Technology from Kyoto University

Mathematical Method for Robust Pathological Tissue Image Analysis Without AI

We are looking to out-license the technology for its commercialization.

New imaging diagnostic method that enables quantitative comparison and evaluation that compensates for differences in pathologists' experience

◆Background

In recent years, the use of AI for diagnosing pathological stained images and classifying cases has become mainstream. However, AI-based image diagnosis relies on staining intensity and color tone as information, making standardization difficult and failing to provide robust metrics for quantitative tissue comparison. Additionally, AI is unreliable in diagnostics since it cannot clearly justify its reasoning thus it is hard to validate against expert pathologists.

◆Description

Kyoto University researchers have established a method to quantitatively compare and evaluate pathological images by standardizing cellular information within tissues from multiple perspectives using mathematical approaches. The method enables consistent evaluation even for complex and distorted tissue sections. Furthermore, statistical values derived from multiple quantitative indicators have revealed characteristics corresponding to the progression of epithelial cancer (Fig.1). As a result, disease progression can be numerically represented from histopathological images.

- **Standardization of Pathological Image Diagnosis**

  By complementing pathologists' experience-based diagnoses with numerical indicators, this method contributes to the standardization of pathological image diagnosis.

- **Output from Mathematical Approaches**

  The method avoids the black-boxing of decision criteria associated with DL-based AI, providing reliable and transparent diagnostic results for both patients and medical professionals.

- **Development of Various Software Applications**

◆Development Status

- Successfully identified core numerical indicators

◆Applications

- Pathological image diagnosis software
- Training programs that numerically guide less experienced pathologists on key diagnostic features
- Diagnostic tools for early detection of poor prognosis

◆Offer

- Patent License
- Option for Patent License

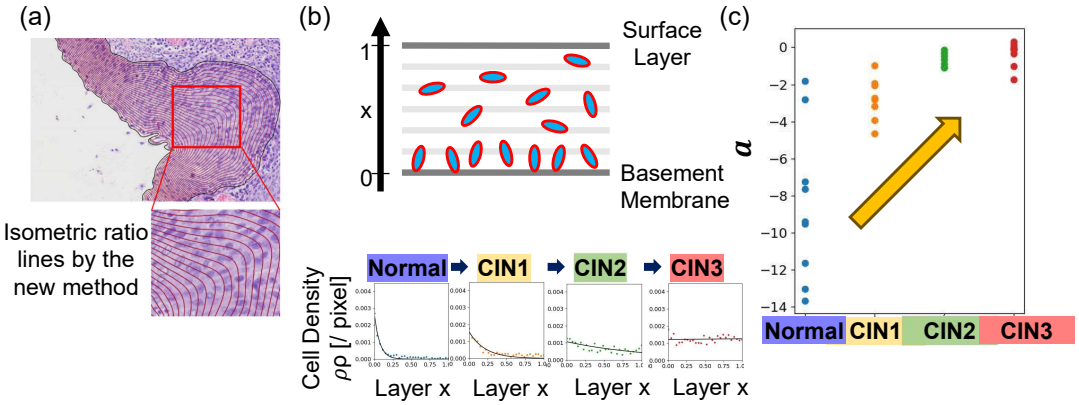

Fig.1: Example of Indexing Based on Nuclear Density Distribution

(a) By applying the new method, smoother isometric ratio lines can be obtained.
(b) Using isometric ratio lines, the positions of nuclei are determined, and the cell density ρρ for each layer x is calculated. As epithelial cancer progresses, the density distribution $\rho(x)$ρ(x) becomes more uniform.
(c) As epithelial cancer progresses, the index aa, which represents the shape of the density distribution, approaches zero, allowing estimation of disease severity.

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