Embracing digital and computational pathology during residency training: Perspectives from two former anatomic pathology residents

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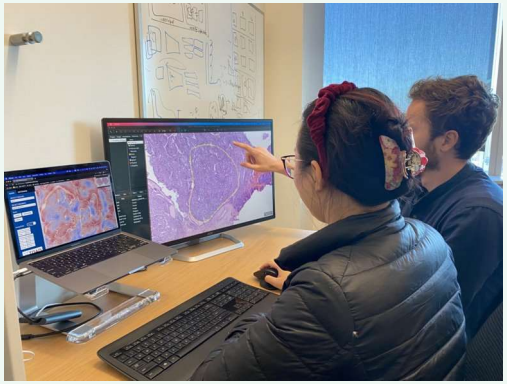
Background

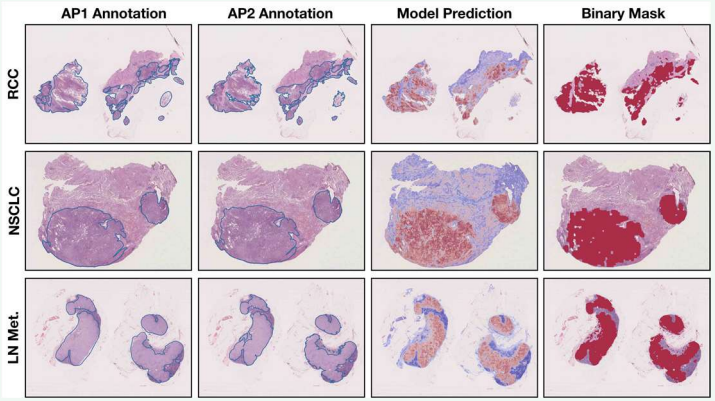
As the practicality and promise of digital and computational pathology increases, it is imperative that pathology residents gain exposure to these potentially disruptive technologies. Many institutions have advanced to operating on a digitized or semi-digitized diagnostic workflow, with residents now previewing and signing out digitized images. At our home institution, digital and computational pathology topics have been introduced to residents through various lecture series. As anatomic pathology (AP) residents, we wanted more experience interfacing with whole slide images and advanced computational techniques so sought to create elective training in computational pathology during our third year of residency.

Experiences

- Identifying areas of pathology with unmet need
- Given computational models with certain assumptions/strengths/weakness, finding appropriate areas of pathology to which to apply them
- Educating computer scientists and engineers about the diagnostic process and clinical workflows
- Dataset creation and curation
- Translation of pathology reports and medical jargon
- Assessing the output of interpretability methods
- Reviewing incorrect predictions to troubleshoot models
- Manuscript writing and review to for clarity and interest to pathologists and physicians
- Communication with attending pathologists



Two former AP residents hard at work analyzing annotations and heatmaps.



Annotating slides and evaluating model outputs is a common task for pathologists in computational pathology projects and one we have encountered many times. Creating detailed annotations is a great test of trainee knowledge and helped us find gaps in our knowledge. Additionally, looking at dozens of examples from a specific disease can help solidify a trainee's diagnostic skills.

Benefits

- Increased our knowledge of computational methods including deep learning algorithms
- Developed skills in evaluating the performance of machine learning techniques
- Learned what constitutes adequate validation of complex models
- Gained experience with a wide variety of digital pathology tools including QuPath, NDP.view, OpenSlide, ASAP, and many more
- Learned and practiced programming in Python with NumPy, PyTorch, and others
- Improved translation and collaborative skills between the very different and jargon-filled worlds of computer science and medicine
- Familiarity with whole slide scanners including their limitations and file formats
- Better general pathology informatics knowledge and appreciation of the pain points from both the research and clinical sides
- Solidified our AP learnings on the disease processes we studied computationally

Conclusions

Dedicated exposure to computational pathology (beyond the use of digital pathology in routine clinical work) has fundamentally altered our understanding of the past, present, and future of the specialty of anatomic pathology. We have observed that computational projects that aim to be clinically meaningful require interaction with individuals with pathology and medical expertise and found that learning enough to provide helpful guidance for these projects increased our own knowledge of pathology. Computational pathology is a fast-growing field that is likely to impact clinical practice in the not-so-distant future, so learning the strengths and weaknesses of the algorithms at work will be important when we former trainees are inevitably asked to use and evaluate computational pathology techniques for our own future practices. Finally, pathology departments should make an active effort to recruit researchers in computational pathology and to encourage residents to collaborate with them so that more residents can have this valuable experience.