 2023, a pivotal step in its mission of integrating artificial intelligence (AI) into Italy's healthcare landscape. This event gathered a multidisciplinary cohort of 51 professionals (36 males and 15 females), comprising 36 physicians and 15 non-physicians, encompassing mathematicians, veterinarians, engineers, statisticians, lawyers, and data scientists. The diversity of this group is not merely a demographic characteristic but a critical asset for fostering innovation in healthcare through interdisciplinary collaboration on healthcare advancements [1].

Research indicates that the blend of diverse professional backgrounds catalyzes innovative thinking in healthcare. Additionally, the cognitive diversity of interdisciplinary teams, such as the one assembled at the SIIAM meeting, is crucial for fostering innovation through debate and knowledge exchange and enhancing group performance, particularly in innovative settings [2, 3].

During the conference, a key highlight was the collaborative workshop moderated by the organizers, wherein attendees were organized into diverse groups to brainstorm ideas centered on the integration of AI within Italy's healthcare framework. In this paper, we report the insights that emerged from this workshop, reflecting the participants' collective creativity and forward-thinking vision.

SIIAM COLLABORATIVE WORKSHOP

The collaborative workshop was designed to foster individual and group discussion about introducing AI solutions in healthcare. Participants spent the first time slot thinking individually about a particular issue they identified within the Italian healthcare system that they thought could be addressed with AI-based solutions. Next, they had a time slot to discuss their thoughts with the person next to them. After this, they were joined into groups of four to five people to discuss their proposals. Each group chose a representative to present their ideas in a plenary session. Each group representative presented one or more proposals, based on group consensus. In this phase, a lively Q&A session with questions from the

moderators and the audience helped explore and refine the proposals.

REMOTE PATIENT MONITORING USING LLMS

The clinical applications of AI emerged as the topic that the proposals most frequently centered on. One emerging theme was the remote monitoring of patients, particularly chronic patients with several comorbidities. While some mHealth solutions already exist, Large Language Models (LLMs) show great potential for timely, detailed symptom checking and patient remote monitoring. This application of LLMs enables the development of anomaly detection and alert systems, which can identify deviations from a patient's usual health patterns and prompt timely interventions [4]. Participants highlighted how future solutions tackling remote monitoring of patients, including LLMs, will benefit from the implementation of the national telemedicine platform [5, 6].

Remote patient monitoring, while offering numerous benefits, faces several challenges. These include issues related to the implementation of national platforms, concerns about data privacy laws, costs associated with monitoring devices, the phenomenon of alert fatigue, and the necessity for real-world testing and validation.

EMPATHY IN MEDICAL COMMUNICATION

Another proposal underlined the importance of empathy in medical communication [7, 8]. Communication between patients and healthcare professionals, either nurses or physicians, may be marred by misunderstandings or miscommunications, and empathy is an important element of a successful clinical communication strategy [9]. Factors that may negatively impact communication and the successful use of an empathic approach include high workload and burnout prevalence among healthcare workers, which is characterized by emotional exhaustion, depersonalization, and reduced personal accomplishment [10]. In addition, patients with different cultural and social backgrounds could have different communication styles. One group suggested using LLMs to collect data to enact better communication strategies tailored to individual patients' needs [11]. Whereas some tests already address this issue and attempt to gather data to identify specific communication styles best tailored to a patient's needs, they are flawed by the impossibility of collecting non-structured data. The nature of communication itself, however, suggests that there may be a need for a tool capable of analyzing conversations and extracting data flexibly [12]. Participants proposed conducting a prospective study where healthcare practitioners have a conversation with patients and record it, then fine-tune an LLM to analyze it and provide a report on possible strategies and improvements. Data standardization is, however, critical: such a qualitative data source must be handled with care to train an LLM.

The use of LLMs in medical communication is promising, but not without limitations. Challenges include establishing a reliable ground truth for communication, a high risk of biases, significant privacy concerns, and

insufficient audio capability alone to capture emotional nuances. Moreover, while analyzing facial expressions could enhance understanding, it remains a contentious issue due to privacy and ethical considerations [13].

STANDARDIZING PEDIATRIC EMERGENCY CARE

One group suggested creating a Machine Learning (ML) algorithm to address the issue of inconsistent treatment approaches in pediatric emergency departments [14, 15]. The proposed steps were: a comprehensive review of existing literature, searching for existing solutions tackling problems in the realm of pediatric emergencies, consultation with clinical experts in the field to identify previously unaddressed solutions or to explore feedback from their side (*e.g.*, adopting Delphi surveys as an instrument for expert opinion collection), and the execution of targeted clinical studies to evaluate and refine the algorithm [16]. This algorithm should be designed to standardize patient care by incorporating a set of defined clinical parameters and systematically extracting data from patients' clinical files and other pertinent diagnostic information (*e.g.*, lung imaging, given the high burden of respiratory disease among pediatric patients in emergency departments) [17].

Developing an AI algorithm to standardize treatment in pediatric emergency departments is complex. Limitations include the scarcity of pediatric-specific emergency data, the need for a multimodal AI model due to the diverse nature of pediatric emergencies, and the challenge of achieving expert consensus, which is crucial for training an effective AI clinical model. These challenges highlight the necessity for a gold standard in data and methodology given the difficulties in data collection and expert agreement in these settings [18].

BRIDGING THE TECHNOLOGICAL DIVIDE

A critical challenge that emerged is the scarcity of infrastructure necessary for leveraging AI and optimizing data availability in hospitals situated in remote or low-income areas. Such limitations are particularly pronounced outside of metropolitan areas and university hospitals. To mitigate this issue, SIIAM should promote educational and informational projects to elevate awareness of the benefits of AI's application in healthcare in underserved regions. These initiatives are crucial for bridging the technological divide and ensuring that advancements in AI and data analytics translate into tangible health benefits across diverse geographical landscapes.

Moreover, addressing the technological and digital divide within the elderly population is imperative. Italy is the "oldest" country globally, with approximately 23% of its population over the age of 65. This demographic not only requires the majority of healthcare resources but also faces significant challenges in accessing and utilizing digital technologies. The elderly are often less familiar with digital tools and platforms, which hinders their ability to benefit from AI-driven healthcare solutions. Therefore, targeted efforts must be made to include elderly individuals in educational initiatives,

ensuring they understand and can access AI technologies. While education and awareness about AI's potential in healthcare are important, they alone cannot bridge the technological divide in remote or low-income areas and among the elderly. Significant investment in digital infrastructure is crucial for the practical implementation of AI solutions in these regions and for this demographic [19].

By combining educational efforts with substantial infrastructure investments, we can ensure that AI-driven healthcare improvements are inclusive and equitable, thereby addressing the diverse needs of Italy's aging population alongside other underserved communities.

EFFICIENT DATA EXTRACTION AND ANALYSIS

Researchers participating in the workshop reported on the issue of data extraction and quality analysis in scientific literature and suggested leveraging LLMs to address this [20]. These tools could navigate vast arrays of academic texts, identify pertinent data, and thoroughly assess the research findings. By deploying LLMs, researchers have the potential to streamline the process of manual literature reviews, facilitating more efficient extraction of relevant information and providing a rigorous analysis of the data's integrity and relevance. For example, tools like ChatGPT and similar models can quickly summarize key points from extensive research papers or support title-abstract screening phase in systematic reviews.

While LLMs offer transformative potential in data extraction and quality analysis in scientific literature, they place significant limitations. Researchers must validate each step performed by AI to ensure the accuracy and reliability of the results, Moreover, the over-reliance on automated systems can lead to the risk of deskilling researchers. Additionally, creating trustworthy systems that are readily accepted by healthcare professionals remains challenging, and there is a risk of misinformation, and biases being introduced into the research process [21].

INTERPRETING HEALTHCARE NORMS AND COMMUNICATIONS

Introducing new norms in healthcare practice often yields diverse impacts, shaped by policy directives from various levels of governance, including local, regional, national, and international bodies [22]. Similarly, directives from hospital management play a pivotal role at a more localized level. Interpreting these norms and directives poses significant challenges, particularly in assessing their interplay with existing norms and recalling pertinent past communications. Workshop participants bringing up these problems underlined the potential of LLMs in this context. They can be effectively employed for assessing the impact of new norms, examining their interactions with pre-existing ones, and keeping abreast of relevant changes and updates [23]. These applications are valuable not only for individuals tasked with drafting these norms and communications but also for those who interpret and implement them. The utilization of LLMs in this capacity is anticipated to yield substantial benefits. By alleviating

the burden associated with interpreting complex norms and translating them into plain language, these tools can aid healthcare professionals in adapting their practices to new or updated standards and guidelines. Additionally, they offer the potential to identify and address any blind spots in the norms before their implementation, enhancing the overall efficacy and applicability of healthcare policies and directives. While LLMs show promise in interpreting healthcare norms and directives, their use is not without challenges. These include the risk of generating inaccurate or misleading content (known as 'hallucinations') and the potential for deskilling professionals to over-reliance on automated interpretation. Additionally, interpreting laws involves a degree of subjectivity that may be difficult for LLMs to navigate.

STREAMLINING HOSPITAL DISCHARGE RECORDS

The task of compiling hospital discharge records (Scheda di Dimissione Ospedaliera, SDO) often presents a significant administrative burden for physicians. This process involves identifying the appropriate diagnosis-related group (DRG) for conditions and interventions and managing administrative details, which is complex and time-consuming. This situation often leads to heterogeneity in SDOs across different practitioners and healthcare facilities, potentially resulting in inconsistencies in patient information, variations in care quality, and challenges in maintaining comprehensive patient histories [24]. Data from discharge records in Italy flow into a unified national SDO database and are, at least theoretically, among the most highly standardized healthcare datasets available nationally, as they are relevant both to clinical and public health research and are how hospital services within the Italian national healthcare service are paid. The use of AI solutions to improve the standardization of data entry and create a semi-automatic process to complete SDO entries could significantly lighten the administrative burden on physicians while ensuring higher data quality. Additionally, physicians are tasked with preparing hospital discharge letters (HDLs) often resulting in unstructured texts that are pieced together through the repetitive copying and pasting from previous reports, which can compromise the quality of these documents. Despite these challenges, discharge records are indispensable for ensuring continuity of care, as they enable primary care and specialist doctors outside the hospital to manage patient care post-discharge effectively. A viable solution to mitigate these issues involves leveraging electronic healthcare records to populate HDLs automatically.

Subsequently, LLMs can draft discharge letters, which the physicians would review and finalize. This approach not only streamlines the administrative process but also enhances the consistency and quality of patient care documentation, ultimately reducing the workload on healthcare professionals and ensuring a more standardized approach to patient discharge procedures. The communication style in the discharge letter could be tailored to the individual patient's communication style,

Tab. I. Summary of the key AI solutions that emerged during SIIAM's First Annual Meeting collaborative workshop: Advancing Healthcare Through Diverse AI Applications.

Advancing Italian healthcare: Artificial Intelligence solutions from SIIAM's interdisciplinary workshop	
Remote Patient Monitoring Using LLMs	The potential of LLMs in the remote monitoring of chronic patients was a major focus. LLMs can facilitate detailed symptom checking and anomaly detection, thereby enabling timely interventions
Empathy in Medical Communication	Enhancing Empathy in patient-healthcare professional communication through LLMs. This approach involves using LLMs to analyze conversation data, thereby enabling the development of patient-tailored communication strategies
Standardizing Pediatric Emergency Care	The development of an ML algorithm to standardize treatment approaches and pain management in pediatric emergency departments, incorporating clinical parameters and patient history data
Bridging the Technological Divide	Emphasizing the need for educational and informational projects to promote AI adoption in healthcare, particularly in rural and underserved regions
Efficient Data Extraction and Analysis	Leveraging LLMs for efficient and rigorous extraction and analysis of data from scientific literature, thus enhancing the research process and supporting healthcare professionals in keeping themselves up-to-date
Interpreting Healthcare Norms and Communications	Utilizing LLMs to assess the impact of new healthcare norms and directives, ensuring their effective integration and implementation in practice
Streamlining Hospital Discharge Records	Proposing using electronic healthcare records and LLMs to automate and standardize the process of preparing Hospital Discharge Records (SDO), thereby reducing the administrative burden on physicians and improving the quality of patient care documentation

integrating this solution with the one previously proposed. While leveraging electronic healthcare records with LLMs for drafting discharge letters streamlines the process, it faces limitations. These include potential legal issues related to giving LLMs access to sensitive health records and the legal ramifications of using LLM-compiled discharge letters in a medical context [25].

Conclusions

This paper has presented a comprehensive overview of the innovative ideas and solutions discussed during the SIIAM First Annual Meeting collaborative workshop. The confluence of diverse professional backgrounds significantly contributed to the creativity and feasibility of the proposed solutions. The key outcomes of this workshop focused on integrating artificial intelligence (AI) into Italy's healthcare system, are summarized in Table I.

These initiatives underscore SIIAM's commitment to spearheading the integration of AI into healthcare, recognizing the immense potential of AI to revolutionize patient care, improve healthcare outcomes, and streamline administrative processes while remaining mindful of the potential risks and limitations that may arise. The collaborative efforts of interdisciplinary teams, as demonstrated at the SIIAM meeting, are pivotal in realizing these advancements with an unwavering commitment to patient safety, clinical efficacy, and healthcare quality. At the moment, the Italian healthcare system is characterized by time-consuming manual processes, limited data utilization, and slower patient care response times. With the integration of AI, the future of healthcare in Italy promises to be more efficient, empathetic, and patient-centered, setting a benchmark for global healthcare innovation.

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Conflict of Interest statement

The authors declare no conflict of interest.

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Author's contributions

LDA, FB, GD, AT, FAC: conceived the paper, performed the literature search, drafted the manuscript, and contributed equally to the manuscript. The SIIAM workshop participants provided expert insights and

contributed to the manuscript revision. All authors contributed to the article and approved the submitted version.

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