Methods for Exchanging Quantified Imaging Research Data Using Informatics

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Abstract

Through software to extract and interpret morphometric and functionally indicators, imaging has a huge untapped potential to assist cancer research. Probabilistic imaging software can be transformative in providing minimally invasive, objective, and replicable evaluation of cancer treatment response in the era of non-cytotoxic treatment agents, multi-modality image-guided ablative therapies, and rapidly evolving computational resources. High-throughput analysis and fine-grained distinction of many molecular targets necessitate the use of post-processing methods. The software tools employed in these analyses must be stable and reliable over a wide range of information collected from various people, time periods, and institutions. To ensure the software's validity, analysis methodologies must be clearly specified, analysis results must be documented, and explicit recommendations for their interpretation must be provided. However, there is a dearth of infrastructure to promote common data interchange and method sharing, as well as cancer research data in forms that facilitate quantitative analysis. As a result, we propose to create an interoperable imaging bioinformatics base for the development of software tools for quantifiable imaging protein biomarkers. This platform will allow for the archiving, organising, retrieval, and dissemination of data generated by new analytical tools, as well as the performance review of quantitative analytical techniques. The needs of active QIN research projects in quantifiable imaging biomarker discovery for prostate adenocarcinoma, brain and neck cancer, and glioblastoma multiforme will define its usefulness.

Keywords

Biomedical Informatics, Research data, Imaging, Biomarkers

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1. Introduction

One of the purposes of the QIN as a research network is to encourage member sites to share research data, imaging techniques, and informatics tools. One of the purposes of data exchange in this context is to allow subsequent reuse of research results for imaging algorithm validation and biomarker qualification. Image-processing algorithms must be validated on several imaging data sets collected on multiple devices at many institutions, sometimes using multiple imaging modalities (e.g., generalizability of image processing techniques across CT, PET, and MRI) Verification across various patient sets of data, potentially for different cancers diagnoses (e.g. breast cancer and lung cancer), various imaging modalities (e.g. CT, PET, MRI), multiple classes of treatment modalities (e.g. multiple classes of systemic drug treatment, radiation treatment), and multiple lines of therapy is also required for image biomarker qualification sufficient to change clinical practise (e.g. neoadjuvant versus metastatic therapy) [1].

The assessment of QIN member sites reveals a wide range of disease and treatment options, as well as a lot of overlap in imaging techniques and imaging features. However, many QIN locations lack scientific infrastructures for image storage and sharing over the network. This is due in part to a lack of mature information tools and models to accomplish this purpose. As a result, we came up with a list of functional criteria for just an infrastructure that would allow the QIN to exchange research results [2].

Three types of data must be provided in order to be most valuable for the aims of algorithmic validation and biomarker qualification: images, image meta-data, and clinical data. Data repositories can be centralised or federated, but they must enable investigators to manage data distribution rights. If a centralised data model was chosen, the NCI required committing to supporting the repository's continued upkeep. To enable data inquiry and retrieval across data repositories, systems should be integrated. Systems should be linked together to assist research workflow, such as allowing research methodology to obtain data

for the analysis and visualisation. Only de-identified information should be provided. The QIN should come to an agreement on de-identification processes standards. When possible, open source software should be employed [3].

Moreover, the QIN domains should put together a specific set of use cases to enhance our understanding of the applicability of existent formats for sharing picture meta-data and to highlight potential constraints of the information available models for expressing and keeping image meta-data [4].

In an ideal world, these platforms would not only facilitate data sharing as a means to a goal. They should assist the QIN sites in carrying out their research workflow. Important work is needed in advance of the first round of QIN contract renewals in three years to clearly outline a route ahead for each site fully share all of their research results [5].

2. Conclusion

Our first efforts yielded a list of the different experiments and information that each network member is conducting, a wide range of changes structure to support the QIN‘s research purpose, and a preliminary strategy and implementation for picture data sharing. Clarifying the requirements and identifying technologies that can be integrated to serve the QIN research mission is still being worked on.

3. References

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