

Do Biomedical Tasks Require Biomedical Foundation Models?

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Abstract

Foundation models are increasingly used across biomedical domains, including clinical text, medical imaging, genomics, and protein modeling. At the same time, rapidly advancing general-purpose foundation models can often be adapted to biomedical tasks through prompting, fine-tuning, and tool use. This raises a central question: **do biomedical applications require domain-specific foundation models, or can general models be adapted effectively?**

In this review, we examine the landscape of biomedical foundation models and compare domain-specific pretraining with adaptation of general models. We discuss how these approaches interact with biomedical data systems and the challenges of evaluation, reliability, and deployment. We conclude by outlining key open problems that will shape the future of foundation models in biomedical research and healthcare.

Introduction

The Current State of Domain-Specific Biomedical Foundation Models

Overview of foundation models trained directly on biomedical data across major modalities such as clinical text, imaging, genomics, proteins, and EHRs.

Adapting General Foundation Models to Biomedical Tasks

How general-purpose foundation models (e.g., large language and vision models) are adapted to biomedical applications through prompting, fine-tuning, and tool use.

Integrating Foundation Models with Biomedical Data Systems

How foundation models interact with structured biomedical data and knowledge sources, including electronic health records, ontologies, and databases.

Evaluation, Reliability, and Deployment of Biomedical Foundation Models

Challenges in deploying and evaluating biomedical foundation models and ensuring reliability, including benchmarking, dataset bias, interpretability, and clinical validation.

Open Problems and Future Directions

Key unresolved questions and research opportunities that will shape the development and deployment of foundation models in biomedicine.

Conclusions

References
