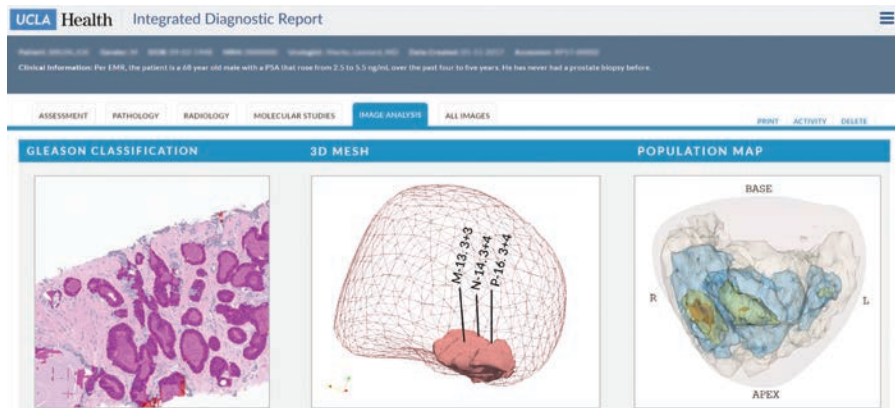# UCLA developing machine learning to improve management of prostate cancer

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The UCLA Integrated Diagnostic Report for prostate cancer correlates radiology and pathology findings. This unique report provides a platform that researchers can use to translate machine learning insights to physicians.

Could artificial intelligence eventually be used to help diagnose and treat patients' prostate cancer using data from medical imaging and pathology? A group led by Corey Arnold, PhD, associate professor in UCLA's Department of Radiological Sciences and Department of Pathology & Laboratory Medicine, is developing machine learning algorithms with the potential to improve doctors' abilities to recommend the appropriate treatment for prostate cancer patients — and, equally important, to allow patients with slow-growing cancer to possibly defer invasive diagnostic and treatment procedures.

UCLA currently offers a state-of-the-art imaging program that employs a combination of ultrasound imaging and magnetic resonance imaging (MRI) to screen men for prostate cancer. Radiologists review the images, and if certain regions are deemed suspicious for prostate cancer, a biopsy is performed and the extracted tissue is sent to pathologists for diagnosis and assessment of the cancer's severity. Because many forms of prostate cancer are slow growing, some men with low-risk tumors who choose to delay or forgo immediate treatment — which comes with the risk of significant side effects — may be placed in a program of active surveillance. Typically, a new biopsy is performed on these men every six to 12 months to ensure that their cancer has not become more aggressive and in need of treatment.

But biopsy can be an unpleasant procedure, typically involving the insertion of at least a dozen needles into the prostate to collect tissue, and it carries its own potential side effects, including the risk of infection. So Dr. Arnold and colleagues are exploring the feasibility of using machine learning to perform an "imaging biopsy." Such technology may allow radiologists to improve their identification of suspicious regions — adding value for subsequent targeted biopsies — or may even allow some men to defer physical biopsy until the imaging biopsy indicates its necessity.

"We have a very rich set of imaging data, including anatomical images and functional images of the prostate," Dr. Arnold explains. "Our hypothesis is that this data contains untapped complex signals that differentiate between slow-growing and more aggressive prostate cancers, and that these signals can be detected using deep learning [a type of machine learning] techniques. We believe that one day these algorithms will help men avoid unnecessary biopsies, and may also allow us to identify men who would benefit from a particular treatment plan."

The team developing machine learning for integrated diagnostics includes several clinical and scientific researchers, and represents a collaboration between the radiology and pathology departments. UCLA has a massive database with which to develop the algorithms, using pathology results from previous biopsies and prostatectomies as gold standards against which the predictive models are measured. "Our initial results indicate that the use of machine learning to identify serious cancer from medical images is promising," Dr. Arnold says.

In addition to developing machine learning algorithms for prostate imaging, Dr. Arnold and his colleagues have similar projects for other cancers, including brain and lung. "In the next five to 10 years, with the ability to train these deep learning algorithms with more and more high-quality data, we will see the development of tools that will assist radiologists in performing their jobs more efficiently and at higher levels of accuracy," Dr. Arnold explains. "There is also the potential that a machine-learning algorithm that has been trained with our data and expertise could be used by general radiologists in other parts of the country, improving health care in areas where there is not the same level of subspecialty expertise." Ⓡ