

The Next-Level Precision Medicine in Cancer Management Using Artificial Intelligence

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Dr. Jie Tian received his PhD degree (with honors) from Chinese Academy of Sciences in 1993. He has been a professor at the Institute of Automation, Chinese Academy of Sciences since 1997, and the director of the Beijing Advanced Innovation Center for Big Data-Based Precision Medicine in Beihang University since 2018. Dr. Tian has been elected as the Fellow of AAAS, ISMRM, AIMBE, IAMBE, IEEE, OSA, SPIE, and IAPR. He serves as the editorial board member of *European Journal of Nuclear Medicine* and *Molecular Imaging*, *IEEE Transactions on Medical Imaging*, and *Photoacoustics*. He is the author of over 400 peer-reviewed journal articles, which have received over 36,000 Google Scholar citations (H-index 93). He has received numerous awards, including five national top awards for his outstanding work in medical imaging. Dr. Tian is recognized as a pioneer and a leader in China in the field of molecular imaging. He has developed a series of new optical imaging models and reconstruction algorithms for *in vivo* optical tomographic imaging. He has also explored novel artificial intelligence strategies for medical image quantitative analysis, and constructed several open-access softwares.

RAPID accumulation of medical big data and development of artificial intelligence techniques are promoting next generation of precision medicine in cancer management. A bunch of marvelous studies that applied artificial intelligence in diagnosis, treatment outcome evaluation, as well as prognosis prediction of cancer sprung up and have been published on top journals.^[1-3]

As early as 2007, Segal *et al.* found that 28 computed tomography (CT)-based radiological traits could reconstruct 78% of the global gene expression profiles of liver cancer, which correlated with cell proliferation, liver synthetic function and prognosis.^[4] This groundbreaking research laid the emphasis on utility of multi-omics in cancer, in which large load of hidden

information was beyond revealed to facilitate understanding of carcinogenesis and appropriate treatment strategies making.^[5] Novel artificial intelligence techniques, especially deep learning methods, were then widely applied to predict prominent histopathological outcomes such as tumor metastasis, microvascular invasion, and molecular biomarkers, *etc.*, and to perform optimized treatment selection regarding stratified prognosis. Dong *et al.* demonstrated that convolutional neural network based model could even predict the number of lymph node metastasis using a noninvasive manner.^[6] It manifested great potential of artificial intelligence in the paradigm of cancer management. Regarding the latest therapy, radiomics was used to elaborately describe tumor-infiltrating CD8 cells and divide corresponding immune phenotypes that respond to anti-programmed cell death protein (PD)-1 or

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anti-programmed cell death ligand 1 (PD-L1) monotherapies.^[7] These state-of-art explorations bear out the important role of artificial intelligence as propeller in the next level of precision medicine.

We fully appeal to multi-discipline investigators to pay more attention to novel artificial intelligence technique development as well as proper application of these techniques on cancer management in clinical setting. In the future work, high-quality, prospective, and large sample size based cohort is the key to enable further explorations. Multiple centers would be encouraged to ally to establish elaborately designed database and standardize data acquisition protocol. Let us hope it will not take too long to concert and witness substantial progress of artificial intelligence in clinical application of next-level precision medicine in cancer management.

Conflict of interests

None.

REFERENCES

1. He J, Baxter SL, Xu J, et al. The practical implementation of artificial intelligence technologies in medicine. *Nat Med* 2019; 25(1):30-6. doi: 10.1038/s41591-018-0307-0.
2. Dong D, Tang L, Li ZY, et al. Development and validation of an individualized nomogram to identify occult peritoneal metastasis in patients with advanced gastric cancer. *Ann Oncol* 2019; 30(3): 431-8. doi: 10.1093/annonc/mdz001.
3. Wei J, Jiang H, Gu D, et al. Radiomics in liver diseases: current progress and future opportunities. *Liver int* 2020; 40(9): 2050-63. doi: 10.1111/liv.14555.
4. Segal E, Sirlin CB, Ooi C, et al. Decoding global gene expression programs in liver cancer by noninvasive imaging. *Nat Biotechnol* 2007; 25(6):675-80. doi: 10.1038/nbt1306.
5. Zhang F, Zhong L, Zhao X, et al. A deep-learning-based prognostic nomogram integrating microscopic digital pathology and macroscopic magnetic resonance images in nasopharyngeal carcinoma: a multi-cohort study. *Ther Adv Med Oncol* 2020; 12: 1758835920971416. doi: 10.1177/1758835920971416.
6. Dong D, Fang M, Tang L, et al. Deep learning radiomic nomogram can predict the number of lymph node metastasis in locally advanced gastric cancer: an international multicenter study. *Ann Oncol* 2020; 31(7): 912-20. doi: 10.1016/j.annonc.2020.04.003.
7. Sun R, Limkin EJ, Vakalopoulou M, et al. A radiomics approach to assess tumour-infiltrating CD8 cells and response to anti-PD-1 or anti-PD-L1 immunotherapy: an imaging biomarker, retrospective multicohort study. *Lancet Oncol* 2018; 19(9):1180-91. doi: 10.1016/S1470-2045(18)30413-3.