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## The future of artificial intelligence in Healthcare: smaller, more specialized language models

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Dear Editor,

In a recent editorial, Mayol et al. (1) summarize the key themes surrounding the application of artificial intelligence (AI) in medicine and highlight that healthcare is likely one of the sectors most in need of this technology. Many of the possibilities outlined by the authors are already becoming a reality and are under continuous development.

In relation to the various AI models, particularly large language models (LLMs), despite the current prominence of proprietary models hosted on large corporate servers, there is growing consensus that the future of AI in healthcare lies in smaller, more specialized language models. These models, built upon pre-trained base models (2), can be fine-tuned using parameter-efficient techniques such as Low-Rank Adaptation (LoRA) (3), Quantization+LoRA (QLoRA) (4), and Reinforcement Learning from Human Feedback (RLHF). Platforms like Hugging Face (5) provide access to these pre-trained models, which can then be specialized to perform more focused tasks.

Such fine-tuning processes can be carried out using cloud computing resources, which are increasingly affordable for smaller companies or even individual developers. Once retrained, these models can be deployed on standard corporate networks, ensuring that clinical data security and privacy are maintained. This approach would also prevent large corporations from holding disproportionate control over AI in healthcare.

Moreover, concerns around the use of "unapproved" AI tools or issues of liability can be mitigated, as legal responsibility would rest with the institution deploying and utilizing the application, rather than with the developers or external AI providers.

We stand at the threshold of a transformative technology whose full impact is yet to be realized. However, it is perhaps premature to worry about a future devoid of human doctors, as depicted in science fiction. While Star Wars may offer a vision of medical automation, Star Trek reminds us that despite the advanced AI systems aboard the USS Enterprise, human expertise—embodied in characters like Dr. Leonard McCoy—remains irreplaceable.

Looking ahead, it seems evident that as we confront future challenges, potentially as complex as intergalactic travel, human medical professionals will need to rely on AI tools. It is essential that we guide the development of these technologies with the goal of ensuring they augment human expertise, starting with the imperative to understand and shape the AI tools of tomorrow.

## REFERENCES:

1. Mayol J, Gámez Alastuey M, Anula Fernández R. Redefining healthcare - The transformative power of generative AI in modern medicine. *Rev Esp Enferm Dig.* 2025 Feb 3. doi: 10.17235/reed.2025.11081/2024. Epub ahead of print. PMID: 39898717.
2. Anisuzzaman DM, Malins JG, Friedman PA, Attia ZI. Fine-Tuning Large Language Models for Specialized Use Cases. *Mayo Clin Proc Digit Health [Internet].* 2025 Mar 1 [cited 2025 Feb 8];3(1):100184. Available from: <https://www.sciencedirect.com/science/article/pii/S2949761224001147>
3. Hu EJ, Shen Y, Wallis P, Allen-Zhu Z, Li Y, Wang S, et al. LoRA: Low-Rank Adaptation of Large Language Models [Internet]. arXiv; 2021 [cited 2025 Feb 8]. Available from: <http://arxiv.org/abs/2106.09685>
4. Dettmers T, Pagnoni A, Holtzman A, Zettlemoyer L. QLoRA: Efficient Finetuning of Quantized LLMs [Internet]. arXiv; 2023 [cited 2025 Feb 8]. Available from: <http://arxiv.org/abs/2305.14314>
5. Hugging Face – The AI community building the future. [Internet]. 2025 [cited 2025 Feb 8]. Available from: <https://huggingface.co/>